Trees during drought: their value and challenges

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University of California
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Cooperative Extension

Drought: a challenging time for urban trees

Urban trees: Beautiful, beneficial, cost-effective

Drought challenges and solutions

Resources, Discussion (soft projectiles only, please)

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A common sight in 2015…

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Bottom line…

Urban trees
are a long-term investment, worth preserving

Drought
~ trees are water-efficient, thus 1st priority!

~ re-emphasize also the IPM BMPs!

~ and remember the arboriculture BMPs

~ a chance to re-consider species composition (WUCOLS, PVM)

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urban forests & trees

Trees are good! (.com)

~~amenity~~ green infrastructure

Trees are cost-effective

Yearly values, **Costs** **$65**

In Berkeley: **Benefits** **$89**

Net Benefit **$24/tree** ($31/person)

But trees must be managed & maintained

Urban forest = trees + environment + people

Tree Benefits

"Ecological Functions"
wildlife-related, etc.

"Ecosystem services"
stormwater, energy, carbon

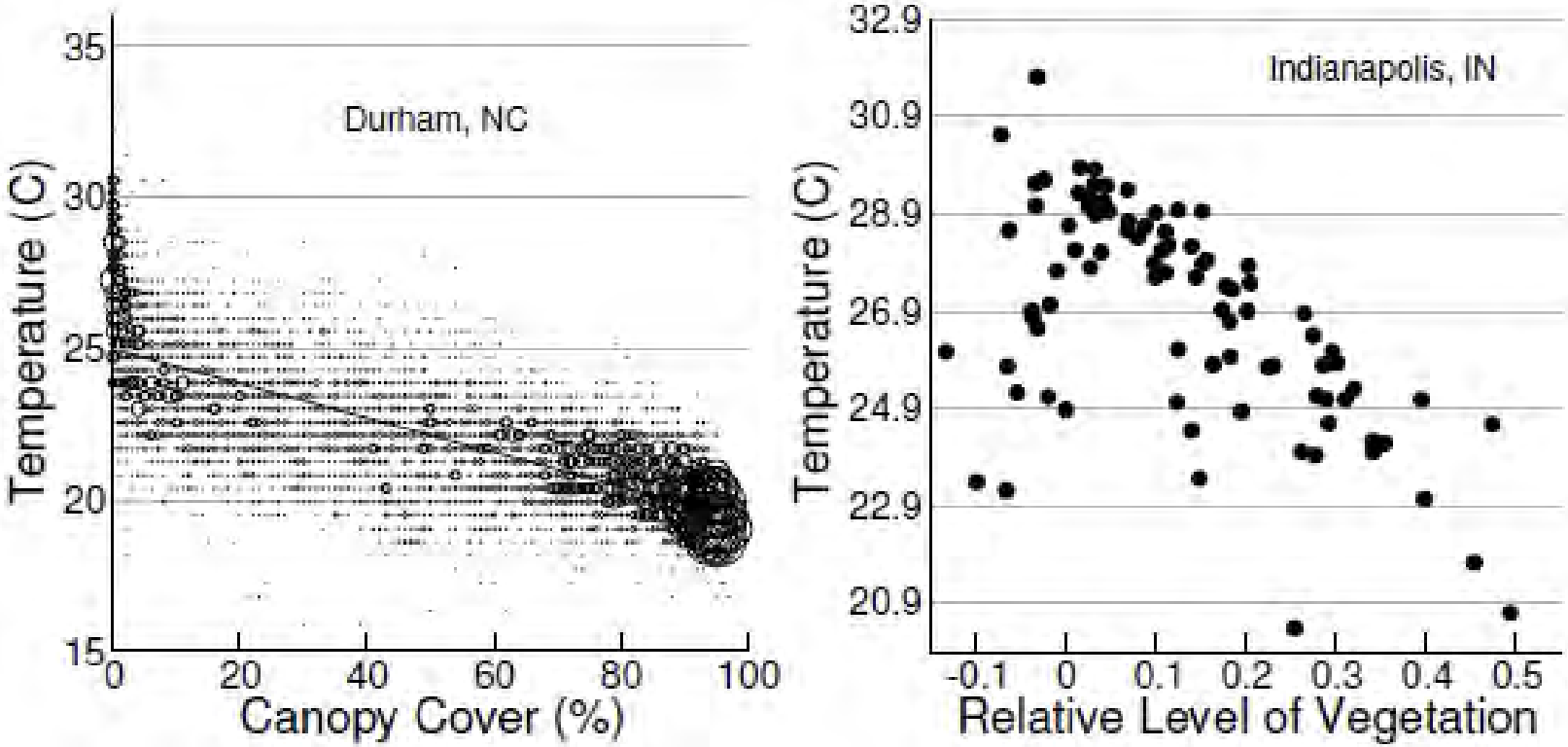
"Human/Health Benefits"
property value, crime, chronic disease

