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Benefits and costs of urban parks: a review

Urban parks (UPs) play a fundamental role in improving the quality of living in urban areas since they can produce many types of benefits for the inhabitants. In the last years scholars have devoted a lot of effort to estimating the economic value of these benefits. The literature review has shown that previous studies are not free of bias and limitations, but they contributed towards improving our knowledge on the benefits that UPs produce and the methodologies that can be used to estimate them. As a general results it is possible to state that in many cases the flow of benefits largely overcomes the management costs so the UPs seem to produce a net gain for the citizens.

1. Introduction

According to Dunnett *et al.* (2002), urban green spaces (UGSs) encompass many types of green area (Tab. 1). Urban parks and gardens belong to the category of Recreation Green Spaces that are a part of Amenity Green Space. Urban parks and gardens (UPs) can be defined as landscapes that have been designed and are managed to meet some needs of the population. These needs relate to the necessity to relax spending time in contact with nature, enjoying the view of landscapes of high aesthetic and architectural quality, meeting people or participating in social activities, playing or taking part in physical activities and sports. UPs are mainly designed to provide benefits (recreational and social) that can be enjoyed only through their direct use by citizens. In some cases, due to their high architectural, aesthetic, historical and environmental quality, UPs can also have a relevant educational and cultural value. Their use is generally free, but in some contexts, as in the case of historical parks, there is an entrance fee.

However, like all other UGSs, UPs may have other important effects on the characteristics of the urban environment. For example, they can improve the atmosphere (physical and chemical characteristics), hydrology (water depuration, runoff regulation), reduce traffic noise and increase biodiversity. These can all result in considerable economic benefits for the population. For example, recreational activities can promote an increase in cognitive and physical performances that can directly (increased work productivity) and indirectly (less time lost through

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Table 1. Urban types of green spaces. Source: Dunnett *et al.*, 2002.

All urban green space	Amenity Green Space	Recreation Green Space	Parks and Gardens
			Informal Recreation Areas
			Outdoor Sports Areas
			Play Areas
		Incidental Green Space	Housing Green Space
			Other Incidental Space
		Private Green Space	Domestic Gardens
	Functional Green Space	Productive Green Space	Remnant Farmland
			City Farms
			Allotments
		Burial Grounds	Cemeteries
			Churchyards
		Institutional Grounds	School Grounds (including school farms and growing areas
			Other Institutional Grounds
	Semi-natural habitat	Wetland	Open/running water
			Marsh, Fen
		Woodland	Deciduous woodland
			Coniferous woodland
			Mixed woodland
		Other Habitats	Moor/heath
			Grassland
			Disturbed Ground
	Linear Green Space		River and Canal Banks
			Transport Corridors (road, rail, cycleways and walking routes)
			Other linear features (e.g. cliffs)

illness) improve incomes. The better air quality and the possibility for physical activity can improve health and lower healthcare expenditure. The reduction of the air temperature in summer leads to lower air-conditioning costs.

Since UGSs provide economic benefits, if the market were efficient, we would find a balanced presence of green, residential and productive areas in cities. In other words, if people were willing to pay a premium price to live in proximity to UGSs exactly equal to the benefits they receive, developers would build homes with private gardens or other green spaces in a proportion that satisfies the needs of the buyers and renters. If that happened, there would be no need for public interventions to increase the presence of green areas.

However, there are various factors that hinder the market operating efficiently. First the benefits provided by UGSs generally assume the nature of pure public goods and this can induce people to adopt strategic behaviour (e.g. free riding.). The creation of a private park produces environmental and aesthetic benefits that can be enjoyed at least partially by all those residing nearby, so every developer will be strongly encouraged to bear only part of the costs for the establishment and maintenance of urban green. As a result the percentage of urban area occupied by UGSs will be lower than is socially optimal level. It should also be emphasized that people are not always able to properly evaluate the benefits produced by UGSs because they cannot know the exact trade-off between the amount of UGSs and individual well-being. For example, it is difficult for a person to have precise knowledge of the energy savings due to living in proximity to a park. It is even more complex for a person to understand the health benefits associated with the restorative effect of seeing a pleasant landscape or the improvement in air quality generated by the trees in a park.

In addition, UPs are places for citizens to meet and socialize, so must therefore be open to the public. This vital function can only be provided through public intervention that takes into account the needs of the community and not just individual aspirations.

