Measuring the Economic Value *of a* City Park System

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Cover Photos: Scott Parker (left), Nita Winter (right)

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Introduction

Cities are economic entities. They are made up of structures entwined with open space.

Successful communities have a sufficient number of private homes and commercial and retail establishments to house their inhabitants and give them places to produce and consume goods. Cities also have public buildings—libraries, hospitals, arenas, city halls—for culture, health, and public discourse. They have linear corridors—streets and sidewalks—for transportation. And they have a range of other public spaces—parks, plazas, trails, sometimes natural, sometimes almost fully paved—for recreation, health provision, tourism, sunlight, rainwater retention, air pollution removal, natural beauty, and views.

In successful cities the equation works. Private and public spaces animate each other with the sum greatly surpassing the parts. In unsuccessful communities some aspect of the relationship is awry: production, retail, or transportation may be inadequate; housing may be insufficient; or the public realm might be too small or too uninspiring.

In 2003, The Trust for Public Land's Center for City Park Excellence gathered two dozen park experts and economists in Philadelphia for a colloquium to analyze how park systems economically benefit cities. Based on this conversation and subsequent consultation with other leading economists and academics, the center identified seven attributes of city park systems that provide economic value and are measurable.

Not every aspect of a park system can be quantified. For instance, the mental health value of a walk in the woods is not known, and there is no agreed-upon methodology for valuing the carbon sequestration value of a city park. But seven major factors—*property value, tourism, direct use, health, community cohesion, clean water, and clean air*—have been enumerated. While the science of city park economics is still in its infancy, TPL has worked to carefully consider and analyze these values. Our report sets forth a summary of this methodology.

Two of the factors provide a city with ***direct income*** to its treasury. The first factor is increased property tax from the increase in property value because of proximity to parks. (This is also called "hedonic value" by economists.) The second is increased sales tax on spending by tourists who visit primarily because of the city's parks. (Beyond the tax receipts, these factors also bolster the ***collective wealth*** of residents through property appreciation and tourism revenue.)

Three other factors provide city residents with ***direct savings.*** By far the largest amount stems from residents' use of the city's free parkland and free (or low-cost) recreation opportunities, which saves them from having to purchase these items in the marketplace. The second is the health benefit—savings in medical costs—due to the beneficial aspects of exercise in the parks. And the third is the community cohesion benefit of people banding together to save and improve their neighborhood parks. This "know-your-neighbor" social capital helps ward off antisocial problems that would otherwise cost the city more in police and fire protection, prisons, counseling, and rehabilitation.

The last two factors provide ***environmental savings.*** The larger involves water pollution reduction—the retention of rainfall by the park system's trees, bushes, and soil, thus cutting the cost of treating stormwater. The other concerns air pollution—the fact that park trees and shrubs absorb a variety of air pollutants.

In the following chapters, after describing the value factor and the rationale for calculating it, we provide a real-life example of the mathematical outcome, based on the first five test cases undertaken in this program—the cities of Washington, D.C., San Diego, Boston, Sacramento, and Philadelphia.

Peter Harnik
Director, Center for City Park Excellence
March 2009

Increasing Hedonic (Property) Value

More than 30 studies have shown that parks have a positive impact on nearby residential property values. Other things being equal, most people are willing to pay more for a home close to a nice park. Economists call this phenomenon "hedonic value." (Hedonic value also comes into play with other amenities such as schools, libraries, police stations, and transit stops. Theoretically, commercial office space also exhibits the hedonic principle; unfortunately, no study has yet been carried out to quantify it.)

Hedonic value is affected primarily by two factors: distance from the park and the quality of the park itself. While proximate value ("nearby-ness") can be measured up to 2,000 feet from a large park, most of the value is within the first 500 feet. In the interest of being conservative, we have limited our valuation to this shorter distance. Moreover, people's desire to live near a park depends on characteristics of the park. Beautiful natural resource parks with great trees, trails, meadows, and gardens are markedly valuable. Other parks with excellent recreational facilities are also desirable (although sometimes the greatest property value is a block or two away if there are issues of noise, lights, and parking). Less attractive or poorly maintained parks are only marginally valuable. And parks with frightening or dangerous aspects can reduce nearby property values.