Tree Benefits

Shading & cooling

Wilson, 2011

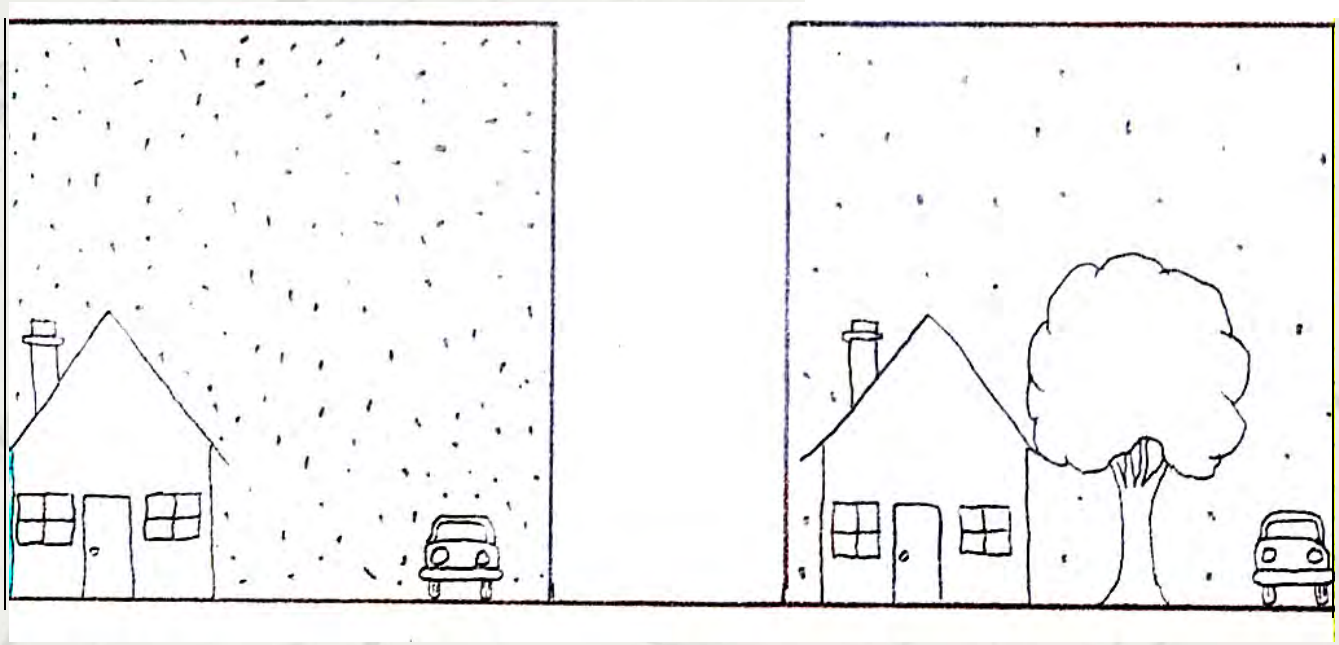
Low temperature correlates with high vegetation.



