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CONTENTS



**Abstract.** Drawing on the experience of greater metropolitan Adelaide, South Australia, Australia, the paper points to the links and gaps between science and public policy. The paper explores urban stormwater management lessons emerging from a ten-year, prolonged dry period that impacted the integrity of urban forests in the City of Adelaide. Among the questions addressed: will stormwater remain, as its historic and institutional settings suggest, a liability or can it become an asset? Who owns stormwater resources and to whom is its management vested? The paper examines these issues with consideration to the dangers of continuing to use urban forestry management practices that are not informed by science. The study concludes that a more integrated approach to urban water management can maintain the integrity of urban forests in ways that potentially enhance social amenities and economic efficiency.
**Key Words.** Adelaide; Australia; Stormwater; Urban Forest Management; Water Policy.



**Abstract.** Water is a valuable resource, but its preferred use by society for other, higher priorities has resulted in a scarcity for the urban forest. However, the value of the urban forest in providing environmental and ecological services that have significant benefits for human health, well-being, and the liveability of cities demands the reconsideration of the priority of water use by the urban forest. Health authorities are advocating the value of urban greenspace that may require the use of water, especially storm water, as climate change threatens more severe heatwaves.

Trees have an important and long-term role in water-sensitive urban design that efficiently uses and reduces pollution from storm water. Knowledge of tree root systems and their interaction with soils means that irrigation can be targeted in a way that maximizes the efficient and effective use of water. Understanding stomatal behavior also allows optimal timing of irrigation for photosynthetic efficiency while capturing the benefits of transpirational cooling, which may reduce extra deaths during heat waves. The economic, social, and health benefits justify the efficient and effective use of valuable water.
**Key Words.** Australia; Drought; Foliage; Root Adaptation; Urban Water Use.



**Abstract.** The maintenance and expansion of urban forests is a major challenge in periods of low rainfall and restricted availability of appropriate-quality water sources for trees. The recent drought in eastern Australia has highlighted the need for innovation and new approaches to ensure tree health is preserved. Responses adopted by the Royal Botanic Gardens Melbourne and others have involved investigations into species more suited to changing climate conditions, assessment of tree and landscape water demand, understanding the hydrology of the site, effective irrigation delivery, management of the soil reservoir to optimize harvested stormwater, and provide soil water reserves for future high demand summer periods.
**Key Words.** Australia; Crop Coefficients; Drought; Royal Botanic Gardens Melbourne; Tree Watering; Soil Moisture Sensors; Urban Forest.

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**Abstract.** Understanding native habitats of species successful as subtropical and tropical urban trees yield insights into how to minimize urban tree water deficit stress experienced during monsoonal dry periods. Equatorial and montane wet forest species rarely subject to drought are generally absent in subtropical and tropical cities with pronounced monsoonal dry seasons. Species native to monsoonal dry forests appear to have wide environmental tolerances, and are successful as urban trees in many tropical cities. Monsoonal dry forest species have a tendency to be deep rooted to avoid drought, with leaf habits falling along an avoidance to tolerance spectrum. Dry deciduous species, typically found on more fertile soils, maximize growth during the monsoonal wet season with high photosynthesis and transpiration rates, then defoliate to avoid stress during the dry season. Evergreen tree species, typically found on less fertile soils, have a higher carbon investment in leaves that photosynthesize and transpire less year-round than do dry deciduous species. Dry deciduous tree species are more common urban trees than dry evergreen species explicitly due to more ornamental floral displays, but also implicitly due to their ability to adjust timing and duration of defoliation in response to drought. An empirical study of three tropical species exhibiting a range of leaf habits showed isohydric behavior that moderates transpiration and conserves soil water during drying. However, dry evergreen species may be less adaptable to tropical urban conditions of pronounced drought, intense heat, and limited rooting volumes than dry deciduous species with malleable leaf habit.

**Key Words.** Climate Change; Drought Deciduous; Drought Physiology; Dry Evergreen; *Lagerstroemia loudonii*; *Pterocarpus indicus*, *Swietenia macrophylla*; Urban Forestry; Water Stress; Wet Evergreen.



**Abstract.** A review of the literature concerning water needs and water loss from landscape plants is presented. Studies conducted in the field, using lysimeters, and in containers are summarized and discussed. In some studies, crop coefficients or water use coefficients are included. A discussion of the variability found in research methods and the need for a standardized protocol for tree water needs studies is presented.

**Key Words.** Crop Coefficients; Irrigation; Lysimeter; Plant Water Loss; Reference Evapotranspiration; Tree Water Needs; Urban Trees; Water Conservation.



**Abstract.** Drought can lead to mortality in urban tree populations. The City of Melbourne, Victoria, Australia, manages a large population of trees that provide important ecosystem services and cultural heritage values. Between 1997 and 2009 Melbourne was affected by a serious drought resulting in significant tree health decline. Elms and planes in particular, were badly affected. This paper presents data from a survey of tree health status, and of studies of retrofitted buried drip line irrigation. A study of soil wetting in autumn of 2009 found that the use of drip irrigation had, in most cases, little or no effect on soil moisture levels and a modeled study of tree water use showed that water delivered by drip irrigation provided only a fraction of the water required by a mature tree. By contrast, drip irrigation in late winter was able to recharge soil moisture levels. Mechanisms responsible for the decline in tree health seen during the drought are discussed. While the drought has temporarily been alleviated, climate change scenarios for southern Australia suggest that increased rainfall variability and drought events will be more common. The experiences gained during the recent drought event provide useful information for urban tree managers planning for the future.

**Key Words.** Australia; Climate Change Strategy; Drip Irrigation; Drought; Melbourne; *Platanus* × *acerifolia*; Retrofitted Irrigation; Soil Moisture; Tree Health, Tree Water Use; *Ulmus procera*.