Determining an accurate park-by-park, house-by-house property value for a city is technically feasible but prohibitively time-consuming and costly. Therefore, we formulated a methodology to arrive at a reasonable estimate. Computerized mapping technology known as Geographic Information Systems (GIS) was used to identify all residential properties within 500 feet of every significant park. ("Significant" is defined as one acre or more; "park" includes every park in the city, even if owned by a county, state, federal, or other public agency.)

Coleen Gentles

Meridian Hill Park in Washington, D.C. provides extra value to the thousands of dwelling units surrounding it, and to the city itself through higher property tax receipts.

Unfortunately, because of data and methodology problems, it is difficult to determine exactly which of a city's parks confer "strongly positive," "slightly positive," and "negative" value to surrounding residences. Research into quantifying park quality continues; in the interim we have chosen to assign the conservative value of 5 percent as the amount that parkland adds to the assessed value of all dwellings within 500 feet of parks. (The preponderance of studies has revealed that excellent parks tend to add 15 percent to the value of a proximate dwelling; on the other hand, problematic parks can subtract 5 percent of home value. Taking an average of this range yields the 5 percent value that will be used until a park quality methodology can be established.)

Once determined, the total assessed value of properties near parks is multiplied by 5 percent and then by the tax rate, yielding the increase in tax dollars attributable to park proximity.

PARK VALUE IN ACTION

Increasing Property Values in Washington, D.C.

The most famous park in Washington, D.C. may be the National Mall with its museums and government agencies, but it is the many other parks—from huge Rock Creek Park to tiny Logan Circle, the ones surrounded by homes—that provide the city with the greatest property value benefit.

The city's abundance of green has placed much of Washington's real estate either directly abutting or within a stone's throw of a park. This makes it convenient for the capital's denizens to toss a ball around, enjoy a picnic, or just get a pleasurable view. The city's coffers are also reaping the benefits.

Getting to this number is fairly straightforward. Using GIS in combination with the city's assessment data, we find that the value of all residential properties (apartments, condominiums, row houses, and detached homes) within 500 feet of a park is almost $24 billion (in 2006 dollars). Using an average park value benefit of 5 percent, we see that the total amount that parks increased property value is just under $1.2 billion. Using the effective annual tax rate of 0.58 percent, we find that Washington reaped an additional $6,953,377 in property tax because of parks in 2006.

The Hedonic (Property) Value of Washington, D.C.'s Parks	
Value of properties within 500 feet of parks	$23,977,160,000
Assumed average value of a park	5%
Value of properties attributed to parks	**$1,198,858,025**
Effective annual residential tax rate	0.58%
Annual property tax capture from value of property due to parks	**$6,953,377**
Property values were obtained from the District of Columbia	

Income from Out-of-Town Park Visitor Spending (Tourists)

Though not always recognized, parks play a major role in a city's tourism economy. Some such as Independence National Historic Park in Philadelphia, Central Park in New York, Millennium Park in Chicago, or Balboa Park in San Diego are tourist attractions by themselves. Others are simply great venues for festivals, sports events, even demonstrations. Read any newspaper's travel section and you'll usually see at least one park among the "to see" picks.

Calculating parks' contribution requires knowing the number of park tourists and their spending. Unfortunately, most cities have little data on park visitation or visitor origin. (By definition, local users are not tourists—any spending they do at or near the park is money not spent locally somewhere else, such as in their immediate neighborhood.) Sometimes there are tourism numbers for one particularly significant park, but it is not possible to apply these numbers to the rest of the city's parks. To get around these missing data, visitation numbers and expenditures from other sources must be obtained and then used to make an educated guess about trips that are taken entirely or substantially because of parks or a park.

First, we estimate the number of park tourists. Then we reduce this to an estimate of the number of park tourists who came *because* of the parks. After dividing that number into day visitors (who spend less) and overnighters (who spend more), we multiply these numbers by the average spending per tourist per day (a figure that is usually well known by the local convention and visitors bureau). Finally, tax revenue to the city can be estimated by multiplying park tourism spending by the tax rate.

