

# Urban Street Trees

**22 Benefits**

**Specific Applications**



Dan Burden,  
Senior Urban Designer, Glatting Jackson, Walkable Communities, Inc..  
Summer, 2006



# Urban Street Trees

## 25 Benefits

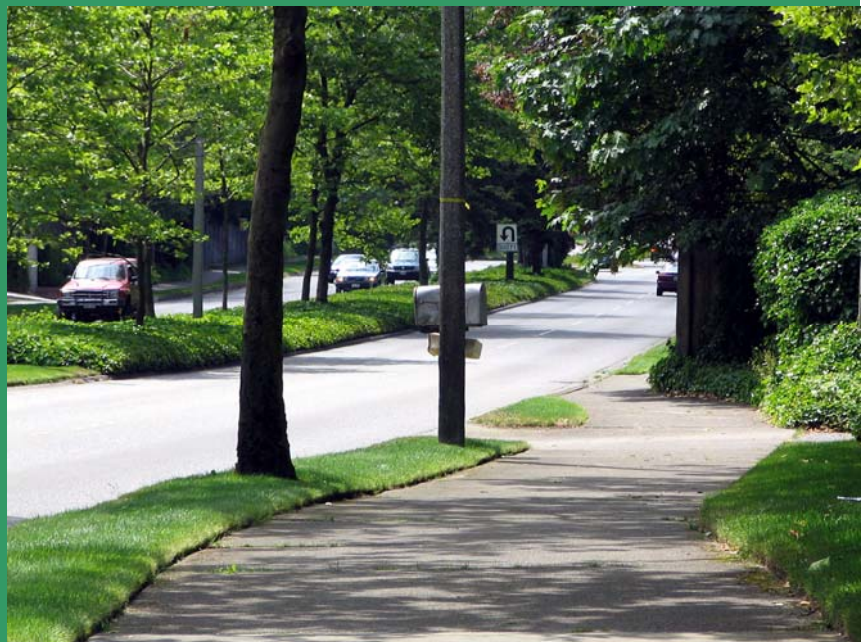
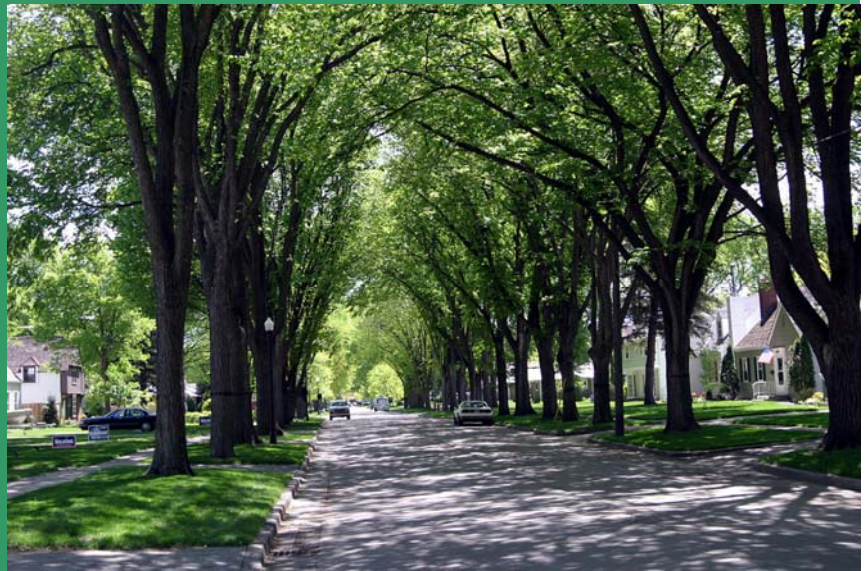
By Dan Burden, Senior Urban Designer  
Glattig Jackson and Walkable Communities, Inc;  
August, 2006

U.S Forest Service facts and figures and new traffic safety studies detail many urban street tree benefits. Once seen as highly problematic for many reasons, street trees are proving to be a great value to people living, working, shopping, sharing, walking and motoring in and through urban places. With new emphasis on LEEDS neighborhoods, expect this interest to grow in most urban places.

For a planting cost of \$250-600 (includes first 3 years of maintenance) a single street tree returns over \$90,000 of direct benefits (not including aesthetic, social and natural) in the lifetime of the tree. Street trees (generally planted from 4 feet to 8 feet from curbs) provide many benefits to those streets they occupy. These trees provide so many benefits that they should always be considered as an essential urban area street making feature.

With new attentions being paid to global warming causes and impacts more is becoming known about negative environmental impacts of treeless urban streets. We are well on the way to recognizing the need for urban street trees to be preferred urban design, rather than luxury items tolerated by traffic engineering and budget conscious city administrators.

The many identified problems of street trees are overcome with care by designers. Generally street trees are placed each 15-30 feet. These trees are carefully positioned to allow adequate sight triangles at intersections and driveways, to not block street luminaries, not impact utility lines above or below ground. Street trees of various varieties are used in all climates, including high altitude, semi-arid and even arid urban places.





