Maintaining Tree Health on A Limited Water Budget

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- B.S. & M.S. Horticulture, Ohio State University
- 38 years experience
  - Educational and applied research programs
  - Landscape & urban horticulture
  - Landscape irrigation mgt., plant water needs, weather-based irrigation control
  - Presentations, workshops, publications, Web

Objectives

Understand:

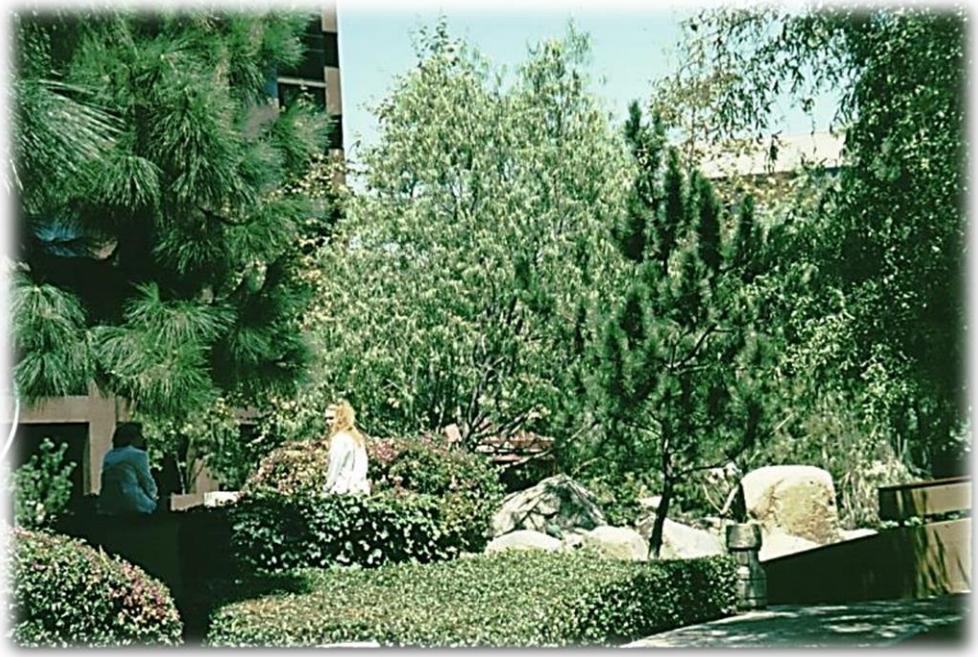
- Priorities for limited irrigation water
- Tree water demand and water requirements
- Fundamentals of effective tree water management

Value of Urban Trees

- Structural framework of landscapes
- Cooling shade
- Carbon dioxide storage
- Wildlife habitat
- Beauty
- Mental well-being