Jon Sullivan (www.pdphoto.org)

Beautiful Balboa Park—with its zoo, botanical gardens, numerous museums, sports fields, and public events—is the single biggest tourist attraction in San Diego.

PARK VALUE IN ACTION

Stimulating Tourism in San Diego

A visit to San Diego is not complete if it doesn't include a park—whether that's a beach, a harbor park, Old Town State Park, Mission Bay, or 1,200-acre Balboa Park. In fact, when the *New York Times* featured San Diego in its "36 Hours" travel series, it mentioned all of the above places. The role of parks in the city's tourism economy is huge.

Spending by Tourists Who Came Because of Parks, San Diego, 2006	
Overnight Visitors	
Overnight visitors to San Diego	16,050,000
Overnight visitors who visited parks (20%*)	3,210,000
Estimated 26%* who visited *because* of parks	834,600
Spending per overnight visitor per day	$107
Spending of overnight visitors because of parks	**$87,302,200**
Day Visitors	
Overnight visitors to San Diego	11,874,000
Overnight visitors who visited parks (20%)	2,374,800
Estimated 22% who visited because of parks	522,456
Spending per day visitor per day	$48
Spending of day visitors because of parks	**$25,077,888**
Total Spending (overnight and day visitors)	**$114,380,088**
Sales, meal, and hotel taxes (7.5% average) on park tourist spending	**$8,578,507**
Net profit (35% of tourist spending)	**$40,033,031**
*San Diego Convention and Visitors Bureau and California Travel and Tourism Commission, 2006.	

According to data from the San Diego Convention and Visitors Bureau (CVB), the California Travel and Tourism Commission, and a telephone survey by the Morey Group, an estimated 20 percent of tourists visited a park while in San Diego in 2007. The phone survey further revealed that 22 percent of San Diego park visitors came *because* of the parks. (Using this methodology assures that the count did not include the many tourists who came to San Diego for other reasons and happened to visit a park without planning to do so.) The conclusion was that just under 5 percent of San Diego tourism in 2007 was due to the city's parks—835,000 overnighters and 522,000 day visitors.

Knowing the average daily spending level of those tourists—$107 per overnight visitor and $48 per day visitor—we determined that total park-derived tourist spending in 2007 came to $114.3 million. With an average tax rate on tourist expenditures of 7.5 percent, tax revenue to the city was $8,579,000. In addition, since economists consider that an average of 35 percent of every tourist dollar is profit to the local economy (the rest is the pass-through cost of doing business), the citizenry's collective increase in wealth from park-based tourism was $40,033,000.

Direct Use Value

While city parks provide much indirect benefit, they also provide huge tangible value through such activities as team sports, bicycling, skateboarding, walking, picnicking, benchsitting, and visiting a flower garden. Economists call these activities "direct uses."

Most direct uses in city parks are free of charge, but economists can still calculate value by knowing the cost of a similar recreation experience in the private marketplace. This is known as "willingness to pay." In other words, if parks were not available in a city, how much would the resident (or "consumer") pay in a commercial facility? (Thus, rather than income, this value represents *savings* by residents.)

The model used to quantify the benefits received by direct users is based on the "Unit Day Value" method developed by the U.S. Army Corps of Engineers. Park visitors are counted by specific activity, with each activity assigned a dollar value by economists familiar with prices in the private martketplace. For example, playing in a playground is worth $3.50. Running, walking, or in-line skating on a park trail is worth $4, as is playing a game of tennis on a city court. For activities for which a fee is charged, like golf or ice skating, only the "extra value" (if any) is assigned; that is, if a round of golf costs $20 on a public course and $80 on a private course, the direct use value of the public course would be $60. Under the theory that the second and third repetitions of a park use in a given period are slightly less valuable than the first (i.e., the child visiting a playground gets somewhat less value the seventh time in a week than the first), we modified the model with diminishing returns for heavy park users. (For example, playground value diminishes from $3.50 for the first time in a week to $1.93 for the seventh.) We also estimated an average "season" for different park uses to take into account reduced participation rates in the off-season. (Although some people are active in parks 365 days a year, we conservatively eliminated seasons when participation rates drop to low levels.) Finally, for the few activities for which a fee is charged, such as golf, ice skating, and the use of fields for team sports, we subtracted the per-person fee from the assumed value.