Ultimately only public intervention can ensure that there is an adequate supply of greenery and parks in urban areas (Choumert and Salanié, 2008). However, this poses the problem of being able to properly establish the area that should be occupied by parks and how it should be distributed within the city in order to maximize the net social benefits. In other words, to avoid the so-called "public failures" means that the costs incurred for public parks provision must be lower than the benefits. As we will see, calculation of the costs and especially of the benefits is anything but simple.

2. The costs

Following Mcdonough Maland (2012), the costs of UPs can be summarized as follows: "costs of acquiring the property; costs associated with developing the property, including design and construction costs; costs associated with operation and maintenance, including employee payroll and landscaping costs; the opportunity costs associated with the loss of property tax income that communities would have received if the property had been developed for other purposes". TPL-CCPE (2014) considers two main categorises of costs: operating and capital costs.

Obviously all these costs can vary widely depending on the specific characteristics of the area where the park has been established and its design; e.g. in some cases the area belongs to the municipality and in others not. The features of the paths can strongly modify the maintenance costs; the density of trees and shrubs or the presence of flower beds can increase the costs significantly, etc. Moreover, UPs can be managed in very different ways (Tempesta, 1997). Their maintenance can be contracted out to a private company or it can be provided

by the municipality. Especially in a period of economic crisis municipalities tend to reduce maintenance expenditures and delay some tasks (e.g. pruning), so an analysis of current expenditure could lead to an underestimation of the true costs (Fratini *et al.*, 2009). As a result, a wide variability exists in maintenance costs. A study conducted in 40 municipalities in the Veneto Region (Tempesta, 1997) highlighted that maintenance costs varied from € 0.39 to 2.73 per m^2 (constant price 2012) with an average of € 1.10 per m^2. On average the cost per inhabitant was € 10.08 per year. In the 87 biggest USA cities the spending on parks and recreation per resident ranges from $ 10 to 287 per capita per year (median = $ 73) (CCPE, 2014). In 15 UK parks the cost per inhabitant range from € 10.61 to € 44.12 and the cost per m^2 from € 0.28 to € 1.34 (constant price 2002) (Dunnett *et al.*, 2002).

Considering the different categories of expenditure (maintenance or operating costs and capital costs), following the results of the previous studies, it is possible to assume that maintenance costs constitute the major part of the total cost, ranging from 75% to 95%. For example, operating costs are more than 70% of the total costs in two thirds of the 87 municipalities analysed by the TPL-CCPE (2014).

3. The benefits

As previously described, UPs and UGSs in general may produce several benefits for the population. Despite a general consensus on some benefits, in some cases there seems to be a partial discrepancy among scholars' opinions. Konijnendijk *et al.* (2013), reviewing the scientific literature in the field of UPs services, listed the following effects: direct and indirect health effects, social cohesion, tourism, house prices, biodiversity, air quality and carbon sequestration, water management, cooling (Tab. 2). Analyzing the benefits of UPs in some USA cities, Harnik and Welle (2009) added to the list "direct uses" (sports, bicycling, skateboarding, walking, picnicking, bench-sitting and visiting a flower garden).

Nowak and Dwyer (2007), with reference to urban forests and trees, distinguished two main categories of benefits:

1 - Physical/biological: 1.1 urban atmosphere - temperature and microclimatic effects, removal of air pollutants, emission of volatile organic compounds by trees and emissions due to tree maintenance, energy conservation in buildings and consequent effects on emissions from power plants; 1.2 urban hydrology; 1.3 urban noise; 1.4 urban wildlife and biodiversity; 1.5 phytoremediation.

2 - Social and economic benefits: 2.1 benefits to individuals - city aesthetic improvement, emotional and spiritual experiences, psychological benefits, health; 2.2 benefits to communities - sense of community, stronger ties among neighbours, greater sense of safety, more supervision of children in outdoor places, healthier patterns of children's play, more use of neighbourhood common spaces, fewer incivilities, fewer property crimes, and fewer violent crimes; 2.3 real estate values.

Table 2. Experimental evidence of parks' effects. Source: Konijnendijk *et al.* (2013).