The science of street tree placement and maintenance is well known and observed in a wide ranging number and diversity of communities by size and region (i.e. Chicago, Illinois; Sacramento, Davis, California; Eugene, Oregon; Seattle, Redmond, Olympia and Issaquah, Washington; Charlotte, N.C.; Keene, New Hampshire and Cambridge, Mass). Although care and maintenance of trees in urban places is a costly task, the value in returned benefits is so great that a sustainable community cannot be imagined without these important green features.

### **Properly placed and spaced urban street trees provide many benefits:**

**Increased motorized traffic and pedestrian safety** (contrary to engineering myths). See below article for details on mode safety enhancements. See especially the compilation of safety benefits detailed in, Safe Streets, Livable Streets, by Eric Dumbaugh Journal of the American Planning Association, Vol. 71, No. 3, Summer 2005. One such indication of increased safety with urban street trees is quoted from this document:

*"...Indeed, there is a growing body of evidence suggesting that the inclusion of trees and other streetscape features in the roadside environment may actually reduce crashes and injuries on urban roadways. Naderi (2003) examined the safety impacts of aesthetic streetscape enhancements placed along the roadside and medians of five arterial roadways in downtown Toronto. Using a quasi-experimental design, the author found that the inclusion of features such as trees and concrete planters along the roadside resulted in statistically significant reductions in the number of mid-block crashes along all five roadways, with the number of crashes decreasing from between 5 and 20% as a result of the streetscape improvements. While the cause for these reductions is not clear, the author suggests that the presence of a well defined roadside edge may be leading drivers to exercise greater caution."*



## **Trees**

I think that I shall never see  
A poem lovely as a tree.  
A tree whose hungry mouth is prest  
Against the sweet earth's flowing breast;  
A tree that looks at God all day,  
And lifts her leafy arms to pray;  
A tree that may in summer wear  
A nest of robins in her hair;  
Upon whose bosom snow has lain;  
Who intimately lives with rain.  
Poems are made by fools like me,  
But only God can make a tree.

...Joyce Kilmer (1913)  
American poet,  
killed during WWI at the age of 31



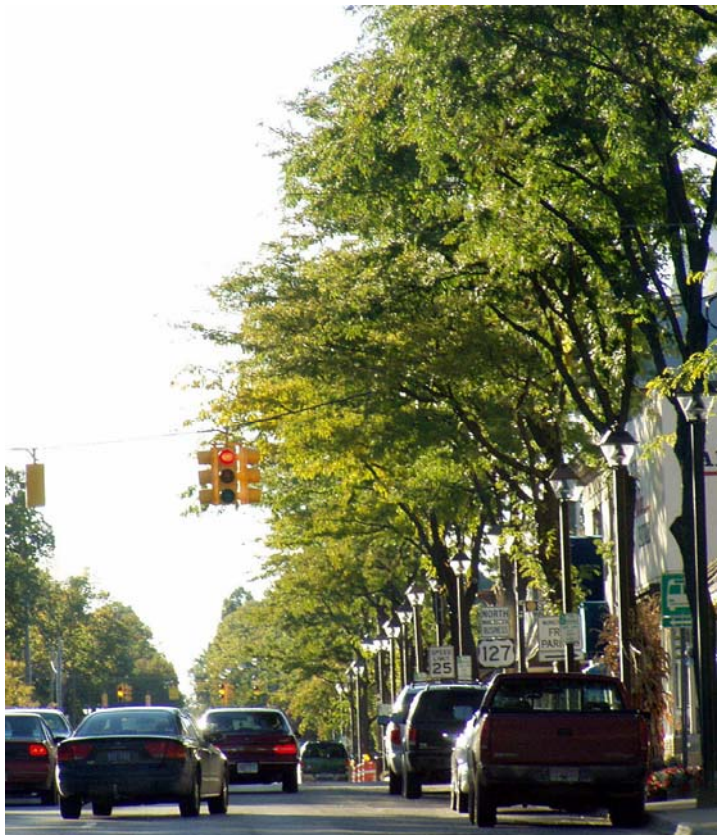
# 25 Benefits Detailed:

1. **Reduced and more appropriate urban traffic speeds.** Urban street trees create vertical walls framing streets, providing a defined edge, helping motorists guide their movement and assess their speed (leading to overall speed reductions). Street safety comparisons show reductions of run-off-the-road crashes and overall crash severity when street tree sections are compared with equivalent treeless streets. (Texas A and M conducted simulation research which found people slow down while driving through a treed scape. These observations are also seen in the real world when following motorists along first a treed portion of a street, and then a non treed portion (see page 13). Speed differentials of 3 mph to 15 mph are noted.
2. **Create safer walking environments,** by forming and framing visual walls and providing distinct edges to sidewalks so that motorists better distinguish between their environment and one shared with people. If a motorist were to significantly err in their urban driving task, urban street trees help deflect or fully stop the motorist from taking an innocent human life.
3. **Trees call for placemaking planting strips and medians,** which further separate motorists from one another, pedestrians, buildings and other urban fabric. This green area adds significantly to aesthetics and placemaking. Urban area medians with trees are safer than those without trees (R. Ewing, Caltrans Study, circa 2003). Medians reduce crashes by 50% or more.