The number of park visits and the activities engaged in is determined through a professionally conducted telephone survey of city residents. Residents are asked to answer for themselves; for those adults

Boston Parks and Recreation Department

The Frog Pond in the Boston Common is but one of the numerous park facilities that provide Bostonians with hundreds of millions of dollars of direct use value.

with children under the age of 18, a representative proportion are also asked to respond for one of their children. (Nonresidents are not counted in this calculation; their value is measured through out-of-town tourist spending.)

While some might claim that direct use value is not as "real" as tax or tourism revenue, it nevertheless has true meaning. Certainly, not all park activities would take place if they had to be purchased. On the other hand, city dwellers do get pleasure and satisfaction from their use of the parks. If they had to pay and if they consequently reduced some of this use, they would be materially "poorer" from not doing some of the things they enjoy.

PARK VALUE IN ACTION

Providing Direct Use Value in Boston

When Frederick Law Olmsted designed the park system of Boston, he envisioned a series of places of respite accessible to all. No need to pay for a trip out to the countryside—the park system could provide that—and more—right near home. Today that vision lives on in Boston's 5,040 acres of parks and the pastimes these parks offer: jogging down the Commonwealth Avenue median and into Boston Common, spending a morning at the playground, watching a tennis match, birdwatching across 1,765 natural acres, attending a summer festival, enjoying lunch in Post Office Square, walking the trails of 527-acre Franklin Park, admiring the flowers of the Public Garden, or taking in movie night in Jamaica Pond Park.

These and many more "direct uses" were measured in a telephone survey of Boston residents and were then multiplied by a specific dollar value for each activity. Based on the level of use and those values, it was found that in 2006 Boston's park and recreation system provided a total of $354,352,000 in direct use value.

Shared Benefits: The Economic Value of Direct Use of Parks in Boston, 2006

Facility/Activity	Person-Visits	Average Value per Visit	Value ($)
General park use (playgrounds, trails, dog walking, picnicking, sitting, etc.)	76,410,237	$1.91	$146,230,236
Sports facilities use (tennis, team sports, bicycling, swimming, running, ice skating, etc.)	48,407,572	$3.05	$147,812,453
Special uses (golfing, gardening, festivals, concerts, attractions, etc.)	6,467,113	$9.33	$60,309,713
Totals	**131,284,922**		**$354,352,402**

Data were drawn from a telephone survey of 600 Boston residents.

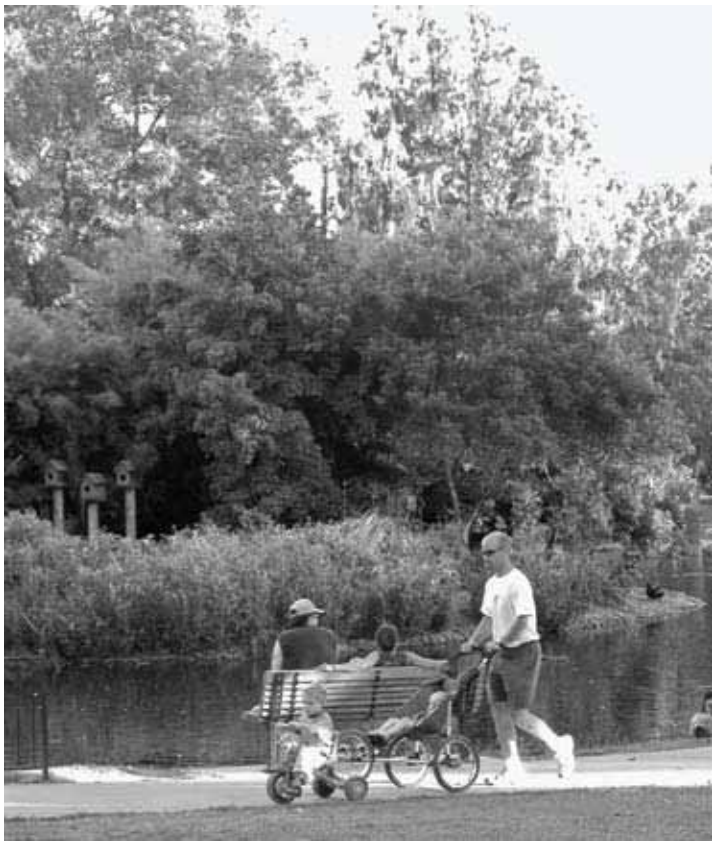
Health Value

Several studies have documented the economic burden of physical inactivity. Lack of exercise is shown to contribute to obesity and its many effects, and experts call for a more active lifestyle. Recent research suggests that access to parks can help people increase their level of physical activity. The Parks Health Benefits Calculator measures residents' collective economic savings through the use of parks for exercise.