Benefits category	Nr. of articles	Main findings	Strength of evidence
1 - Biodiversity	62	Parks harbour higher species richness than other types of urban green space	Strong
2 - House prices	23	Nearby parks mostly have a positive impact on property prices - thus demonstrating that people's appreciation of parks in their living environment	Moderate to strong
3 - Health and wellbeing	86	3.1 Parks contribute to increasing physical activity and reducing obesity	Strong (moderate to strong for obesity)
		3.2 Parks contribute to stress reduction and improved self-reported health and mental health	Moderate
		3.3 Parks have an indirect effect through offering opportunities for recreation, psychological wellbeing and social support	Weak to moderate
		3.4 Parks have indirect health effects through reduced noise and cooling and increased longevity	Moderate
4 - Cooling	24	Parks contribute to cooling as they have lower day and night temperatures than surrounding areas	Moderate to strong
5 - Air quality and carbon dioxide sequestration	11	Parks contribute to air pollution removal and carbon dioxide sequestration	Weak to moderate
6 - Water regulation	6	Parks contribute to stormwater/run off management	Weak
7 - Tourism	8	Parks are attractive to tourists and are among their motivations to visit certain cities	Weak
8 - Social cohesion	5	Urban parks contribute to social inclusion and cohesion	Weak

Tyrväinen *et al.* (2007) also included historical and cultural benefits. The Trust for Public Land - Center for City Park Excellence (TPL – CCPE) analyzed the urban parks benefits in several U.S. cities and considered the following categories:

1 - Revenue-producing factors for city government (tax receipts from increasing property value and increased tourism value).

2 - Cost-saving factors for city government (stormwater management value; air pollution mitigation value).

3 - Cost-saving factors to citizens (direct value; health value, community cohesion value).

4 - Wealth-increasing factors to citizens (property value from park proximity; net profit from tourism).

In my opinion two major concerns arise from these lists of benefits. First, as pointed out by Konijnendijk *et al.* (2013), not all the effects are supported by sci-

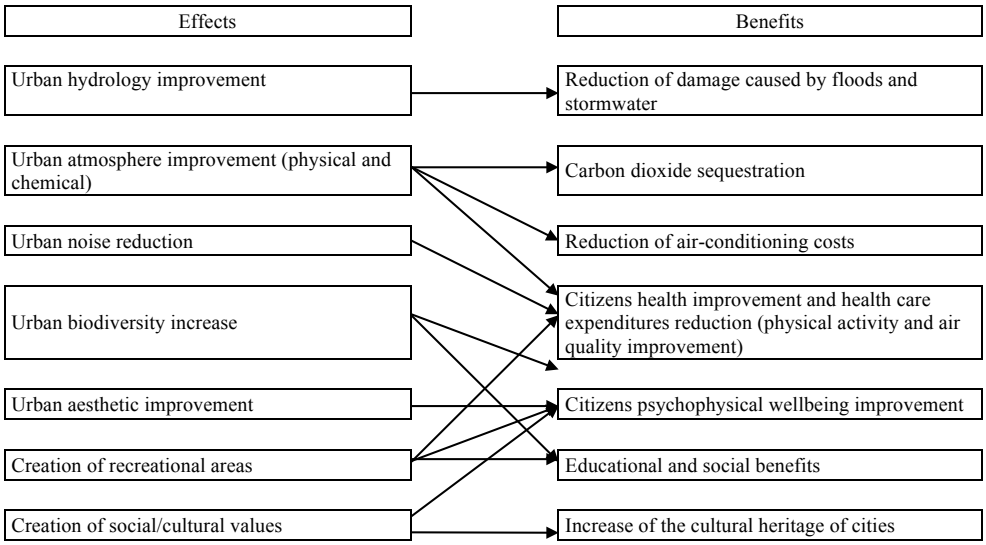
entific evidence (Tab. 2). These authors, reviewing the recent literature, state that the effects of UPs on tourism, social cohesion and water regulation have not been clearly and univocally demonstrated. Evidence of the effects on health and carbon dioxide sequestration is also weak to moderate.

Second, a certain degree of confusion seems to exist since authors do not generally distinguish the urban environment modifications generated by green areas from the benefits that they can produce and the methods that can be used in order to quantify these benefits in monetary terms; e.g. the increase in house prices is not a benefit per se, but can be considered as a sign that people like to live in proximity to the UPs. So the willingness to pay a higher price for a home is a monetary measure of all the benefits that can come from living near a green area.