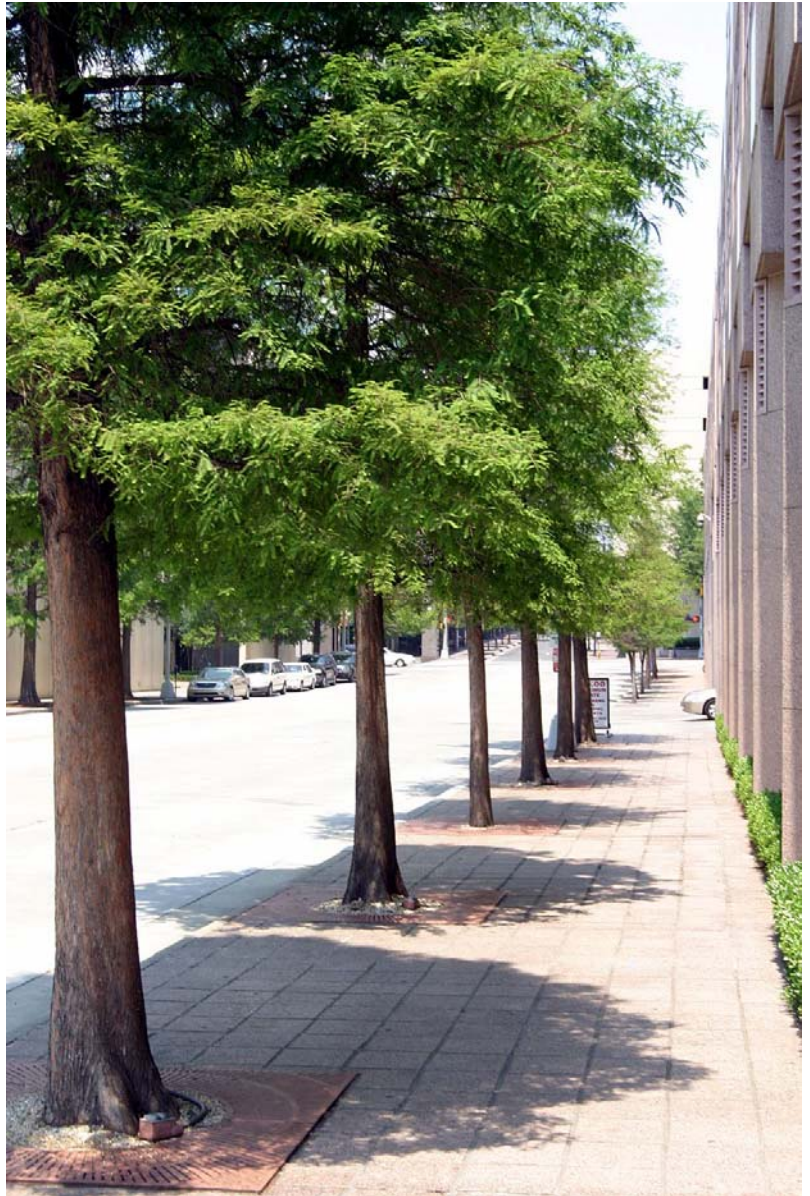


4. **Increased security.** Trees create more pleasant walking environments, bringing about increased walking, talking, pride, care of place, association and therefore actual ownership and surveillance of homes, blocks, neighborhoods plazas, businesses and other civic spaces.
5. **Improved business.** Businesses on canopied streets report people pay 12 cents more on the dollar than on equivalent treeless main streets. This is an essential competitive edge needed for main street store success, versus competition from plaza discount store prices. Prices were, on average, about 12% higher for products in the landscaped district compared to the no-tree district. This was true of low-price, impulse-buy convenience goods (e.g. lunch sandwich, flower bouquet), as well as bigger ticket, comparison shopped items (e.g. sports shoes, new glasses). Given the low profit margins of most retail businesses, trees appear to provide a significant amenity margin (Kathleen Wolfe, Grow for the Gold, University of Washington, TreeLink, Spring, 1999).
6. **Less drainage infrastructure.** Trees absorb the first 30% of most precipitation through their leaf system, allowing evaporation back into the atmosphere. This moisture never hits the ground. The leaves of a mature tree intercept an average of 760 gallons of rainfall a year. Each tree that lives about 40 years saves \$10 a year in reduced water flow treatment and control in the Portland metro area. (Source: Trees for Green Streets, Metro) Another percentage (up to 30%) of precipitation is absorbed back into the ground and taken in and held onto by the root structure. Some of this moisture is then absorbed and transpired back to the air. Some of this water also naturally percolates into the ground water and aquifer. Storm water runoff and flooding potential to urban properties is therefore reduced. Every 1,000 urban trees we plant in the Northwest (and most places) today will save our region more than a million dollars in stormwater management, pollution abatement, and energy costs. (Source: Center for Urban Forest Research, Davis, California).