After identifying the common types of medical problems that are inversely related to physical activity, such as heart disease and diabetes, we created the calculator based on studies in seven different states that show a $250 cost difference between those who exercise regularly and those who don't. For people over the age of 65, the value is $500 because seniors typically incur two or more times the medical care costs of younger adults.

The key data input is the number of park users who indulge in a sufficient amount of physical activity to make a difference. (This is defined as "at least 30 minutes of moderate to vigorous activity at least three days per week.") To determine this number, we took a telephone park use survey of activities and age and eliminated low-heart-rate uses such as picnicking, sitting, strolling, and birdwatching. We also eliminated respondents who engage in strenuous activities but do so less than three times per week because they are not active enough for health benefit.

After obtaining the number (and age) of city dwellers engaged in strenuous park activities, we applied the multipliers (by age) and added the subtotals. The calculator makes one final computation, applying a small multiplier to reflect the differences in medical care costs between the city's region and the United States as a whole.



Sacramento Department of Parks and Recreation

With or without a stroller, a regular vigorous run can cut medical costs by an average of $250 a year. McKinley Park, Sacramento.

PARK VALUE IN ACTION

Promoting Human Health in Sacramento

Sacramento has 5,141 acres of parks that provide a multitude of ways to stay healthy. The city has 43 tennis courts, 101 baseball diamonds, 116 basketball hoops, 171 playgrounds, 78 soccer fields, 7 skate parks, 12 swimming pools, over 80 miles of trails, and many more facilities.

Using the Parks Health Benefits Calculator, we determined the medical savings realized by city residents because of park exercise and found that about 78,000 Sacramentans engage actively enough in parks to improve their health—72,000 of them under the age of 65 and about 6,000 older. Using the estimated dollar value attributable to those activities, we calculated the savings in 2007, which came to $19,872,000.

Health Care Savings: Physically Active Users of Sacramento Parks, 2007

Cost Description	Residents Physically Active in Parks*	Average Medical Cost Difference Between Active and Inactive Persons	Amount
Adult users under 65 years of age	71,563	$250	$17,890,750
Adult users 65 years of age and older	6,054	$500	$3,027,000
Subtotals combined	77,617	——	$20,917,750
Regional cost multiplier (based on statewide medical costs)			0.95
Total Value			**$19,871,863**

*People engaging in moderate, vigorous, or strenuous activity at least half an hour, three days per week

Community Cohesion

Numerous studies have shown that the more webs of human relationships a neighborhood has, the stronger, safer, and more successful it is. Any institution that promotes this kind of community cohesion—whether a club, a school, a political campaign, a religious institution, a co-op—adds value to a neighborhood and, by extension, to the whole city.

This human web, which Jane Jacobs termed "social capital," is strengthened in some cities by parks. From playgrounds to sports fields to park benches to chessboards to swimming pools to ice skating rinks to flower gardens, parks offer opportunities for people of all ages to interact, communicate, compete, learn, and grow. Perhaps more significantly, the acts of improving, renewing, or even saving a park can build extraordinary levels of social capital. This is particularly true in a neighborhood suffering from alienation partially due to the lack of safe public spaces.

While the economic value of social capital cannot be measured directly, it is instructive to tally the amount of time and money that residents devote to their parks. This can serve as a proxy. In cities with a great amount of social capital, park volunteers do everything from picking up trash and pulling weeds to planting flowers, raising playgrounds, teaching about the environment, educating public officials, and contributing dollars to the cause.