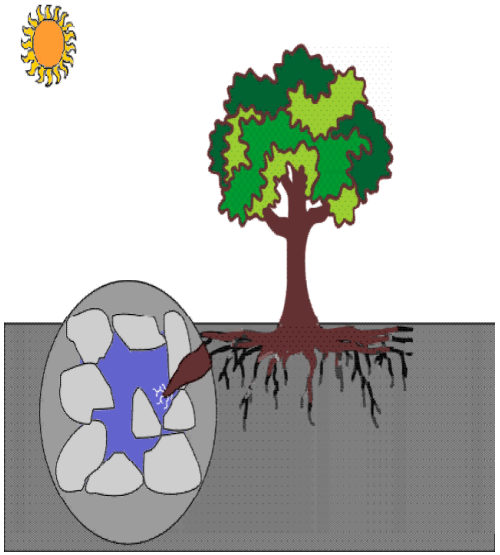
Prioritizing Irrigation

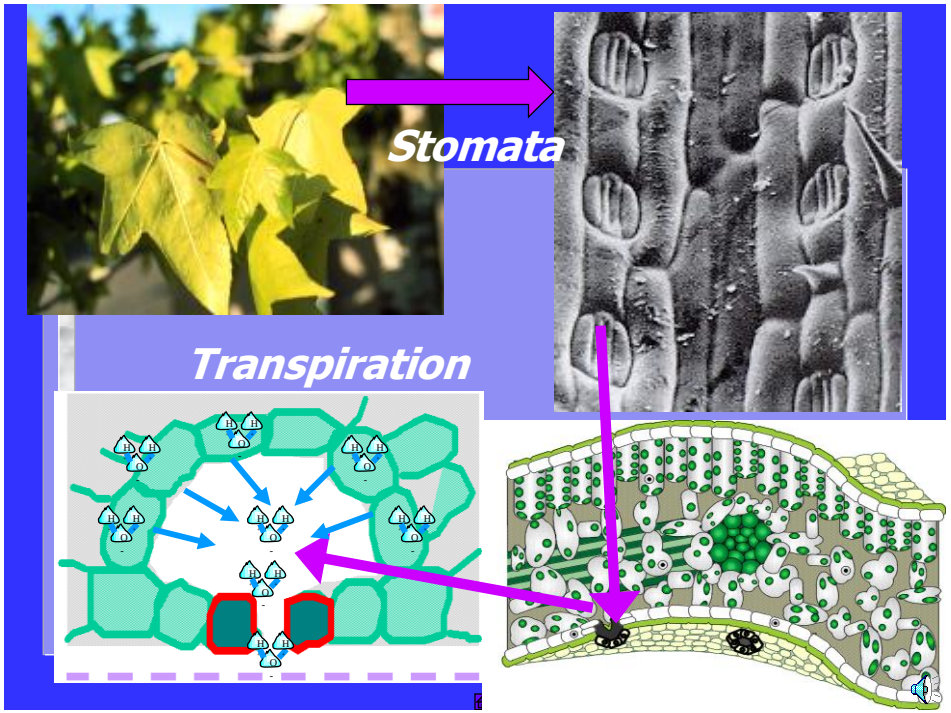
- Focus water on valuable & difficult to replace plants
- Trees/Shrubs/Vines/Grndcvr > Perennials > Turf/Annuals



Why & How Plants Use Water

- Transpiration
- SPAC: ***Soil-Plant-Air-Continuum***
- Creates pull



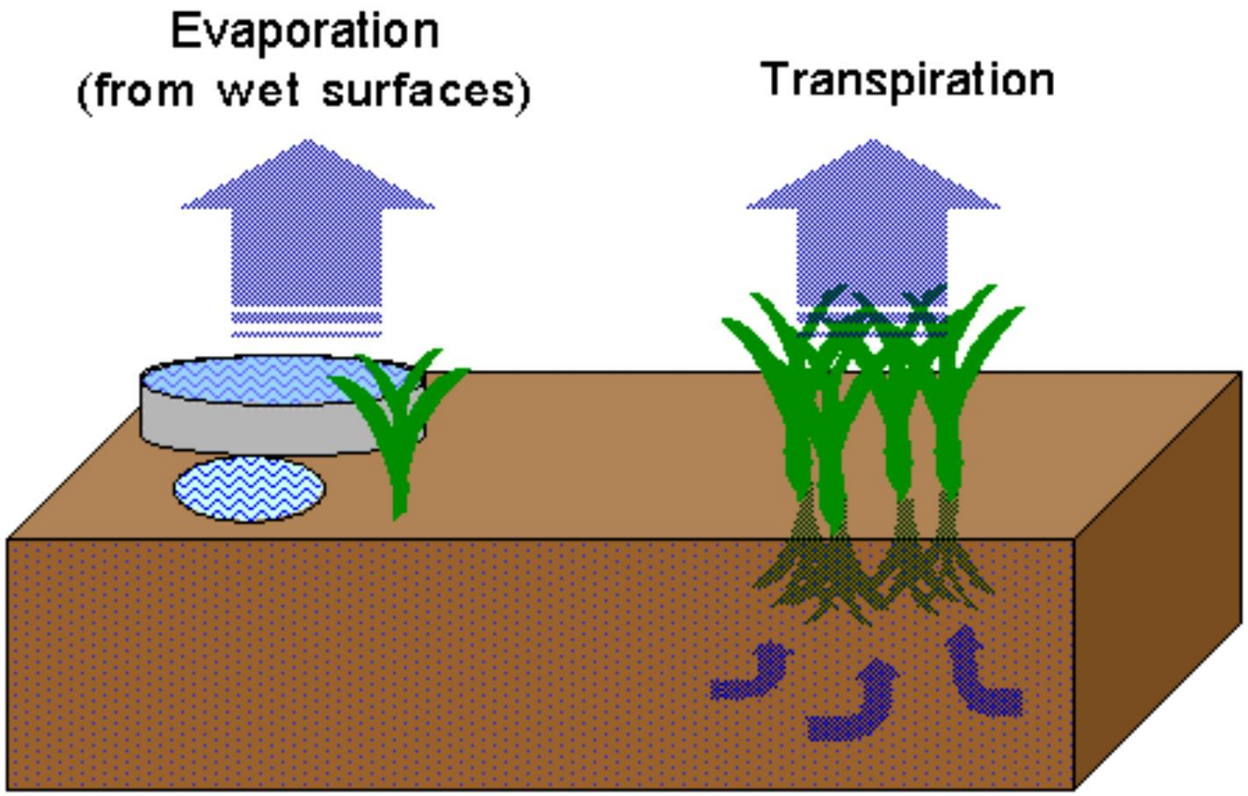


Why & How Plants Use Water

- *Water loss is essential!!*
- Maintains plant structure
- Photosynthesis & physiological processes
- Cooling
- Transports minerals & nutrients