Third, as summarized in Fig. 1, a benefit can be the result of the interaction between many social and environmental modifications. For example, the improvement of health (a benefit) depends on several and interacting environmental modifications: reduction of air pollution, noise reduction, the creation of recreational areas that increase the possibility for physical activities, etc. Instead, a modification of the environment can influence many different categories of benefits. For example, the urban atmosphere improvement can reduce the carbon dioxide concentration, air-conditioning costs and health care expenditures.

As a result it can be stated that the estimation of the benefits generated by UPs is very complex, given that each effect can contribute to different types of benefits and at the same time a single benefit can be the result of several environmental changes. In this respect double counting is probably the most important source of bias that can occur when estimating UPs benefits.

Figure 1. Effects of parks on urban social and ecological system and consequent benefits production.



4. Benefits evaluation

To estimate the value of the services generated by natural and semi-natural ecosystems in monetary terms, economists have proposed several methods that can be grouped into two broad categories: the approaches based on consumer surplus evaluation through demand analysis; the approaches based on the market value of benefits and costs. The first category includes stated preferences methods (contingent valuation – CV; discrete choice experiments – CE) and revealed preferences methods (hedonic pricing – HP; travel cost – TC). The second category includes analysis of: the avoided damage costs, the defensive expenditures and market value of the foodstuffs and raw materials provided by a natural environment. The evaluation can refer to an environmental effect (e.g. the composition of the atmosphere), to a benefit (e.g. health improvement) or to an ecosystem (e.g. a specific UP). As noted above, UPs can be evaluated in two different ways: analysing each benefit one at a time and then adding up the value of all the benefits; evaluating an urban park system as a whole or a single park. Unfortunately, in the past economists have rarely used one of these alternatives.

By means of contingent valuation, economists have usually tried to estimate the recreational value, which is a typical "use value" that encompasses several different benefits (health, psychological restoration, socializing needs, educational, etc.). But some of these benefits are not strictly linked to visiting the parks, e.g. health and psychological benefits are in some cases not strictly linked to frequenting the UPs. People can enjoy the view from their houses without visiting the park at all (Kaplan, 2001; Ulrich, 1984).

Hedonic price estimations can also be questionable. There are several motivations that can induce the people to pay more for a home located near a UP. The view of the green area, less time needed to reach the park, health benefits, reduction in air-conditioning costs, etc. By means of the hedonic price methods it is not possible to capture the recreational benefits for people living far from the park. While the influence of a UP on house prices tends to disappear within a radius of 600 m (Crompton, 2005), the visitors usually come from a wider area. 40% of visitors to 7 UPs in the Veneto Region travelled more than 5 km to reach the recreational area (Tempesta, 2009).

Revealed preferences

The HP method is based on the analysis of the relationships between the price of real estate (housing in particular) and quality of the surrounding environment.

A number of studies have used this method to estimate the value of UPs (Crompton, 2005 and 2007; McConnell and Walls, 2005), but the results are often not entirely comparable. In this respect McConnell and Walls (2005) stated that "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" so the results tend to be very case-study specific.

Bourassa *et al.* (2004) and Sander and Polasky (2009) highlighted the importance that visibility of the natural element from the home can assume. Their findings support the hypothesis that house price variation due to the proximity to natural elements depends on several factors, among which the aesthetic quality of the view is of particular importance. It is also interesting to note that the natural elements that mostly concur to increase the price are water and grassland while the impact of a forest is much lower.

With reference to distance, the model estimated by Brander *et al.* (2011) through a meta-analysis suggests that the impact of UPs on house prices tends to reduce very quickly. Crompton (2005, p.216) maintains that, in general, despite the high variability of HP researches, "a positive impact of 20% on property value abutting or fronting a passive park area is a reasonable starting point guideline". However the impact is substantial up to 150-180 m. "In the case of community size parks it tended to extend out to 450-600 m but after 150-180 m the premium was very small" (Crompton, 2005, p. 216).

With reference to park size, Poudyal *et al.* (2009) found that a 20% increase in park area in the city of Roanoke, Virginia could increase the residents' consumer surplus by about $ 160 per household, that is $ 6.5 million for the whole community. Analyzing the data collected by McConnell and Walls (2005) it emerges that in a radius of 460 m from the park the average price increase is less than 1.8%.