To arrive at the number, all the financial contributions made to "friends of parks" groups and park-oriented community organizations and park agencies are tallied. Also added up, through contacting each organization, are the hours of volunteer time donated to park organizations. This number is then multiplied by the value assigned to volunteerism by the national organization Independent Sector. (This value varies by year and by state.)

Philadelphia Department of Parks and Recreation

With more than 100 "friends of parks" groups, Philadelphia has few peers when it comes to park-based social capital.

PARK VALUE IN ACTION

Stimulating Community Cohesion in Philadelphia

Philadelphia parks have support galore. In fact, there are more than 100 "friends of parks" organizations. Two of them, the Philadelphia Parks Alliance and Philadelphia Green, operate on a citywide basis; the rest deal with individual parks.

This impressive web of formal and informal action greatly boosts the civic life of the city, and it is measurable economically. Using the "community cohesion" methodology, we tallied the financial contributions made to all these groups in 2007. Then we added up the total volunteer hours donated to parks and converted them to a dollar figure (at $18.17 per hour, the latest figure available for the state of Pennsylvania). Combining the two yielded a 2007 community cohesion value of $8,600,000.

Community Cohesion Value: Park Supporters in Philadelphia

Organization or Activity	Volunteer Hours	Value of Volunteer Hours*	Financial Contributions	Total
Fairmount Park Volunteers (54 friends groups)	154,209	$2,894,503	$3,318,713	$6,213,216
Independence National Historical Park	10,390	$195,017	——	$195,017
Pennsylvania Horticultural Society (52 friends groups)	65,052	$1,221,026	$694,680	$1,915,706
Other support groups, combined	452	$8,485	$267,961	$276,446
Total Value		**$4,319,031**	**$4,281,354**	**$8,600,385**

*Value of one hour of volunteer labor in Pennsylvania as determined by Independent Sector, 2005: $18.77.

Reducing the Cost of Managing Urban Stormwater

Stormwater runoff is a significant problem in urban areas. When rainwater flows off roads, sidewalks, and other impervious surfaces, it picks up pollutants. In some cases (cities with sewer systems that separate household sewage from street runoff), the polluted rainwater flows directly into waterways, causing significant ecological problems. In other cases (cities with combined household and street systems), the rainwater is treated at a pollution control facility, but larger storms dump so much water that the system is designed to overflow when capacity is exceeded, resulting in spillage of both rainwater and household sewage.

Parkland reduces stormwater management costs by capturing precipitation and/or slowing its runoff. Large pervious (absorbent) surface areas in parks allow precipitation to infiltrate and recharge the groundwater. Also, vegetation in parks provides considerable surface area that intercepts and stores rainwater, allowing some to evaporate before it ever reaches the ground. Thus urban green spaces function like ministorage reservoirs.

The Western Research Station of the U.S. Forest Service in Davis, California, developed a model to estimate the value of retained stormwater runoff due to green space in parks. First, land cover data are obtained through analysis of aerial photographs. This reveals forested as well as open grassy areas and also water surface; it also reveals impervious surfaces in parks—roadways, trails, parking lots, buildings, and hard courts.

Philadelphia Department of Parks and Recreation

With a wide vegetative buffer to catch runoff, Pennypack Park helps reduce Philadelphia's stormwater management costs.

Second, the same photographs are then analyzed for the amount of perviousness of the *rest* of a city—in other words, the city without its parkland and not counting surface water. (Pervious land in the city can consist of residential front and back yards as well as private natural areas such as cemeteries, university quadrangles, and corporate campuses.)

Third, the amount and characteristics of rainfall are calculated from U.S. weather data. The model (which combines aspects of two other models developed by researchers with the U.S. Forest Service) uses hourly annual precipitation data to estimate annual runoff. By comparing the modeled runoff (with parks) and the runoff that would occur from a city the same size and level of development (i.e., with streets, rooftops, parking lots, etc. but without any parks), we can calculate the reduction in runoff due to parks.

The final step involves finding what it costs to manage each gallon of stormwater using traditional methods (i.e., "hard infrastructure" such as concrete pipes and holding tanks rather than parkland). By knowing this number and the amount of water held back by the park system, we can assign an economic value to the parks' water pollution reduction.