7. **Rain, sun, heat and skin protection.** For light or moderate rains, pedestrians find less need for rain protection. In cities with good tree coverage there is less need for chemical sun blocking agents. Temperature differentials of 5-15 degrees are felt when walking under tree canopied streets. Shade from trees can cool buildings up to 20 degrees in the summer. (Source: City of Portland)
8. **Reduced harm from tailpipe emissions.** Automobile and truck exhaust is a major public health concern and contains significant pollutants, including carbon monoxide (CO), volatile organic compounds (VOC), nitrogen oxides (NOx), and particulate matter (PM). Tailpipe emissions are adding to asthma, ozone and other health impacts. Impacts are reduced significantly from proximity to urban trees.
9. **Gas transformation efficiency.** City trees are fifteen times more capable of reducing carbon in the atmosphere than rural trees. Trees next to or above tailpipe emissions (streets and parking lots) can be even more effective. (Source: ENN "Urban forests make environmental and economic sense," Thursday, April 11, 2002) provided by The Climate Trust.
10. **Lower urban air temperatures.** Asphalt and concrete streets and parking lots are known to increase urban temperatures 3-7 degrees. These temperature increases significantly impact energy costs to homeowners and consumers. Properly shaded neighborhoods, mostly from urban street trees, reduce energy bills for households from 15-35%. Each urban tree with a 50-year lifespan provides an estimated \$273 a year in reduced costs for air conditioning, erosion control, stormwater control, air pollution, and wildlife shelter. (Source: City of Portland, Oregon)



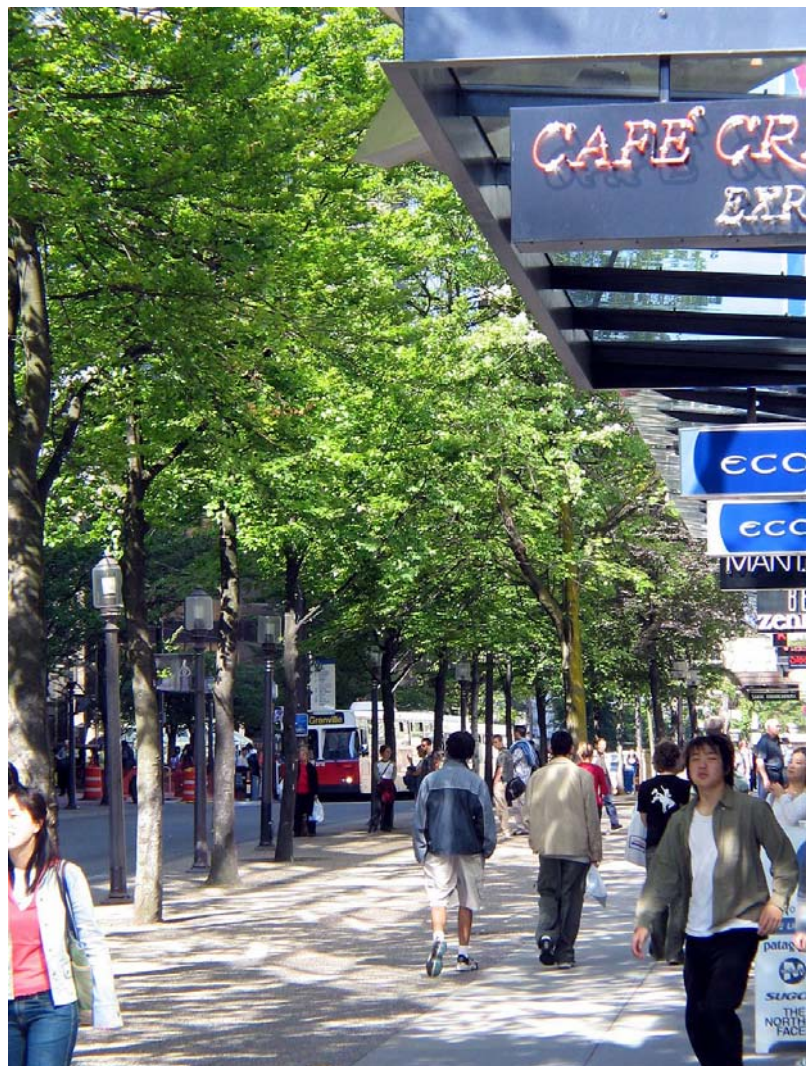


11. **Lower Ozone.** Increases in urban street temperatures that hover directly above asphalt where tailpipe emissions occur dramatically increase creation of harmful ozone and other gasses into more noxious substances impacting health of people, animals and surrounding agricultural lands.

12. **Convert streets, parking and walls into more aesthetically pleasing environments.** There are few streetmaking elements that do as much to soften wide, grey visual wastelands created by wide streets, parking lots and massive, but sometimes necessary blank walls than trees.