Cho *et al.* (2006), analysing the relationship between parks and house prices in Knox County (East Tennessee – USA), found that "the marginal implicit price of proximity to local parks (300 m closer) was estimated to be $ 172 […], but ranged from -$ 662 to $ 840 locally at an individual park level." (p. 504).

These data highlight that the effect of UPs can be very variable depending on the characteristics of the park itself and of the neighbourhood but in some cases its magnitude seems to be not negligible.

Stated preferences

Stated preferences approaches (and in particular CV) are probably the method applied most often in the past to evaluate the benefits produced by several categories of amenities. Despite the presence of a not negligible source of bias (Arrow *et al.*, 1999), in the case of familiar goods (like UPs) the values obtained may be considered substantially reliable.

Several studies applied CV to evaluate UPs benefits (Chen and Jim, 2008; del Saz Salazar, 2007; del Saz Salazar and García Menéndez, 2008; Jim and Chen, 2006; Lo and Jim, 2010; Marone *et al.*, 2010; Oueslati, *et al.* 2008; Tameko *et al.*, 2011; Tempesta, 2010; Tyrväinen and Väänänen, 1998) while, to my knowledge, only two used a CE (Bullock, 2004; Vecchiato and Tempesta, 2013). The CV studies were conducted to estimate the recreational value of existing parks (Del Saz Salazar and Rausell-Köster, 2008; Jim and Chen, 2006; Marone *et al.*, 2010; Tempesta, 2009; Tyrväinen and Väänänen, 1998), the value of the improvement of an existing park (Oueslati *et al.*, 2008; Tameko *et al.*, 2011), the total value of a new or an existing park (Chen and Jim, 2008; Lo and Jim, 2010).

By means of CE, Bullock (2004) and Vecchiato and Tempesta (2013) analysed the total economic value of new recreational areas considering the presence of some elements (water, tree cover, etc.). CE are of particular interest since they permit not only to estimate the social economic value but also to find the best arrangement in terms of land use and presence of facilities.

Given the diversity of the studies it is almost impossible to draw any general conclusion about the value estimated by means of the stated preferences approach. However, with reference to the Italian experience, Tab. 3 summarizes the estimation of the recreational value of 6 parks in Florence (Marone *et al.*, 2010) and 7 in the Veneto Region (Tempesta, 2010). As can be seen, the yearly benefits flow per hectare assumes very different values in both Florence and the Veneto Region. Furthermore, given that maintenance costs in Italy are about € 0.8÷1.0 per m^2, in 4 parks out of 13 the recreational benefits are lower than the maintenance costs.

Other methods

Especially in the USA, there has been an attempt in recent years to evaluate the benefits generated by UPs one by one. With this aim some authors tried to apply the STRATUM methodology originally proposed by the US Forest Service to estimate the total economic value of urban trees (McPherson and Simpson, 2002; Millward and Sabir, 2011). A large number of studies following a similar approach

Table 3. The recreational benefits of 13 Italian urban parks. Source: Fratini *et al.* 2009; Tempesta, 2010.

Park	Municipality	Surface (ha)	WTP (€ per visit)	Total WTP € per ha per year
Villa Voegel	Florence	4.98	3.19	5,924.2
Villa Strozzi	Florence	8.70	4.31	12,165.9
Piazza Tasso	Florence	0.62	2.08	22,427.5
Borgo Allegri	Florence	0.19	4.25	8,145.8
Campo di Marte	Florence	2.60	3.23	9,415.3
Galluzzo	Florence	1.22	5.33	24,754.9
Castello S. Martino	Cervarese Santa Croce (PD)	1.88	1.49	1,535.0
Villa Bolasco	Castelfranco Veneto (TV)	7.63	2.79	2,560.0
Manin	Montebelluna (TV)	3.20	1.40	14,427.0
Buzzaccarini	Monselice (PD)	3.24	0.90	2,781.0
Iris	Padova	6.50	1.12	18,748.0
Bosco di Pianura	Piove di Sacco (PD)	5.00	2.68	16,529.9
Villa Margherita	Treviso	6.50	2.03	14,354.3

have been conducted by the TPL-CCPE[1]. In general these approaches try to transform trees and/or other elements of park cover into a monetary value by defining a trade-off between the environment transformation and the costs saved by the community in terms of energy savings, atmospheric carbon dioxide reductions, air quality benefits, stormwater runoff reductions, aesthetics and other benefits (McPherson and Simpson, 2002). Unfortunately the coefficients utilized to transform the physical modifications of the urban environment into a monetary value do not always seem to be scientifically grounded. Moreover, since the aesthetic value is estimated by means of a simplified hedonic pricing approach a clear problem of double counting exists.

