

O

n a hot summer day, would you rather sit down in a nice shady spot or broil unprotected in the blazing sun? Your car feels the same way. And you know how uncomfortable it is to climb back into the driver's seat after it's been baking in the heat. But...

Where are  
all the **cool**  
parking  
lots?

Center for  
**Urban Forest Research**



# HOW TO DO P

## Increasing Effectiveness

First, to get more extensive shade it will be necessary to increase tree numbers, provide more soil volume for tree roots, and provide information to property managers and arborists on tree care practices that increase tree canopy cover.

Second, and perhaps more important, it will be necessary to make key planning decisions prior to starting the retrofitting process.

## Proper Planning

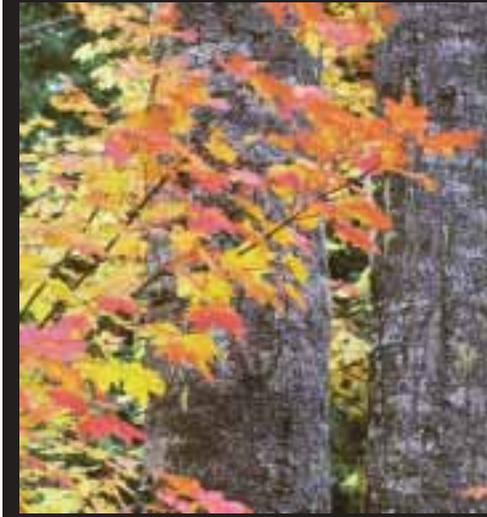
- Avoid double-counting tree shade where tree shade overlaps.
- Do not allow planting of trees not on the ordinance's Recommended Tree List. Improve the Tree List if necessary.
- Be sure crown diameters on parking lot plans correctly reflect crown diameters specified in the Tree List. Correct diameters in the Tree List if necessary.
- Be sure crown diameters for mature trees are not overstated in the Tree List, thus allowing parking lot plans to reflect more shade than they can actually achieve. Correct if necessary.
- Follow-up to ensure trees are actually planted, and not removed shortly after planting, especially at sites near store fronts where trees could obstruct signs.
- Do not allow substitutions after the plans have been approved.
- Do not allow parking lot ratios to exceed those stipulated in the ordinance.

## KEYS TO SUCCESS

1. Provide planning staff with **adequate time and training** to review shade plans and parking lot ratios. 2. Require landscape architects to **certify that the parking spaces and trees** are located as per the ordinance. 3. Teach inspectors how to **identify common problems** and insist they make systematic and thorough site checks.



“ Trees in Davis, CA parking lots reduced the surface temperatures of asphalt by as much as 36°F, cabin temperatures of vehicles by over 47°F, and fuel-tank temperatures by nearly 7°F. ”



WHERE ARE ALL THE COOL PARKING LOTS?

Parking lots occupy about 10% of the land in many of our cities, and since the 1970s energy crisis there has been an increasing interest in parking lot shade ordinances. We chose Sacramento, CA as the test case to investigate how well one “pretty good” ordinance was working.

## SHADE FALLS FAR SHORT

The shade required by the Sacramento ordinance is 50% of the total surface of the parking lot. Not one of the lots we surveyed even came close to achieving this target. In fact, the effective shade provided by existing trees was only 8.1%.

After computer “growing” trees to their projected 15-year size, tree shade increased to only 21%. Many of the lots planted with large-statured trees will probably exceed this figure, and, as expected, the lots with crab apple, crape myrtle and pear will never come close.

One interesting finding was that trees in retail lots produced more shade per tree than trees in office or apartment complex lots. A major reason is that retail lots tend to be larger and contain more double-loaded spaces, and their ratio of interior to perimeter trees is greater.

Many other parking lot ordinances specify one tree for a certain number of parking spaces or a certain amount of landscaped area per space rather than the 50% shade rule. However, under these ordinances, trees can be clustered in islands or along the lot perimeter, often resulting in large areas of unshaded pavement.

# PARKING LOTS RIGHT...

## Proper Site Design

- Promote tree growth, reduce paved surfaces and increase environmental benefits.
- Reduce parking ratios to decrease the number of unused parking spaces.
- Identify peripheral and overflow parking areas, especially in retail lots, and determine the appropriate landscape treatment (e.g., pervious paving, stormwater infiltration areas) (Girling et al., 2000).
- Narrow the width of aisles between rows of spaces. In many cases aisle widths exceed the standard.
- Increase soil volume and reduce soil compaction.
- Ensure adequate species diversity.
- Use structural soil mix under paving to retain parking spaces while increasing soil volume (Grabosky and Bassuk, 1996).
- Convert double-loaded full-size spaces to compact spaces with a tree in between to increase shade without reducing the number of spaces.
- Increase use of one-way aisles, angled parking spaces, and shared parking to reduce overall imperviousness (ULI, 1983; Center for Watershed Protection, 1998).
- Increase the ratio of compact to full-sized spaces.
- Increase tree well and planting island minimum dimensions to 8 feet.
- Require soil in tree wells to be excavated to a depth of 3 feet and amended as necessary.
- Use vegetated swales instead of tree wells or convex-shaped islands to treat stormwater, promote infiltration, and increase soil volume for trees (Richman, 1997).
- Reduce conflicts between trees, lighting and signage by coordinating location of trees, light poles, and signs. 1) Reduce the maximum height of parking lot light poles to the height trees are typically pruned for clearance. 2) Amend sign ordinances to allow monument signs (eye-level signs located near the street) and promote site designs that locate businesses closer to the street and move parking behind the buildings.
- Develop a master tree list, omit species that are not suitable for parking lots (e.g., pines, poplars, birch, etc.) and consider specifying recommended tree spacing and minimum planting island widths for each species.

