TECHNICAL FACT SHEET: Water use by urban lawns and trees in Los Angeles: evaluation of current irrigation practices to develop water conservation strategies

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PROJECT BACKGROUND AND RESULTS

Our laboratory focuses on direct measurements of water use of lawns and trees in the Los Angeles area. To date, we have made continuous measurements of water use on 108 trees of 14 species in 2007-2009 and 11 lawns in 2008-2011, before the recent drought. The results revealed:

Before the implementation of mandatory watering restrictions (2007-2011), landscapes were greatly over-watered:

- Lawns received at least 40% more water (2 mm/day or 30 extra gallons*) in summer in excess of current recommendations (ucanr.edu/sites/WUCOLS).
- Unshaded lawns used approximately 5.5 mm/day (83 gallons*) in summer and 2.5 mm/day (38 gallons*) in winter. Shaded lawns used up to 3 times less (1.8 – 3.8 mm/day or 27 – 57 gallons*) in summer and were similar to unshaded lawns in winter.
- Urban trees used from less than 0.1 mm/day (1.5 gallons*) to 2.6 mm/day (39 gallons*) during the growing season (February to November). Evergreen trees used from less than 0.1 mm/day (1.5 gallons*) to 1.8 mm/day (27 gallons*).

Current watering recommendations are flawed:

- The landscape coefficient method that is most commonly used to estimate water requirements works well for lawns, but not for urban trees.
- During extremely dry weather, such as during Santa Ana winds, unshaded lawns use more water than the maximum recommended irrigation.
- During winter, unshaded lawns use less water than minimum recommended irrigation. Lawns shaded by trees and buildings also use less water than recommended minimum amounts.
- The species composition of lawns does not strongly affect water consumption under non-limiting irrigation.
- In our tests of lawn irrigation systems: conventional timer-based, weather station-based, and soil moisture-based, the soil moisture-based system was the most efficient, with almost 100% efficiency (all irrigation water was transpired by the grass, with negligible runoff and drainage).
- Current methods for estimating the water requirements of urban trees are inaccurate, and do not correctly account for species differences.

Intentional shading of turfgrass is a very effective water-saving measure

- Shading lawns (with landscape trees or built structures) lowers their summertime water use by up to 50%.
- Landscapes with both trees and lawns use less water than landscapes with only lawns.

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*Water amounts in gallons are for a typical small 130 m^2 residential yard

Lawns used more water than trees across the Los Angeles

- Across the city of Los Angeles, landscapes consumed nearly 100 billion gallons of water per year in 2007-2008, with lawns accounting for 70% of the total.
- Wealthier neighborhoods in LA used twice as much water for outdoor landscapes than disadvantaged and low-income neighborhoods. This leads to lower air and surface temperatures in wealthier parts of the city.

POLICY RECOMMENDATIONS

Revise municipal watering recommendations

- The landscape coefficient method of estimating watering needs should be applied to lawns only.
- Landscape coefficients should be updated to reflect the influence of shade and seasonal changes in water use (a technical paper with recommended equations is available on request).
- Water needs of urban trees should be estimated using equations that capture their physiological characteristics. Recommended equations are available on request.

Avoid over-irrigation

- Updated irrigation guidelines should be operationalized and disseminated to the public.
- State water conservation funds should support water agencies in replacing timer-triggered irrigation systems with more advanced soil-moisture based drip irrigation, via residential landscape rebate programs and other means.
- Water agencies should promote the use of the soil-moisture based irrigation systems by residents and provide technical expertise for installation, training, and monitoring.

Strategically modify existing landscapes to conserve water

- Plant trees that have been shown to be water conserving.
- Disseminate information on appropriate watering methods and irrigation systems that support deep tree roots ("deep irrigation").
- Consider municipal tree-planting programs and incentivize residents to plant water-conserving trees to shade existing lawns. While trees may require more intensive irrigation during the first year after planting, when mature they will ultimately lower landscape water use if watered to support deep tree roots.

PROJECT DETAILS

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Citations: (1) Litvak E., Manago K., Hogue T. S. and Pataki D. E., 2017: Evapotranspiration of urban landscapes in Los Angeles, California at the municipal scale. Water Resources Research, 53, DOI: 10.1002/2016WR020254. (2) Litvak E., McCarthy H. R. and Pataki D. E., 2017: A method for estimating transpiration from irrigated urban trees in California. Landscape and Urban Planning, 158, 48-61. (3) Litvak E. and Pataki D. E., 2016: Evapotranspiration of urban lawns in a semi-arid environment: an in situ evaluation of microclimatic conditions and watering recommendations. Journal of Arid Environments, 134, 87-96. (4) Bijoor, N. S., Pataki D. E., Haver D. and Famiglietti J. S., 2014: A comparative study of the water budgets of lawns under three management scenarios. Urban Ecosystems, 17 (4), 1095–1117.

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