For example, McPherson *et al.* (2005) compared the costs and benefits of municipal forests in five US cities (Tab. 4) considering all the trees present in the urban areas. They considered five categories of benefits: energy saving, carbon sequestration, air quality improvement, stormwater damage reduction and property value increase (or aesthetic value). These authors concluded that the benefits largely overcame the costs. Anyway the most important benefit found in the study was the property value increase that in three cases out of five was more than 70% of the total benefits. But to estimate the property price increases they used the results of a research conducted by Anderson and Codell in 1988. To calculate the impact of trees on real estate prices they considered that each large front yard tree was associated with a 0.88% increase in sale price. It is also evident that a problem of double counting exists since the increase in house prices can also depend on energy saving.

With reference to the researches sponsored by the TPL-CCPE, Tab. 5 presents the results of studies carried out in 9 U.S. cities. Also in these cases the benefits estimation is rather questionable. For example the benefits coming from direct use partly encompass health benefits. The property value increase also depends on the possibility of using the park for recreational purposes. Contrary to the previous study, the property value increase constitutes only 25% of the total benefits on average, while recreational benefits are equal to 55%. Moreover from a theoretical point of view is not possible to consider the tax receipts coming from the increase in house prices and profits from tourism as social benefits, as they are just a transfer of money from the private to public sector.

5. Conclusions

In the last years scholars have devoted a lot of effort to estimating the total economic value of UPs. As the literature analysis has shown, previous studies are not free of bias and limitations, but they contributed towards improving our knowledge on the benefits that UPs produce and the methodologies that can be

[1] It is possible to download the research reports consulting this site: https://www.tpl.org/center-city-park-excellence.

Table 4. Annual benefits and costs for the urban forests in five U.S. cities. Source: McPherson *et al.*, 2005.

U.S. Dollars

	Ft. Collins	Cheyenne	Bismark	Berkley	Glendale
Energy	112,025	186,967	84,348	553,061	116,735
Co_2	40,454	29,134	27,268	49,588	12,039
Air quality	18,477	11,907	3,715	-20,635	32,571
Stormwater	403,597	55,297	496,227	215,648	37,298
Property increase	1,596,247	402,723	367,536	2,449,884	467,213
Total benefits	2,170,799	688,029	979,094	3,247,545	665,856
Planting	111,052	45,913	5,880	95,000	21,100
Pruning	405,344	84,677	94,850	770,000	88,412
Remove/dispose	130,487	23,337	50,061	70,000	12,710
Im/litre/gm waste	94,394	97,840	38,241	195,000	65,813
Infrastructure and liability	72,200		21,490	1,062,000	3,000
Admin/inspect/other	184,161	76,130	106,118	180,000	85,401
Total costs	997,638	327,897	316,640	2,372,000	276,436
Net benefits	1,173,161	358,133	662,454	875,545	389,421
Benefits costs ratio	2.18	2.10	3.09	1.37	2.41

Percentage

	Ft. Collins	Cheyenne	Bismark	Berkley	Glendale
Energy	5.16	27.17	8.61	17.03	17.53
Co_2	1.86	4.23	2.79	1.53	1.81
Air quality	0.85	1.73	0.38	-0.64	4.89
Stormwater	18.59	8.04	50.68	6.64	5.60
Property increase	73.53	58.53	37.54	75.44	70.17
Total benefits	100.00	100.00	100.00	100.00	100.00
Planting	11.13	14.00	1.86	4.01	7.63
Pruning	40.63	25.82	29.96	32.46	31.98
Remove/dispose	13.08	7.12	15.81	2.95	4.60
Im/litre/gm waste	9.46	29.84	12.08	8.22	23.81
Infrastructure and liability	7.24	0.00	6.79	44.77	1.09
Admin/inspect/other	18.46	23.22	33.51	7.59	30.89
Total costs	100.00	100.00	100.00	100.00	100.00

Table 5. Estimated annual value of the park recreation system in 9 U.S cities. Source: Harnik, 2014, TPL-CCPE, 2008a, 2008b, 2008c, 009a, 2009b, 2010, 2011a, 2011b.