13. **Soften and screen necessary street features** such as utility poles, light poles and other needed street furniture. Trees are highly effective at screening those other vertical features to roadways that are needed for many safety and functional reasons.

14. **Reduced blood pressure, improved overall emotional and psychological health.** People are impacted by ugly or attractive natural environments where they spend time. Kathlene Wolf, Social Science Ph.D. University of Washington gave a presentation that said “the risk of treed streets was questionable compared to other types of accidents along with the increased benefit of trees on human behavior, health, pavement longevity, etc.” She noted that trees have a calming and healing effect on ADHD adults and teens.





**15. Reduced Road Rage, Improved ability to fight off disease.** An interesting effect found in recent studies on driving and road stress is called the “immunization effect” — the degree of negative response to a stressful experience is less if a view of nature preceded the stressful situation. Constant stress can impact our immune system as well as diminish the ability to cope with challenging situations. Roger Ulrich has done studies that measure the physiological responses of our bodies (such as blood pressure and heart rate) brought on by stress. He has found that people who view nature after stressful situations show reduced physiological stress response, as well as better interest and attention and decreased feelings of fear and anger or aggression. As sprawl induces Americans to increase their time spent in travel — often stuck in traffic — the ability to be in green, natural environments will help.

**16. Time in travel perception.** Other research and observations confirm that motorists perceive the time it takes to get through treed versus non-treed environments has a significant differential. A treeless environment trip is perceived to be longer than one that is treed (Walter Kulash, P.E.; speech circa 1994, Glatting Jackson).

**16. Traffic calming effects.** Experience based on monitoring the speed of motorists as they travel from an urban tree versus stark neighborhood street environment in a number of cities reveals a 5-15 mph difference in their speeds (Burden, Walkable Communities, Inc.). Trees contribute to neighborhood livability by reducing city noise and glare, and by calming and slowing traffic.

**18. Improved operations potential.** When properly positioned and maintained, the backdrop of street trees allow those features that should be dominant to be better seen, such as vital traffic



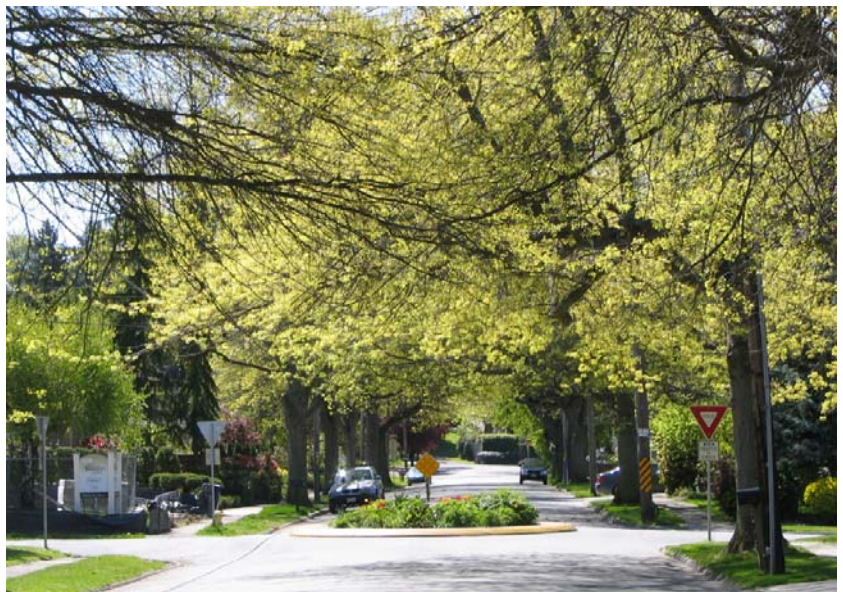


regulatory signs. The absence of a well developed Greenscape allows the sickly grey mass of strip to dominate the visual world. At the same time, poorly placed signs, signals, or poorly maintained trees reduce this positive gain, and thus proper placement and maintenance must be rigidly adhered to.

19. **Added value to adjacent homes, businesses and tax base.** Realtor based estimates of street tree versus non street tree comparable streets relate a \$15-25,000 increase in home or business value. Other estimates are higher. (e.g. “Trees increase home property values 7 to 21 percent, depending on the number and size of the trees.” (Source: City of Portland). In the lower part of Beverly Hills, Calif., where meandering streets are each lined with a different tree species such as blooming jasmine, coral tree and jacaranda, it has been estimated that removal of those trees would decrease property values by 25 percent.

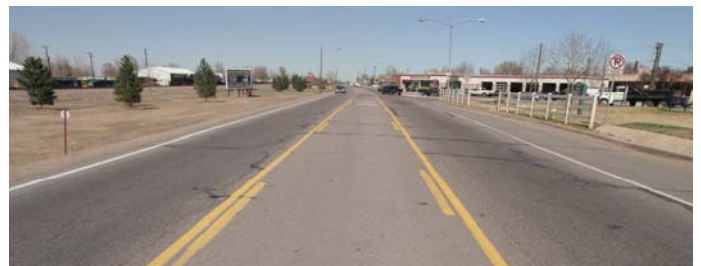
20. **Streets Trees Strengthen City/County Budgets.** As noted above, increase in home values through canopy trees indirectly add to city tax bases and operations budgets, allowing for added street maintenance. Future economic analysis may determine that this offsets or is more than a break even benefit.