Evapotranspiration (ET)

Evapotranspiration = Evaporation + Transpiration



ETo = Reference Evapotranspiration

Estimate of environmental demand for evaporation and transpiration from a reference planted area

- Climate-based reference
- Inches/day
- ETo = estimated water use of well-watered cool-season turf
- Calculated from weather data
  - Sunlight, temperature, RH, wind
  - ASCE Penman-Monteith equation
- Based on field research with agricultural crops

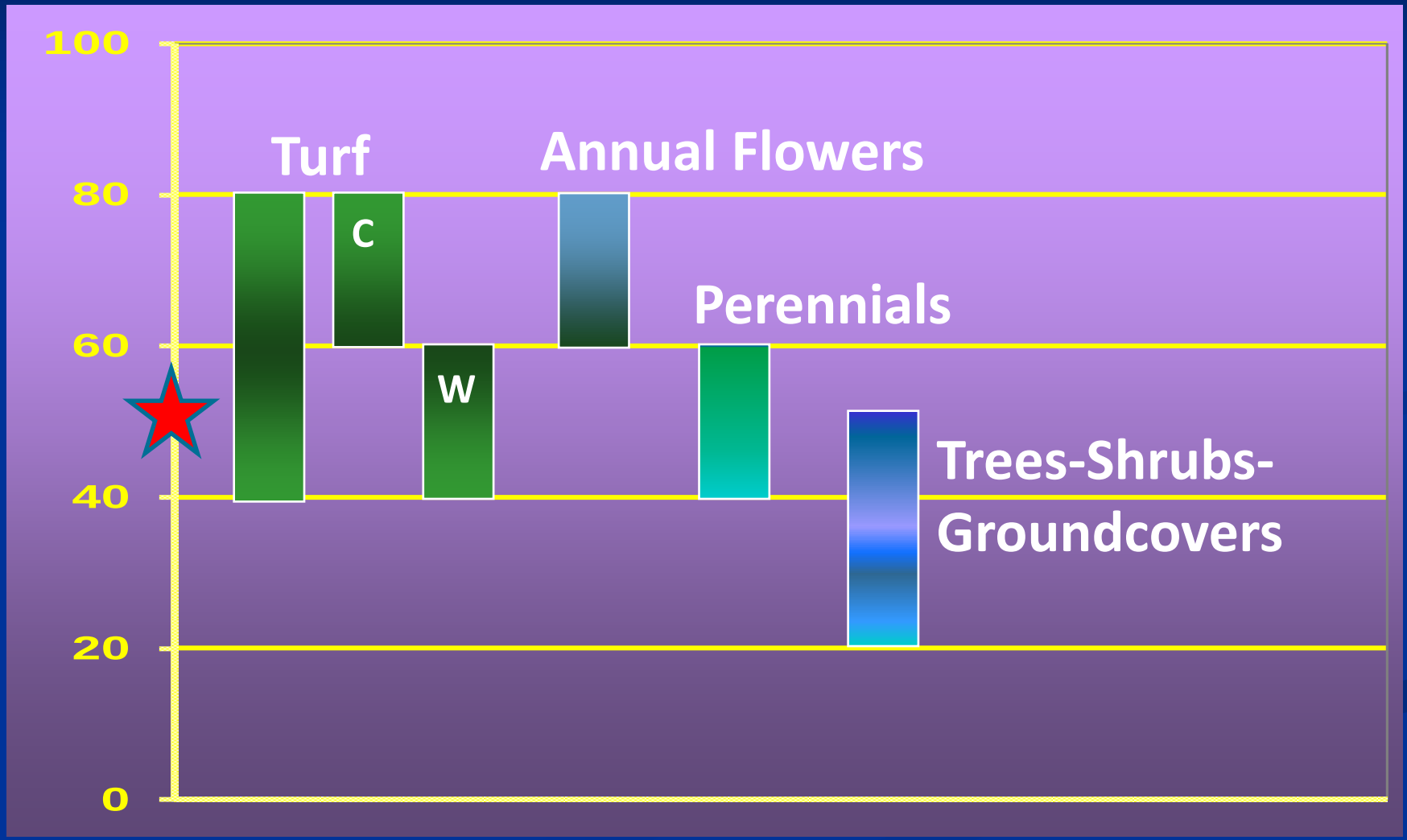
Landscape Water Budget or Water Need

Inches = ETo × PF

Gallons = ETo × PF × Sq. Ft. LA × 0.62

- ETo = inches of reference ET, CIMIS, etc.; climate impact
- PF = plant factor to adjust ETo (turf, shrub, tree, flowers, etc.)
- LA = sq. ft. landscape area
- 0.62 = converts inches of water to gallons

Plant Factors
Percent of ET Required



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- landscape water management and conservation.
- urban tree management and selection.
- assistance for consumers of horticultural products and services.

UPCOMING EVENTS

Event Name	Date
WORKSHOP: Dealing with Drought & Landscape Watering Restrictions - 2015 Landscape EXPO	9/2/2015

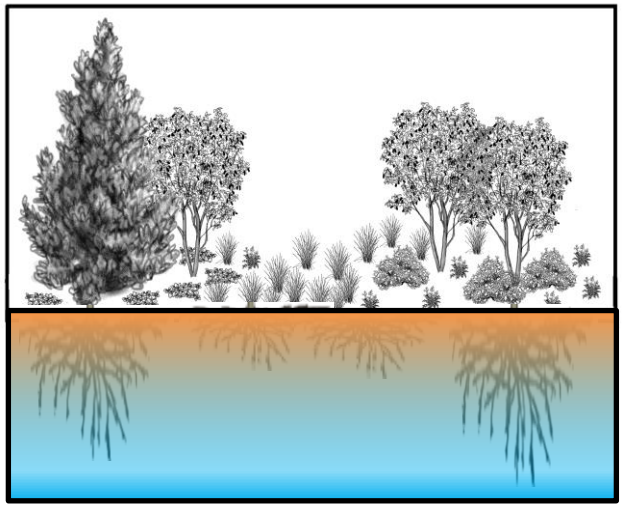
Tree Root Systems

- Tree root systems are wide & shallow
- 80%-90% of roots are within top 2 feet
- Tap root reduced as tree matures

Tree Water Demand

Drought Resistance

Irrigate to refill root zone



- *How long until out of water (MPG)?*
- *What happens when water gets low (run out of gas)?*

Tree Water Demand

- Trees have considerable drought resistance/tolerance
- Species response to severe dryness varies

Low **= wilting**

Medium **= margin burn**

Medium **= defoliation**

High **= not visible until dead**

Water Management for Trees

- Wet soil (roots) 1-2 ft. deep
- Apply ≈ 0.5-2.0 in.
- Summer Rule of Thumb:
  - every 5-15 days
  - *when:*

    ∑(daily ETo × 0.5) ≈ 0.5-2.0 in.

Water Management for Trees

- Consider root depth, soil, ETo
  - 2 ft. roots + low ETo → 15 days
  - 1 ft. roots + high ETo → 5 days
- Shorter interval with drip
- Extend interval ≤30% short-term

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Estimating Water Requirements of Landscape Trees

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Trees in Healthy Turfgrass

- Turf dictates irrigation
- Tree water requirement met with turf's
- Trees require no added water
- Irrigation uniformity critical