U.S. Dollars

	Denver	Seattle	Wilming-ton	San Fran-cisco	Virginia Beach	San Diego	Sacra-mento	Boston	Philadel-phia	Average
Revenue-Producing Factors for City Government										
- Tax receipts for increasing property value	4,081.3	14,771.3	1,234.0	24,674.9	2,218.7	3,922.0	417.0	8,264.0	1,812.9	6,821.8
- Tax receipts from increased tourism value	3,048.9	3,489.4	129.0	46,909.7	8,428.7	8,579.0	2,613.0	1,917.0	5,177.0	8,921.3
Total	7,130.2	18,260.7	1,363.0	71,584.6	10,647.4	12,501.0	3,030.0	10,181.0	6,989.9	15,743.1
Cost-Saving Factors for City Government										
- Stormwater management value	804.2	2,313.3	409.0	1,916.9	1,516.2	3,402.0	842.0	8,675.0	5,949.0	2,869.7
- Air pollution mitigation value	128.9	526.8	39.0	3,117.7	4,516.7	5,915.0	359.0	553.0	1,534.0	1,854.5
- Community Cohesion value	2,674.4	9,537.6	1,058.0	66,567.6	3,954.4	3,795.0	5,525.0	3,858.0	8,600.0	11,730.0
Total	3,607.5	12,377.7	1,506.0	71,602.3	9,987.3	13,112.0	6,726.0	13,086.0	16,083.0	16,454.2
Cost-Saving Factors to Citizens										
- Direct value	452,014.3	447,501.1	41,805.0	211,904.4	337,453.9	1,226,116.0	345,597.0	354,352.0	1,076,303.0	499,227.4
- Health value	64,955.5	30,027.8	4,322.0	49,221.7	38,472.5	45,122.0	19,872.0	78,042.0	69,419.0	44,383.8
Total	516,969.8	477,528.9	46,127.0	261,126.1	375,926.3	1,271,238.0	365,469.0	432,394.0	1,145,722.0	543,611.2
Wealth-Increasing Factors to Citizens										
- Property value from park proximity	30,690.8	80,794.1	10,256.0	122,522.8	10,249.3	261,507.2	72,000.0	724,929.0	688,849.0	222,422.0
- Net profit from tourism	18,027.5	30,027.6	715.0	431,083.8	295,004.1	40,033.0	9,225.0	86,741.0	40,263.0	105,680.0
Total	48,718.3	110,821.7	10,971.0	553,606.6	305,253.3	301,540.2	81,225.0	811,670.0	729,112.0	328,102.0
Total benefits	576,425.8	618,989.0	59,967.0	957,919.6	701,814.4	1,598,391.2	456,450.0	1,267,331.0	1,897,906.9	903,910.5

U.S. Dollars x 1,000
Percentage

	Denver	Seattle	Wilming-ton	San Fran-cisco	Virginia Beach	San Diego	Sacra-mento	Boston	Philadel-phia	Total
Revenue-Producing Factors for City Government										
- Tax receipts for increasing property value	0.71	2.39	2.06	2.58	0.32	0.25	0.09	0.65	0.10	0.75
- Tax receipt from increased tourism value	0.53	0.56	0.22	4.90	1.20	0.54	0.57	0.15	0.27	0.99
Total	1.24	2.95	2.27	7.47	1.52	0.78	0.66	0.80	0.37	1.74
Cost-Saving Factors for City Government										
- Stormwater management value	0.14	0.37	0.68	0.20	0.22	0.21	0.18	0.68	0.31	0.32
- Air pollution mitigation value	0.02	0.09	0.07	0.33	0.64	0.37	0.08	0.04	0.08	0.21
- Community Cohesion value	0.46	1.54	1.76	6.95	0.56	0.24	1.21	0.30	0.45	1.30
Total	0.63	2.00	2.51	7.47	1.42	0.82	1.47	1.03	0.85	1.82
Cost-Saving Factors to Citizens										
- Direct value	78.42	72.30	69.71	22.12	48.08	76.71	75.71	27.96	56.71	55.23
- Health value	11.27	4.85	7.21	5.14	5.48	2.82	4.35	6.16	3.66	4.91
Total	89.69	77.15	76.92	27.26	53.56	79.53	80.07	34.12	60.37	60.14
Wealth-Increasing Factors to Citizens										
-Property value from park proximity	5.32	13.05	17.10	12.79	1.46	16.36	15.77	57.20	36.30	24.61
- Net profit from tourism	3.13	4.85	1.19	45.00	42.03	2.50	2.02	6.84	2.12	11.69
Total	8.45	17.90	18.30	57.79	43.49	18.87	17.79	64.05	38.42	36.30
Total benefits	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

used to estimate them. With reference to the first aspect, past researches are useful because they have provided a systematic and comprehensive knowledge of the categories of benefits generated by UPs.