Particulate Matter Reduction

No Street Trees

Street Trees



Concentration of Particulate Matter

12,000/Lt. Air

3,000/Lt. Air

Tree Benefits Calculator: www.treebenefits.com

Cork oak,

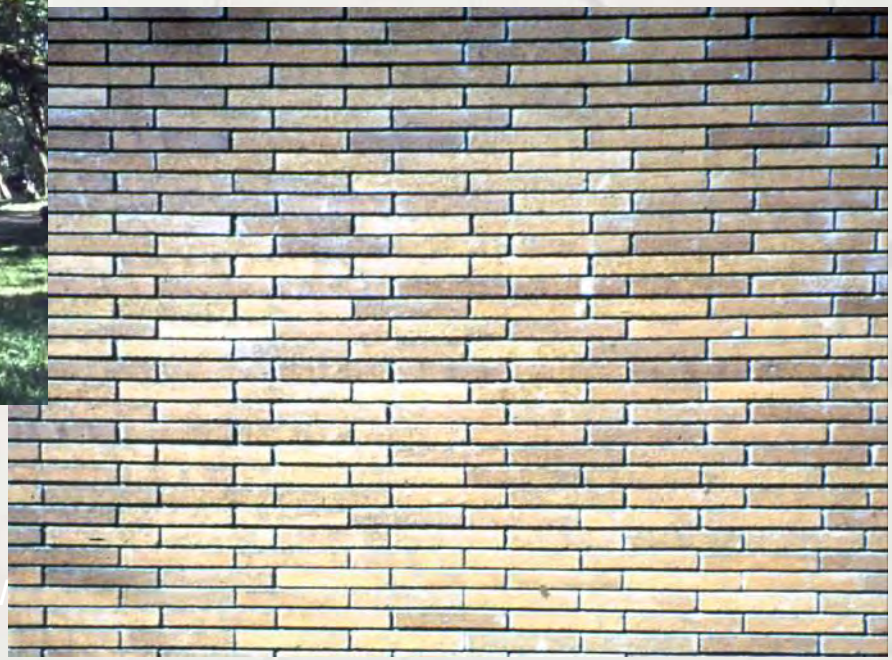
12 inch diameter,

In Fresno

$179 per year in benefits

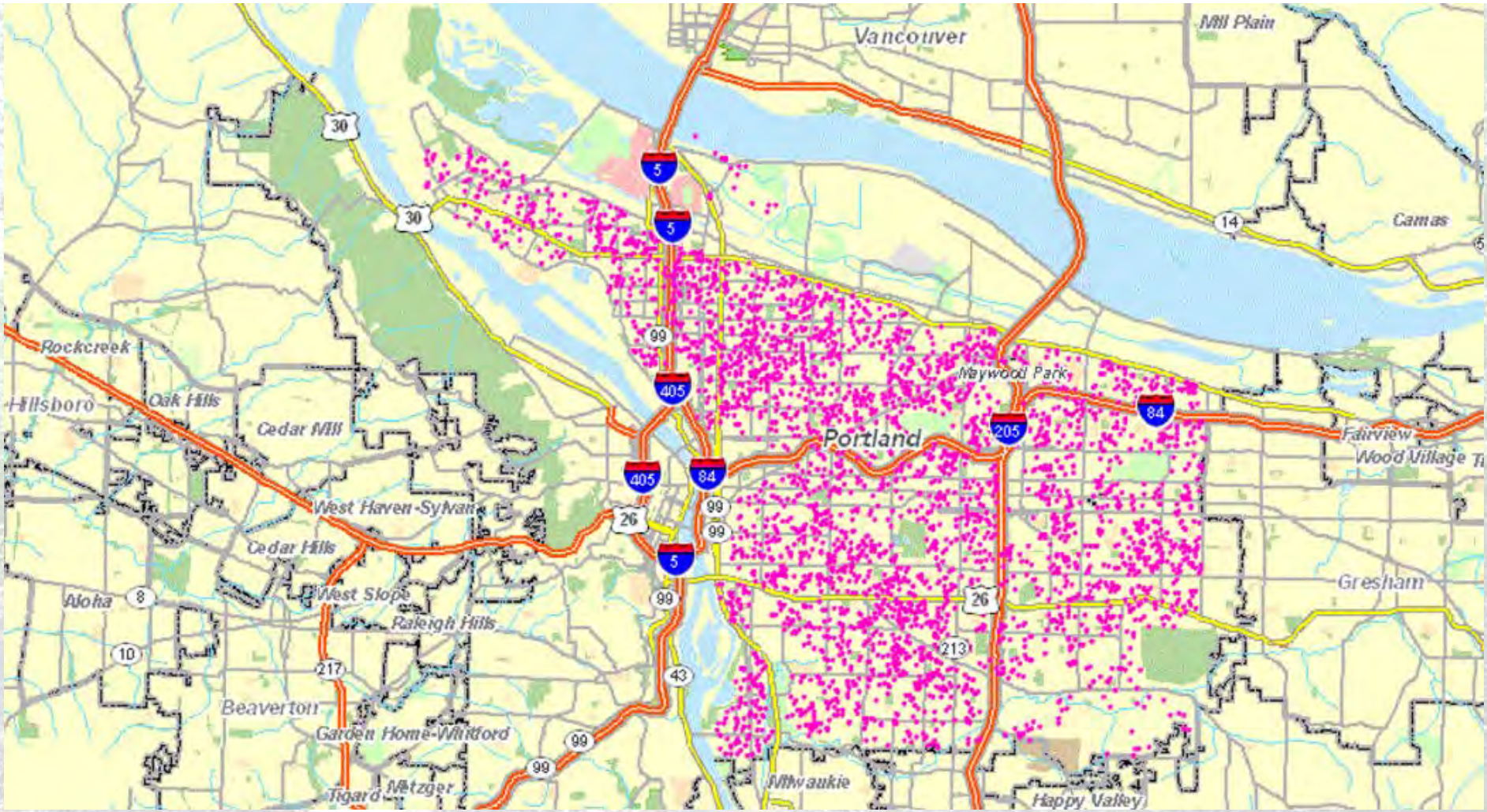
Tree benefits for health, wealth, and happiness: still undervalued

