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Research paper

Water requirements of urban landscape plants: A comparison of three factor-based approaches

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ABSTRACT

The majority of urban water supplies for irrigation are used to maintain vegetation health, aesthetic appearance and municipal amenity. It is common to estimate the water requirements of agricultural crops but not those of urban vegetation. Unlike agricultural crops, landscape plantings are usually composed of a mixture of trees, shrubs and turf grasses with different species and water demands. This research was conducted in Veale Gardens within the Adelaide Parklands in South Australia. In situ climatic and vegetation data were collected and irrigation monitoring data were provided by the local water authority. Three adjustment factors for reference evapotranspiration were estimated and used to compare predicted and actual irrigation rates. The adjustment factors used were a landscape plant coefficient for the Water Use Classifications of Landscape Species (WUCOLS) method, a plant factor for the plant factor (PF) method and a crop stress factor for the Irrigated Public Open Space (IPOS) method. Considering an irrigation efficiency of 70% resulted in close estimation of gross irrigation rates using the WUCOLS method. The results showed that the IPOS method led to the lowest gross irrigation estimate in contrast to the WUCOLS method which produced the highest estimation. Since the acceptable aesthetic levels were achieved by an annual application of 770 mm of irrigation water, the results confirm that the WUCOLS method produced the best estimation of urban vegetation water requirements for the study area.

1. Introduction

Australia is the driest inhabited continent and is highly urbanized, with almost 89% of the population living in cities and towns (Collett and Henry, 2011). Climate change is also threatening Australian urban water supplies through increasing evapotranspiration and decreasing precipitation. The most severe climate change impact is expected in the southern and eastern regions of Australia (Collett and Henry, 2011). The coastal city of Adelaide, which is the capital city of the state of South Australia, is located on the eastern shores of Gulf St. Vincent, on the Adelaide Plains. The city itself is entirely surrounded by urban parklands. The water supply of Adelaide derives from a combination of the River Murray, catchment runoff, groundwater, rainwater tanks, storm water reuse and recycled wastewater (Clark and Bugden, 2008).

The Code of Practice for Irrigated Public Open Space (IPOS) is supported by the South Australian Government's Water Proofing Adelaide Strategy. It provides an efficient practical irrigation management strategy for watering the all urban green spaces including parks, ovals, sport fields and gardens with a total consumption of 15,000 ML in 2003 (Charlton, 2009). The majority of urban water supplies for irrigation are used to maintain the aesthetic appearance and amenity of the city of Adelaide, and predominantly the Adelaide Parklands. Efficient irrigation practices of urban green spaces in Adelaide and particularly in the Adelaide Parklands can significantly reduce urban water demand. It is common to estimate the water consumption of agricultural crops to simultaneously improve crop production and water use efficiency (Bitar, 2004). However, there is a lack of suitable methods to estimate the water demands of urban landscape vegetation (Nouri et al., 2012).

Increasing water use efficiency in urban landscapes is achieved by supplying only the amount of water that the plants require to maintain healthiness and aesthetic appearance. The water demand of urban landscapes is quite different from agricultural crops and turf grasses due to the specific conditions in urban green spaces (Costello et al., 2000; Nouri et al., 2012). Unlike agricultural crops

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