21. **Street trees offset density.** Since many new neighborhoods will need to have more density (to afford parks, walkability, efficiency and sustainability) public perception of streets may require a good growth of street trees. Mature trees make increases in density more palatable to residents. In focus groups conducted for the city of Burlington, outside of Toronto, participants were shown photos of residential buildings at various densities in order to measure the community’s reaction to housing “intensification.” The participants were asked to rate the images. Consistently, the images of dwellings with mature trees and landscaping were ranked highly favorable, regardless of the density of the dwellings in the photo.





22. **Provides a lawn for a splash and spray zone, storage of snow, driveway elevation transition and more.** Tree lawns are essential parts of the operational side of a street.
23. **Filtering and screening agent.** Softens and screens utility poles, light poles, on-street and off-street parking and other features creating visual pollution to the street.
24. **Longer pavement life.** Studies conducted in a variety of California central valley environments show that the shade of urban street trees adds 40-60% more life to costly asphalt. This factor is based on reduced daily heating and cooling (expansion/contraction) of asphalt. As peak oil pricing increases roadway overlays, this becomes a significant cost reduction to maintaining more affordable roadway systems.
25. **Connection to nature and the human senses.** Urban street trees provide a canopy, root structure and setting for important insect and bacterial life below the surface; at grade for pets and romantic people to pause for what pets and romantic people pause for; they act as essential lofty environments for song birds, seeds, nuts, squirrels and other urban life. Indeed, street trees play such a critical role to establish natural and comfortable urban life it is unlikely we will ever see any advertisement for any marketed urban product, including cars, to be featured without street trees making the ultimate dominant, bold visual statement about place.



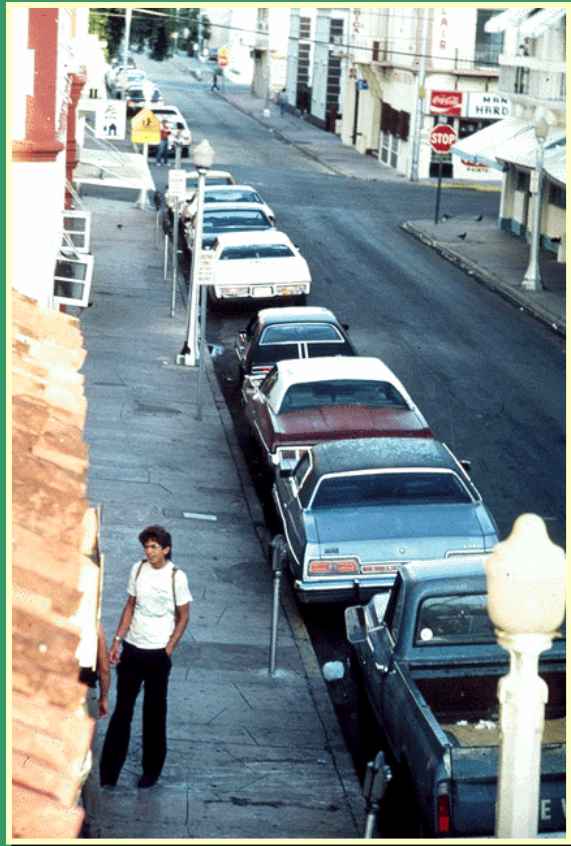


## Trees create place (Before and After)

Shown here, Espanola Way (South Beach, Miami, Florida) one year before and one year after a street-scaping project. Without the use of green it is unlikely that this street would have come alive. Property values went from an estimated \$1M to \$4.3 M for the same building within one year. Sales increases in shops are hard to measure since most marginal operations were quickly replaced with highly successful stores.

“Planting and landscape draw a lot of people...We wouldn’t have what we have without plants,” explained a property manager. Plants and trees, if properly selected and maintained, create a pleasant space. A realtor observed that, “The benefits are huge. [Trees] just give a whole different dimension to a street, particularly with seasonal changes.”

Kathy L. Wolf, Ph.D., [wolf@u.washington.edu](mailto:wolf@u.washington.edu)







## Trees provide enclosure

West Hartford's Farmington Avenue tree canopy forms an attractive wall of green. This sense of enclosure creates an important quality place allowing pedestrians to feel fully separated from the movement of more than 25,000 vehicles in the adjacent street.







## Trees provide shelter

It rained all day. When author Dan Burden spent mid morning to mid-afternoon on West Hartford's Farmington Avenue he did not get wet. The canopy cover kept sidewalks dry, despite a steady light all-day rain. Trees capture significant rainfall then transpire it back into the atmosphere before it can reach the ground. Meanwhile other water runs down branches and trunk to allow deep root and aquifer absorption and penetration.