Ulrich 1984 study:
view from hospital rooms



Hospital Room View

Street trees and health, house values: Geoff Donovan and colleagues (USDA Forest Service)

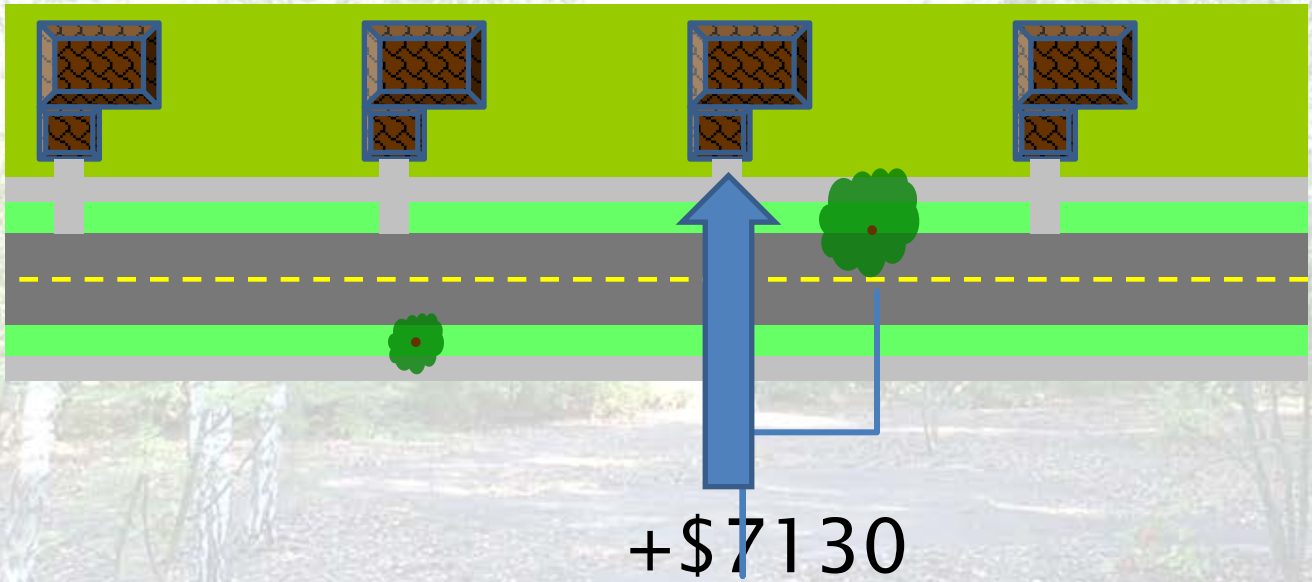


Tree Benefits: Health

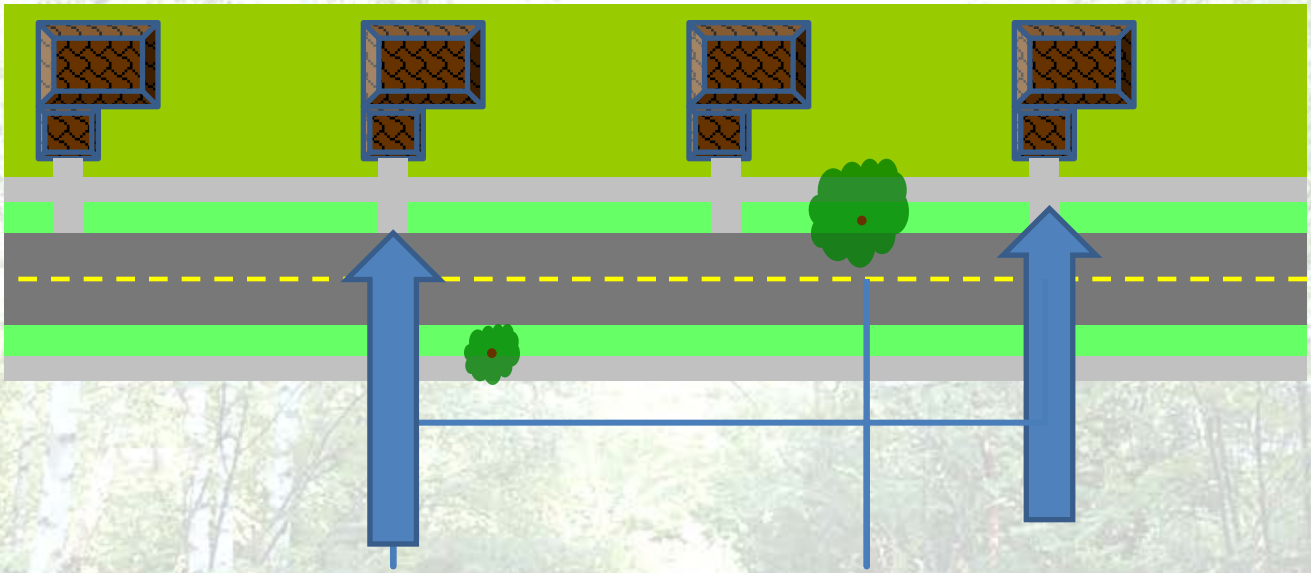
Do trees influence health of newborns?