PARK VALUE IN ACTION

Cutting Stormwater Costs in Philadelphia

Philadelphia's 10,334-acre park system is one of the oldest in the country, and it provides more than seven acres of parkland for every 1,000 residents. About 12 percent of the city is devoted to parkland, and the water retention value of the trees, grass, riparian corridors, and plants significantly reduce the amount (and cost) of runoff entering the city's sewer system.

Philadelphia's parkland is 81.3 percent pervious. The rest of the city is 34.9 percent pervious. Philadelphia receives an average of 43.29 inches of rain per year (with the characteristic mid-Atlantic mix of drizzles, showers, and downpours). The model developed by the Forest Service shows that Philadelphia's parks reduced runoff in 2007 by 496 million cubic feet compared with a scenario in which the city had no parks. It is estimated that Philadelphia stormwater management cost is 1.2 cents ($0.012) per cubic foot.

Thus, the park system provided a stormwater retention value of $5,949,000 in 2007.

Stormwater Costs in Philadelphia per Cubic Foot	
Rainfall on impervious surface	8,667,269,456 cu. ft.
Annual expenditure on water treatment	$100,000,000
Cost per cubic foot	**$0.012**

Cost Savings Due to Runoff Reduction: Philadelphia's Parks	
Results for Typical Year – 43.29 inches of rainfall	**Cubic Feet**
Annual rainfall over Entire City of Philadelphia	1,623,928,386
Amount of actual runoff from parks (81.3% perviousness)	168,480,901
Runoff if parks didn't exist and if that acreage were of the same permeability as rest of city (34.9% perviousness)	664,198,620
Reduction in runoff due to parkland's perviousness	495,717,719
Estimated stormwater costs per cubic foot	$0.012
Total savings due to park runoff reduction	**$5,948,613**

Removal of Air Pollution by Vegetation

Air pollution is a significant and expensive urban problem, injuring health and damaging structures. The human cardiovascular and respiratory systems are affected, and there are broad consequences for health-care costs and productivity. In addition, acid deposition, smog, and ozone increase the need to clean and repair buildings and other costly infrastructure.

Trees and shrubs remove air pollutants such as nitrogen dioxide, sulfur dioxide, carbon monoxide, ozone, and some particulates. Leaves absorb gases, and particulates adhere to the plant surface, at least temporarily. Thus, vegetation in city parks plays a role in improving air quality and reducing pollution costs.

In order to quantify the contribution of park vegetation to air quality, the Northeast Research Station of the U.S. Forest Service in Syracuse, New York, designed an air pollution calculator to estimate pollution removal and value for urban trees. This calculator, which is based on the Urban Forest Effects (UFORE) model of the U.S. Forest Service, is location-specific, taking into account the air pollution characteristics of a given city. (Thus, even if two cities have similar forest characteristics, the park systems could still generate different results because of differences in ambient air quality.)

First, land cover information for all of a city's parks is obtained through analysis of aerial photography. (While every city has street trees and numerous other trees on private property, only the trees on public parkland are measured.)

Then the calculator determines the pollutant flow through an area within a given time period (known as "pollutant flux"), taking into account concentration and velocity of deposition. The calculator also takes into account characteristics of different types of trees and other vegetation and seasonal leaf variation.

National Park Service

Washington, D.C.'s Rock Creek Park has more than 1,500 acres of trees that trap and absorb pollutants from the city's air.

The calculator uses hourly pollution concentration data from the U.S. Environmental Protection Agency. The total pollutant flux is multiplied by tree-canopy coverage to estimate pollutant removal. The monetary value is estimated using the median U.S. externality value for each pollutant. (The "externality value" refers to the amount it would otherwise cost to prevent a unit of that pollutant from entering the atmosphere. For instance, the externality value of a short ton of carbon monoxide is $870; the externality value of the same amount of sulfur dioxide is $1,500.)

PARK VALUE IN ACTION

Cutting Air Pollution Costs in Washington, D.C.

The trees of Washington, D.C., are the city's lungs, inhaling and exhaling the air flowing around them.