Trees Closely Spaced & Trees in Mixed Plantings

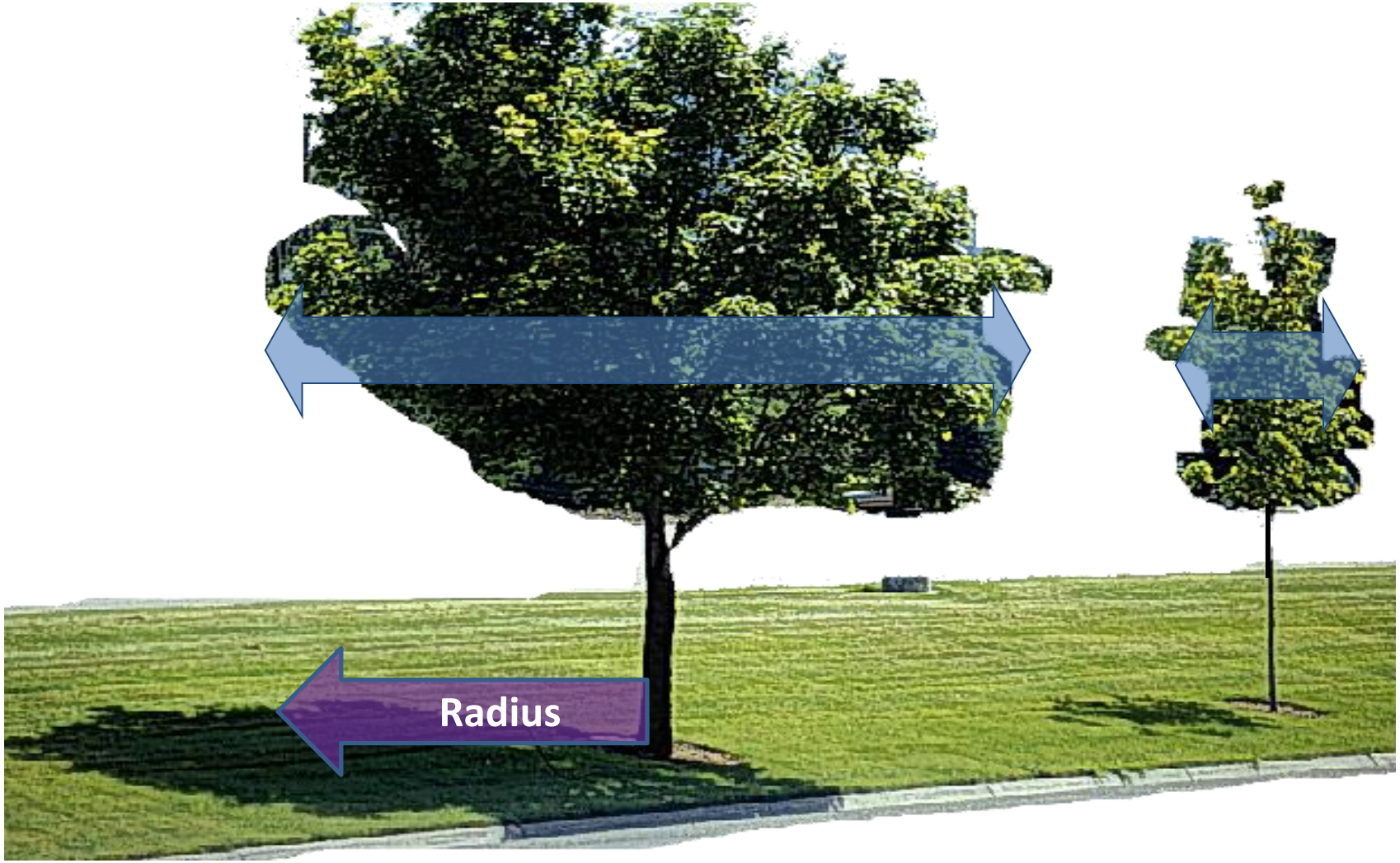
- ≥80% canopy cover – treat as 100% plant cover
- Planting functions as big leaf
- Water requirement set by plant type with highest PF
- Hydrozone plantings
- Irrign. uniformity not critical

Isolated or Widely-Spaced Trees

- <80% canopy cover
- Active transpiration is outer foliage
- Estimate canopy surface area of single plants
- Transpiration can be lower in paved areas
- Irrig. uniformity not critical

Transpiring Leaf Area

Transpiring Leaf Area ≈ 3.14 × Crown Radius ^{2}



Trees in Under-Irrigated Turf

- Meet tree water requirements
- Estimate water requirement based on % canopy cover
- Apply water to at least dripline in isolated trees
- Consider retrofitting irrigation to drip

Spray-to-Drip Retrofit

Spray-to-Drip Retrofit

Trees in Turf Replacement & Landscape Retrofits

- Meet tree water requirements during transition and beyond
- Irrigation distribution to match tree root zone
- Water requirement set by plant type with highest PF

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Useful Equations

Inches = Gallons ÷ (Sq. Ft. × 0.623)

Gallons = Inches × Sq. Ft. × 0.623

1 gal. can cover 1 sq. ft. with 1.6 in. of water

1 Billing Unit = 100 cubic ft. = 748 gallons

$$\textbf{Runtime Minutes} = \frac{\textbf{in. or gal. needed} \times \textbf{60}}{\textbf{in. or gal. applied per hr.} \times \textbf{efficiency \%}}$$