Tree Benefits: Wealth

House with a street tree= +$7130 when sold



Street tree adds value to the neighbors!



+$12,828 to neighbors!

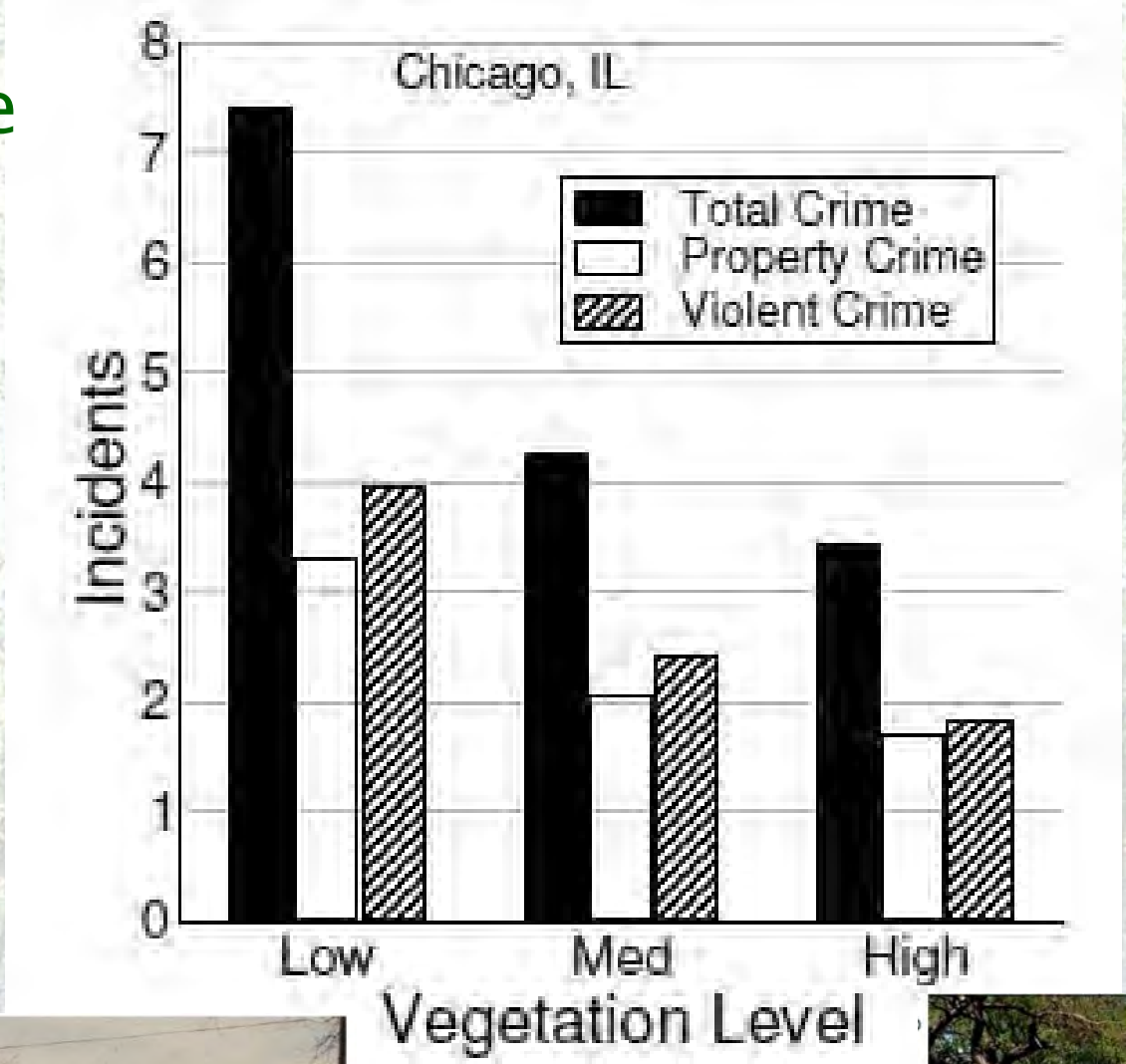
psst…!
Benefit/Cost ratio=12:1

Tree Benefits: Happiness

Chicago, Illinois

Kuo and Sullivan 2001

Trees = Less crime



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Urban trees: Beautiful, beneficial, cost-effective

Drought challenges and solutions

Resources, Discussion

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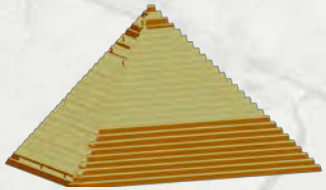