“ Annual benefits provided by the current parking lot trees (8.1% shade) was valued at approximately \$700,000 for improved air quality. By increasing shade to 50% in all parking lots in Sacramento, the annual benefits will increase to \$4 million. ”



## More Information

Center for Watershed Protection. 1998. *Better site design: a handbook for changing development rules in your community*. Center for Watershed Protection. Ellicott City, MD. 174 p.

Girling, C.; Kellett, R.; Rochefort, J.; Roe, C. 2000. *Green neighborhoods: planning and design guidelines for air, water, and urban forest quality*. Center for Housing Innovation. University of Oregon, Eugene. 132 p.

Grabosky, J.; Bassuk, N. 1996. *Testing of structural urban tree soil materials for use under pavement to increase street tree rooting volumes*. J. Arbor. 22: 255-262.

McPherson, E.G. 2001. *Sacramento's parking lot shading ordinance: environmental and economic costs of compliance*. Landscape and Urban Planning 57:105-123.

McPherson, E.G.; Simpson, J.R.; Scott, K.I. 2000. *Actualizing microclimate and air quality benefits with parking lot tree shade ordinances*. Wetter und Leben. 50: 353-369.

Richman, T. 1997. *Start at the source: residential site planning and design guidance manual for stormwater quality protection*. Bay Area Stormwater Management Agencies Association. Oakland, CA. 75 p.

Scott, K.I.; Simpson, J.R.; McPherson, E.G. 1999. *Effects of tree cover on parking lot microclimate and vehicle emissions*. J. Arbor. 25: 129-141.

Scott, K.I.; Simpson, J.R.; McPherson, E.G. 1999. *Green parking lots: can trees improve air quality?* In McPherson, E.G.; Mathis, S., editors. *Proceedings of the Best of the West Summit*. CAES. University of California, Davis, Davis, CA; 86-87.

Urban Land Institute. 1983. *Shared parking*. Urban Land Institute, Washington, D.C. 86 p.

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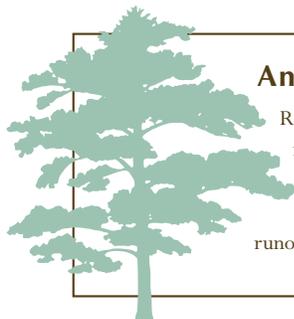
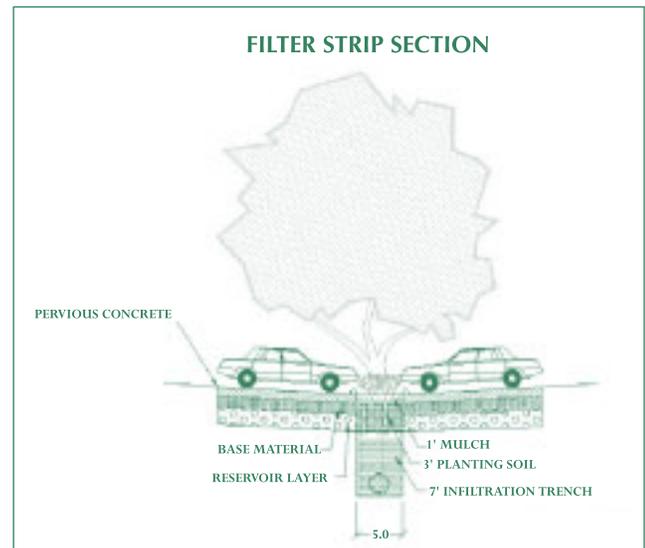
# HOW TO DO PARKING LOTS RIGHT

## After Installation

- Promote adequate tree care after installation to increase tree vigor, crown growth and shade density.
- Remove stakes as soon as young trees can support themselves.
- Prune young trees early to train their growth.
- Allow tree crowns to reach their full potential.
- Make property owners, managers and arborists aware of shade benefits as well as the benefits of a commitment to professional care on a regular and long-term basis.
- Enforce the ordinance to ensure that trees are growing at acceptable rates, are properly pruned and watered, and promptly replaced after removal.
- Require that proper tree care practices are used by qualified professionals.
- Replace removed trees with trees of equivalent size or value.

## Strengthen Ordinances

- Develop an enforcement and monitoring program that records information on the management needs of every tree, and results in a letter sent to the property manager requesting corrective action in a specified time.
- Link inspection fees to the issuance of a building permit.
  - Establish a mechanism to collect fines or place a lien on the property if the owner fails to make the requested improvements.
  - Require interest-bearing bonds to pay for landscape improvements throughout the life of the project.



## Another Benefit

Reducing the amount of impervious surface in parking lots can reduce polluted runoff and the size and costs of stormwater facilities needed to store and treat that runoff. The quantity of pollutants in parking lot runoff is related to vehicular traffic, vehicle condition, and atmospheric deposition. Parking lot runoff has relatively high concentrations of trace metals, oil and grease.

We conduct **research** that demonstrates new ways in which **trees add value** to your community, converting results into **financial** terms to assist you in stimulating more **investment in trees**.



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