## Tree and Lamp Placement

Well placed trees allow even and attractive lamp placement.

It is important that lamps provide proper levels of lumination to create welcoming and comfortable walking environments, day and night.

Generally lamps are placed midway between trees, allowing for some variation between other essential furniture such as seating and fire hydrants.





Collector



Collector



Local



Local



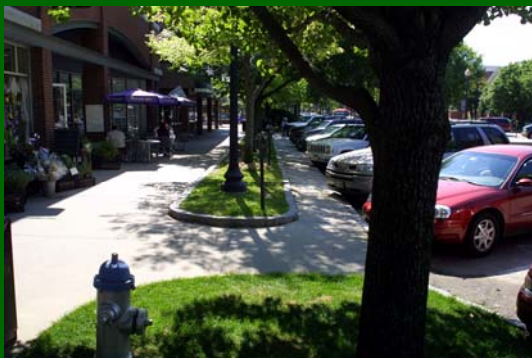
### Traffic Calming results from correct tree placement

The top two images are both collector category streets (Avenues). Historic tree planted streets reduce speeds, provide greater green cover, and allow homes to face streets, thus rewarding walking activity. More recent street making practices maximize asphalt, increasing the tendency to speed. Environments highly discourage developers to orient homes toward the street. Walking becomes a lonely and sometimes scary activity. The bottom two images each have the same curb to curb dimensions. Trees placed at the street and on street parking bring speeds down 6-15 mph.



## Trees Screen Parking

Effective tree placement softens harshening effects of on-street parking. A combination of tree planting tools, from curb extensions, block entry tree clusters, mid-block tree clusters at curb extensions and tree wells are common tools for screening and greening parking areas.







### Alley versus driveway loaded blocks

There is a distinct visual advantage in using alley loaded properties. Driveways break up the natural rhythm and opportunity of attractively and evenly spaced street trees. Driveways also eliminate the possibility of using a longer tree planter strip. Long and narrow strips are sometimes essential to getting in quality growth trees in a minimum right-of-way.

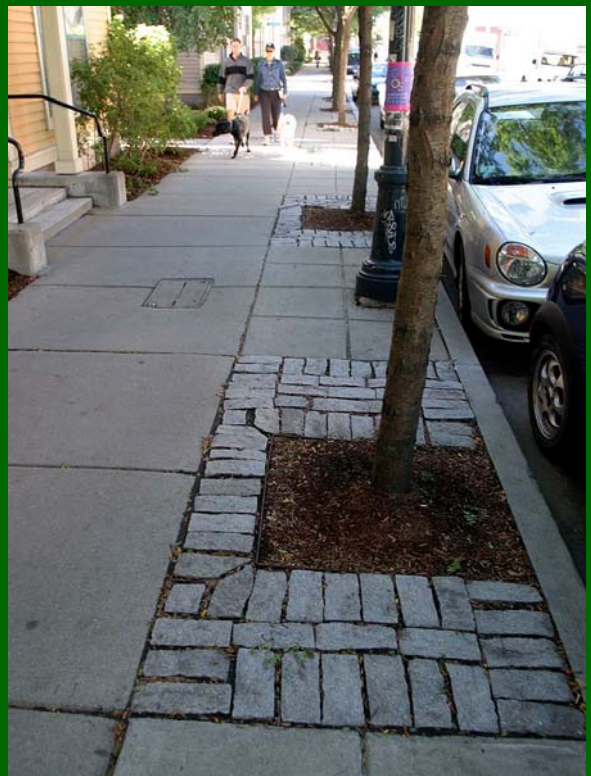




## Maximize Green

Plant good caliper trees (3" or wider) on all streets to soften buildings and street impacts. Use wide or long tree wells and all of the technical knowledge for setting and maintaining successful urban trees. Utilities are placed in locations minimizing impact on green cover.

Urban street trees are generally placed each 15-20 feet. Dense placement is highly desired. In many urban cases carefully designed and placed drip irrigation systems minimize water use and maximize energy efficient street cover.





## Tree Wells



## Tree Wells

In tight urban spaces there may be insufficient space in sidewalks to place trees. In these settings placement of tree wells roughly every 44-66 feet allows two, three or even five parking spaces between wells. Often carefully placed tree wells do not cause the loss of even a single parking space. Tree wells can be added to both parallel and angled parking. Depending on the amount of parking needed, the desired visual pattern, and tree density. Wells are placed every other car, third car and sometimes every fourth or fifth car. Tree wells must be wide enough to prevent large vehicles from backing into trees.



## Tree Wells



### Tree Wells and curb extensions

One of the greatest benefits of tree wells is added screening of parked cars. Properly used tree wells establish compelling lines of green, hiding much of excess asphalt needed for parking. Tree wells are often accented with colorful ground cover. The term tree well is used independently of curb extensions. Curb extensions add to the effect of tree wells, but are much larger. Curb extensions often include sitting areas, crossing areas or corner placements.