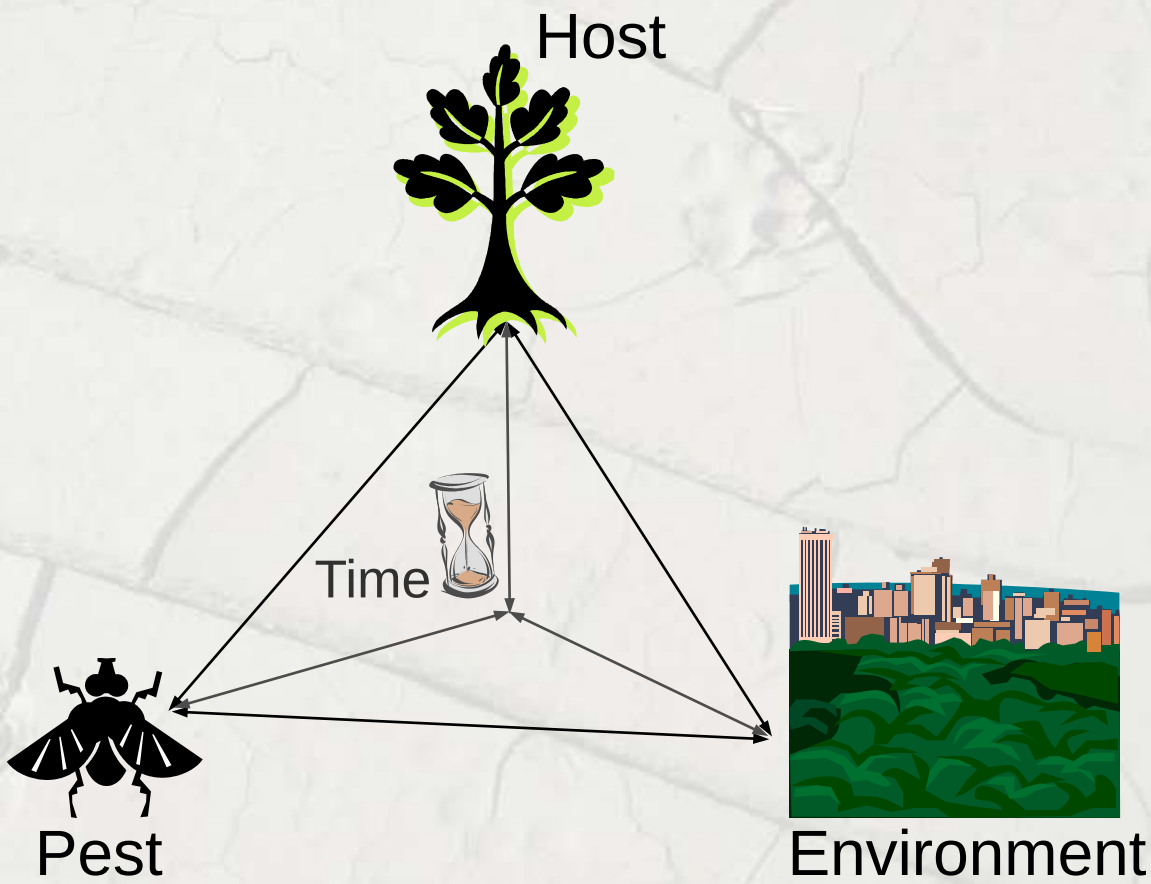
four elements of a pest problem



Plant pathology



Trees and drought: problematic in several ways…

~ Photosynthesis: Trees need water to "feed themselves"
~ Drought = overall reduction in growth (which may persist)
~ Drought = less stored energy = lowered ability to make defensive compounds
~ Drought = indirectly facilitates many insects, some diseases

Drought and pests 1: Eucalyptus longhorned borer

(or: watering can be a part of IPM!)