Beyond the famous Japanese cherry trees around the Tidal Basin, the stately elms gracing the Reflecting Pool, and massive oaks of Lafayette Park, there are 4,839 acres of general tree cover in the city's 7,999 acres of parkland. Their aesthetic value is not countable, but the value of the air pollution they extract is. The Air Quality Calculator determined that they removed 244 tons of carbon dioxide, nitrogen dioxide, ozone, particulate matter, and sulfur dioxide in 2005. Based on the dollar values assigned to these pollutants, the savings was $1,130,000.

Air Pollution Removal Value of Washington D.C.'s Parks, 2005

Pollutant Type	Tons of Pollutant Removed*	Dollars Saved per Ton Removed	Total Pollutant Removal Value
Carbon dioxide	10.4	$870	$9,089
Nitrogen dioxide	43.7	$6,127	$267,572
Ozone	83.7	$6,127	$512,771
Particular matter	70.3	$4,091	$287,709
Sulfur dioxide	35.5	$1,500	$53,246
Total	**243.6**	——	**$19,871,863**

*Based on the city's 60.5% tree cover (4,839 acres) of 7,999 acres total parkland.

Conclusion

While reams of urban research have been carried out on the economics of housing, manufacturing, retail, and even the arts, there has been until now no comprehensive study of the worth of a city's park system. The Trust for Public Land believes that answering this question—"How much value does an excellent city park system bring to a city?"—can be profoundly helpful to all the nation's urban areas. For the first time, parks can be assigned the kind of numerical underpinning long associated with transportation, trade, housing, and other sectors. Urban analysts will be able to obtain a major piece of missing information about how cities work and how parks fit into the equation. Housing proponents and others may be able to find a new ally in city park advocates. And mayors, city councils, and chambers of commerce may uncover solid justification to strategically acquire parkland in balance with community development projects.

Determining the economic value of a city park system is a science still in its infancy. Much research and analysis lie ahead. And cities themselves, perhaps in conjunction with universities, can help greatly by collecting more specific data about park usership, park tourism, adjacent property transactions, water runoff and retention, and other measures. In fact, every aspect of city parks—from design to management to programming to funding to marketing—would benefit from deeper analysis. In that spirit this report is offered: for the conversation about the present and future role of parks within the life and economy of American cities.

Appendix 1
Acknowledgments

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David Chenoweth, Ph.D., Health Management Associates, New Bern, North Carolina

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Appendix 2
Colloquium Participants

The following individuals took part in the colloquium "How Much Value Does a Park System Bring to a City" in Philadelphia in October 2003.

Susan Baird	Denver Department of Parks and Recreation	Denver
Kathy Blaha	The Trust for Public Land	Washington, D.C.
Blaine Bonham	Pennsylvania Horticultural Society	Philadelphia
Glenn Brill	Ernst & Young	New York
Valerie Burns	Boston Natural Areas Network	Boston
Patrice Carroll	Philadelphia Managing Director's Office	Philadelphia
Donald Colvin	Indianapolis Department of Parks and Recreation	Indianapolis
Ernest Cook	The Trust for Public Land	Boston
John Crompton	Texas A&M University	College Station, Texas
Dick Dadey	City Parks Alliance	New York
Nancy Goldenberg	Philadelphia Center City Partners	Philadelphia
Peter Harnik	The Trust for Public Land	Washington, D.C.
Nancy Kafka	The Trust for Public Land	Boston
Alastair McFarlane	U.S. Dept of Housing and Urban Development	Washington, D.C.
Ken Meter	Crossroads Resource Center	Minneapolis
Sarah Nicholls	Michigan State University	East Lansing
Joan Reilly	Pennsylvania Horticultural Society	Philadelphia
Dan Stynes	Michigan State University	East Lansing
Patrice Todisco	Boston GreenSpace Alliance	Boston
Susan Wachter	University of Pennsylvania	Philadelphia
Guijing Wang	Centers for Disease Control	Atlanta
Richard Weisskoff	Everglades Economics Group	North Miami
Wayne Weston	Mecklenburg Parks and Recreation Department	Charlotte, North Carolina
Jennifer Wolch	University of Southern California	Los Angeles
Kathleen Wolf	University of Washington	Seattle
Matt Zieper	The Trust for Public Land	Boston

Appendix 3
Resources Related to the Economic Value of Parks

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