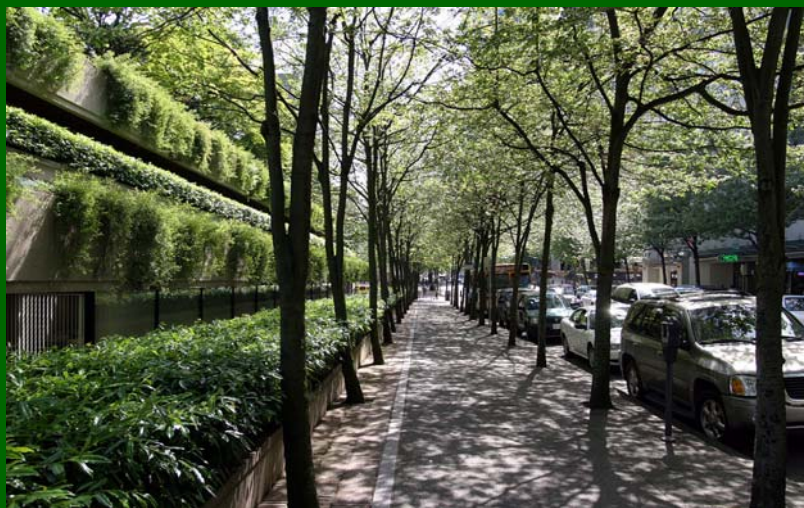
## Tree Height

Based on climate, adjacent building heights, and other factors, trees are selected, planted and manicured for different effects. Shown here is a small sampling of highly varied uses of trees to enliven urban main streets.

In the top photo the eventual placement of buildings has already been determined. These trees will produce appropriate, but limited shade in this very hot desert climate (Mesa, Arizona).

The middle photo embraces coastal Santa Barbara's much cooler climate with high, commanding tree cover.

The bottom photo embraces Erickson's famous raised urban park in downtown wet and often cloudy Vancouver, B.C.





## More or less stress?

These scenes of the same Virginia urban street have ever so slight differences... but with slightly modified greening and landscaping can we measure differing levels of motorist aggression?

“Roger Ulrich has done studies that measure the physiological responses of our bodies (such as blood pressure and heart rate) brought on by stress.

He has found that people who view nature after stressful situations show reduced physiological stress response, as well as better interest and attention and decreased feelings of fear and anger or aggression.









## References and Readings:

Conduct your own research. Here is one of the best web sites we have found on the advantages of urban street trees: <http://www.mrsc.org/Subjects/PubWorks/strees.aspx>

Our summary:

### 1. Urban Nature Benefits:

#### **Psycho-Social Dimensions of People and Plants.**

Kathlene Wolf, Social Science Ph.D. University of Washington gave a presentation that said that the risk of treed streets was questionable compared to other types of accidents along with the increased benefit of trees on human behavior, health, pavement longevity, etc. She noted that trees have a calming and healing effect on ADHD adults and teens. And I added that through my review of literature, ADHD males 16 to 22 years of age had an incident of serious accident that was 5 times what a control population of 16 to 22 male

drivers would experience.

2. Dwyer, J.F., H.W. Schroeder, & P. H. Gobster. 1994. The Deep Significance of Urban Trees and Forests. In R.H. Platt, R.A. Rowntree, P.C. Muick(editors), *The Ecological City: Preserving & Restoring Urban Biodiversity*. Amherst: University of Massachusetts Press.
2. Dr. Rachel Kaplan surveyed desk workers about their rate of illness and level of job satisfaction. Some study participants could view nature from their desks, others could not. Those without, when asked about 11 different ailments, claimed 23% more times of illness in the prior six months. Desk workers with a view claimed the following satisfactions more often than their non-view colleagues: 1) found their job more challenging, 2) were less frustrated about tasks and generally more patient, 3) felt greater enthusiasm for the job, 4) reported feelings of higher life satisfaction, and 5) reported better overall health; Kaplan, R. & S. Kaplan. 1989. *The Experience of Nature: A Psychological Perspective*. Cambridge: Cambridge University Press
4. Lewis, C. A. 1996. *Green Nature/Human Nature: The Meaning of Plants in our Lives*. Chicago: University of Illinois Press.
5. Relf, D. (editor). 1992. *The Role of Horticulture in Human Well-Being and Social Development*. Portland, OR: Timber Press.

#### **REDUCED DOMESTIC CONFLICT**

Surveys of households in Chicago's public housing have explored the role of trees on household interpersonal dynamics.

The housing projects' apartment buildings are nearly identical, differing only in the amount of trees and grass growing around them. Drs. Bill Sullivan and Francis Kuo report that residents living in buildings with trees use more constructive, less violent methods to deal with conflict.



#### **LESS SCHOOL AGGRESSION AND VIOLENCE**

School violence programs help students to control aggressive behavior with training in conflict resolution and peer intervention.

Physical environments around a school also appear to play a role. Education scientists at the University of Michigan have found that scenes of neighborhoods with blighted streetscapes are perceived as dangerous and threatening. Those that are more cared for, including tended landscapes, contribute to reduced feelings of fear and violence.

