DRISI
Caltrans Division of Research, Innovation and System Information

Research Results

Design

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Project Title:
From Complete Streets to Complete, Green, and Sustainable Streets

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Analysis of the Benefits of Green Streets

Develop metrics and calculation methods, and produce data and analysis findings on the benefits of green streets projects for Caltrans' Main Streets Guide, project design, and review processes.

WHAT WAS THE NEED?

Green streets offer many potential benefits including improving water quality, absorbing carbon (sequestration), and reducing urban heat island effects. California Department of Transportation's (Caltrans) landscape architecture program team was seeking off-the-shelf, easy-to-use measurement tools that they could use to quantify the benefits of green streets infrastructure within the project planning, design, engineering, and selection processes.

WHAT WAS OUR GOAL?

The goal was to identify tools to measure the benefits of green streets infrastructure that could be used routinely by Caltrans; and provide useful information for planners, landscape architects, and engineers when identifying and evaluating Caltrans projects.

WHAT DID WE DO?

The research team evaluated 14 tools for calculating green streets benefits and applied the two most promising calculators to a select group of green streets case studies. The researchers are affiliated with the Mineta Transportation Institute (MTI), which serves Caltrans. The report presents the results of the case study analyses, with an emphasis on air quality and carbon sequestration benefits estimated using the i-Tree Design calculator, and improvements to pedestrian levels of service (PLOS) estimated using a Highway Capacity Manual (HCM)-based (the "Landis") method.

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WHAT WAS THE OUTCOME?

The monetary value of planting street trees over a 20-year period is small but significant, according to analysis performed with the i-Tree Design calculator. The calculator measures these benefits in terms of air quality improvements and carbon dioxide (CO2) sequestration.

The total estimated benefits from street trees over a 20-year forecast period on the seven case study sites range from a low of $1,466 for nine trees at site 9A (South Hope Street in Los Angeles) to a high of $9,420 for 56 trees at site 7A (CA 299 in Willow Creek). On a per tree basis, the lowest benefits come from site 3A (Cherry Avenue in San Jose) with $10 per tree, and the highest come from site 1A (San Pablo Avenue in El Cerrito) at $175 per tree. CO2 sequestration accounts for the bulk of monetary value from trees for all sites in this study analyzed using i-Tree Design for most sites. Findings suggest that more mature trees mostly provide air quality benefits, while younger, fast-growing trees absorb and retain CO2.

While the Landis PLOS method accounts for the benefits of short street tree spacings (i.e., a high number of trees) and the benefits of having a continuous biostrip or planter strip serving as a pedestrian buffer, the method does not appear sensitive to tree spacings, while it is very sensitive to buffers. The importance of having a biostrip or planter strip buffer between the sidewalk and street traffic is also reflected in the PLOS findings for all seven case studies.

WHAT IS THE BENEFIT?

The report concludes that i-Tree Design's ease of use, sensitivity to a range of tree and environmental characteristics, and scalability make it a useful candidate to serve as a common frame of reference and analysis for a variety of potential users within Caltrans and as well as other state, local and, federal agencies. While the measurable benefits of a handful of street trees may seem small, this study suggests that adding together the trees analyzed using i-Tree Design by local and state agencies has the potential to provide a compelling picture of the carbon sequestration benefits of trees on public and private lands across California.

A similar argument can be made for the Landis PLOS method. HCM-based methods (such as the Landis method) are already a common standard for the transportation industry. Hence, teaching and advocating for Caltrans and other transportation professionals to use these methods to capture the pedestrian benefits of green streets infrastructure (as done here with pedestrian buffers and street trees) could yield significant gains in the appreciation of green streets' benefits.

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IMAGES

Image 1: Recently Installed Elm Trees and Biostrips Along the East Side of San Pablo Avenue Between Lincoln Avenue to Eureka Avenue Looking North in El Cerrito, CA

Image 2: Biostrips and Street Trees Along Cherry Avenue in San Jose, CA

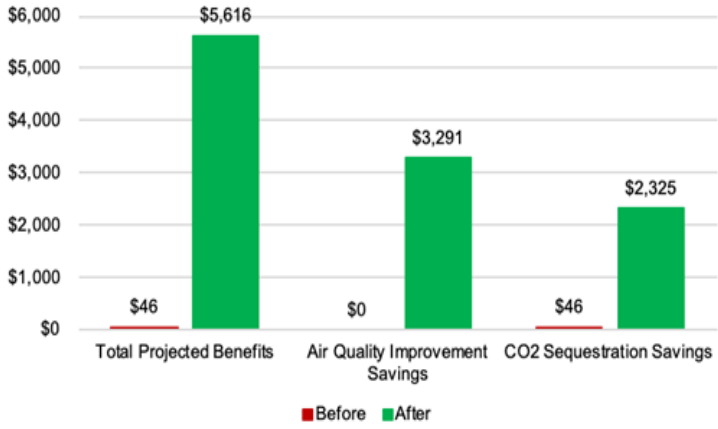

Image 3: The 20-Year Monetary Value of Trees on Woodman Avenue from Saticoy Street to Lanark Street in Los Angeles, CA Estimated Using the i-Tree Design Calculator

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