Water Stress and Insect Injury

Although some species perform well with little or no irrigation water, their susceptibility to insect attack and injury may increase with water stress. For example, many *Eucalyptus* species perform well in nonirrigated locations in many parts of California. When water stressed, however, they become susceptible to attack and injury by the eucalyptus longhorned borer (*Phorocantha semipunctata*). This is also the case for Monterey pine (*Pinus radiata*) and the California fivespined engraver beetle (*Ips paraconfusus*). For these species, evaluations were made with consideration given to water stress and pest interactions. For example, although Tasmanian blue gum (*Eucalyptus globulus*) performs well in Regions 3 and 4 with little summer water, it was assigned the category Moderate to minimize susceptibility to borer injury.

Drought and pests:
Foamy bark canker
on stressed oaks

Management: (1) reduce stress (water!); (2) prevent construction damage;

Eskalenlab.ucr.edu

Drought and pests:
Bark beetles and
Ambrosia beetles

Management: (1) prevent stress (water!);
(2) suppress with insecticide in exceptional cases

Indirect stress
Example:
Botryosphaeria

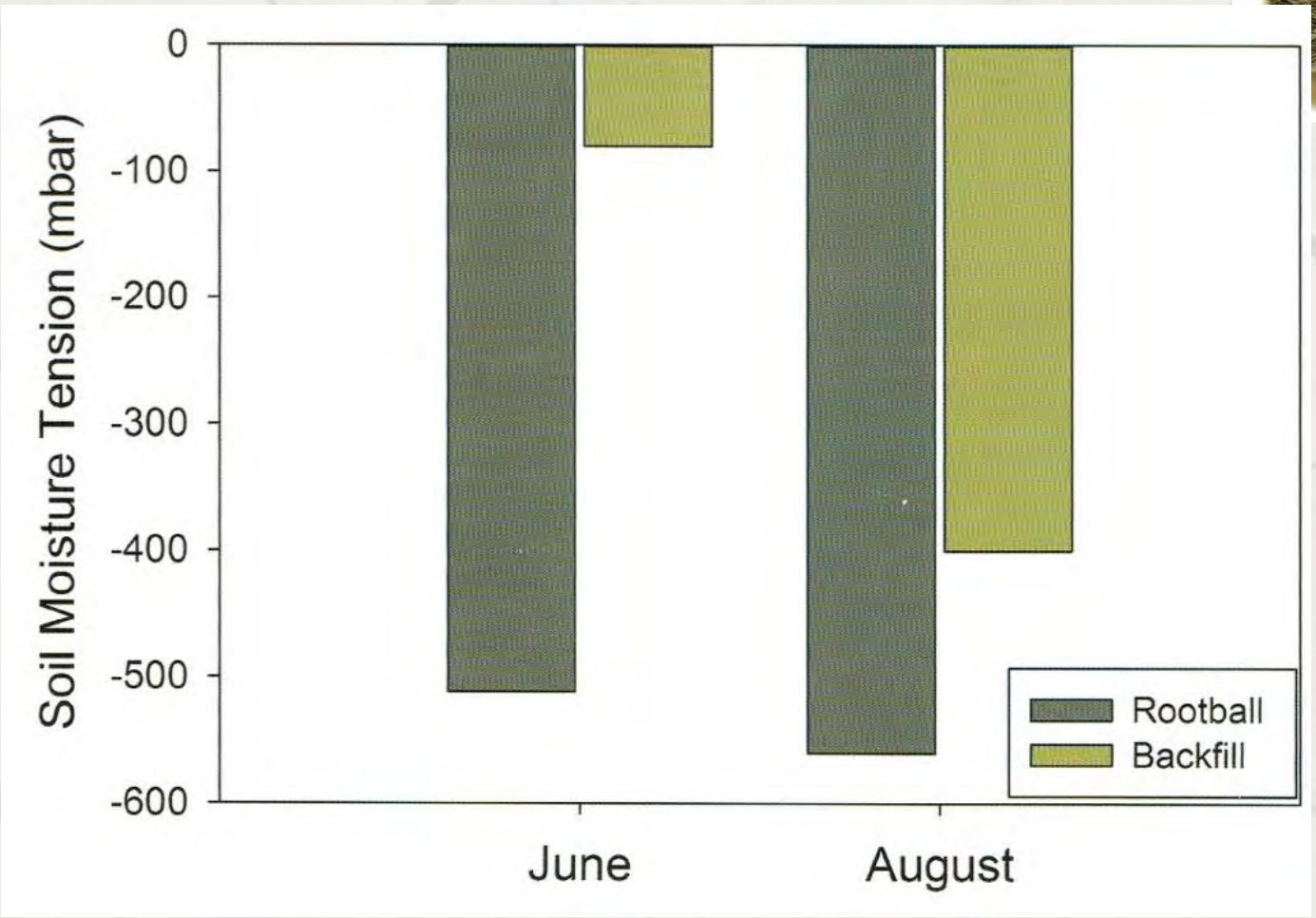
Management: (1) prevent stress (water!);
(2) prune out where possible