Analysing past researches it seems possible to identify six main categories of benefits: reduction of the damage caused by floods and stormwater; carbon dioxide sequestration; reduction of air-conditioning costs; citizens' health improvement; citizens' psychophysical wellbeing improvement, educational and social benefits and increase of the cultural heritage of the cities. It is important to underline that some of these benefits arise from a direct use of the UPs while others tend to be more pervasive, involving all the people living in a municipality or in proximity to a UP. The positive effects on psychological wellbeing, education and social cohesion and, partly on health, depend largely on the direct frequentation of the UPs or on the view of a green area from home. They can be considered as "direct use benefits". Despite the limitations of the methodologies employed, the studies conducted in the USA by the TPL-CCPE seem to support the hypothesis that direct use values constitute the largest fraction of the total benefits produced by UPs. Among the direct use benefits, the recreational ones, i.e. the benefits coming from frequentation of the UPs, are probably the most important since they seem produce no less than half of the total benefits. For the direct use benefits in general it is possible to suppose that people have an approximate idea of the trade-off existing between the quantity and quality of the UPs surrounding the area where they live and their wellbeing, so it is possible to obtain a reliable estimation using both stated and revealed preference approaches. In any case it is necessary to pay attention to the type of benefits that each method is able to capture. In this respect I noted above that while by means of contingent valuation it is possible to estimate the use (recreational) value of the UPs visitors, the estimations obtained by hedonic pricing are rather spurious since, in theory, they can encompass many different types of benefits: psychological wellbeing due to the view of a green area from home, health benefits due to frequenting the UPs and the improvement of air quality, reduced air-conditioning costs. The other benefits listed in Fig. 1 can to a certain extent be estimated by means of the avoided cost (or income loss) approach or by the calculation of the defensive expenditures reduction. This holds in the case of the reduction of damage caused by floods and stormwater, reduction of air-conditioning costs and reduction of health care expenditures (or of income losses due to workers' health improvement) coming from the improvement of air quality and noise abatement in cities.

Calculation of the value of carbon sequestration is also to a certain extent straightforward since it is relatively simple to estimate the amount that the vegetation in UPs can capture each year.

Adding up the willingness to pay to frequent the UPs, the avoided costs, the reduction of defensive expenditures and the value of sequestered carbon dioxide it is possible to correctly compute the majority of benefits coming from the UPs without incurring in the double counting bias. Only one category of benefits cannot be considered in this way, namely the improvement of psychological wellbeing due to the view of a green area from home. To overcome this limitation it is

possible to follow two alternative methods. The first consists in isolating the effect of park visibility from the effect of proximity by means of the hedonic price method. In fact it is possible to suppose that if a price difference exists between apartments fronting the UPs and others located at the same distance but with no view of the UPs, this difference depends essentially on the psychological benefits caused by the visibility of the green area (Bourassa *et al.*, 2004; Sander and Polasky, 2009).

A second possible approach consists in a holistic evaluation of the UPs benefits. In this case, by means of contingent valuation or a choice experiment, it should be possible to estimate the willingness to pay to increase the existing UPs area or to prevent its reduction. Note however that in this case only the marginal value should be estimated and not the average value of the whole urban parks system. This approach is useful only when deciding on whether to create a new park or to develop an area where a park exists.

In conclusion, it seems that new researches should be conducted in the future in order to improve our knowledge about the flow of benefits produced by the UPs in different cities, also taking into account the drawbacks mentioned in this review. Nonetheless, the results of past researches testify that UPs play an important role in urban areas since they are able to improve the quality of life and generate a relevant benefits flow. Moreover in many cases the flow of benefits largely overcomes the management costs so the UPs seem to produce a net gain for the citizens. This finding is of particular importance since it supports the advisability of preserving the existing UPs and also, in some cases, the necessity to create new green areas in cities.

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