Indirect stress: Pitch canker on Monterey pine

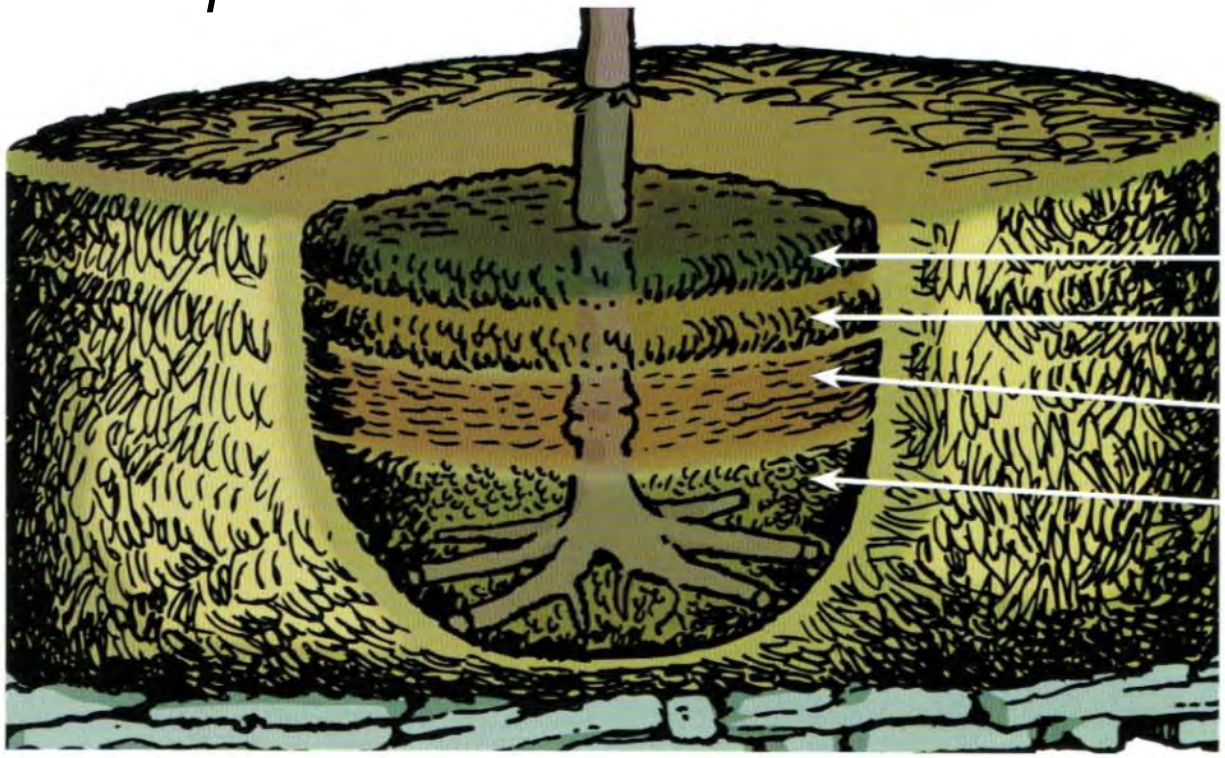
Individual infections, may progress down the branches

Management:
(1) prevent stress (water!);
(2) prune out in initial stage
(3) Suppress beetles, if present

BMPs 1: Watering
(remember that new trees only get water from the root ball soil)



BMPs 2: Ensure that the tree is not planted *too deep*



Even with limited irrigation… the canker diseases will strike…!

BMPs 3:Mulch!

← Tree roots do better under mulch

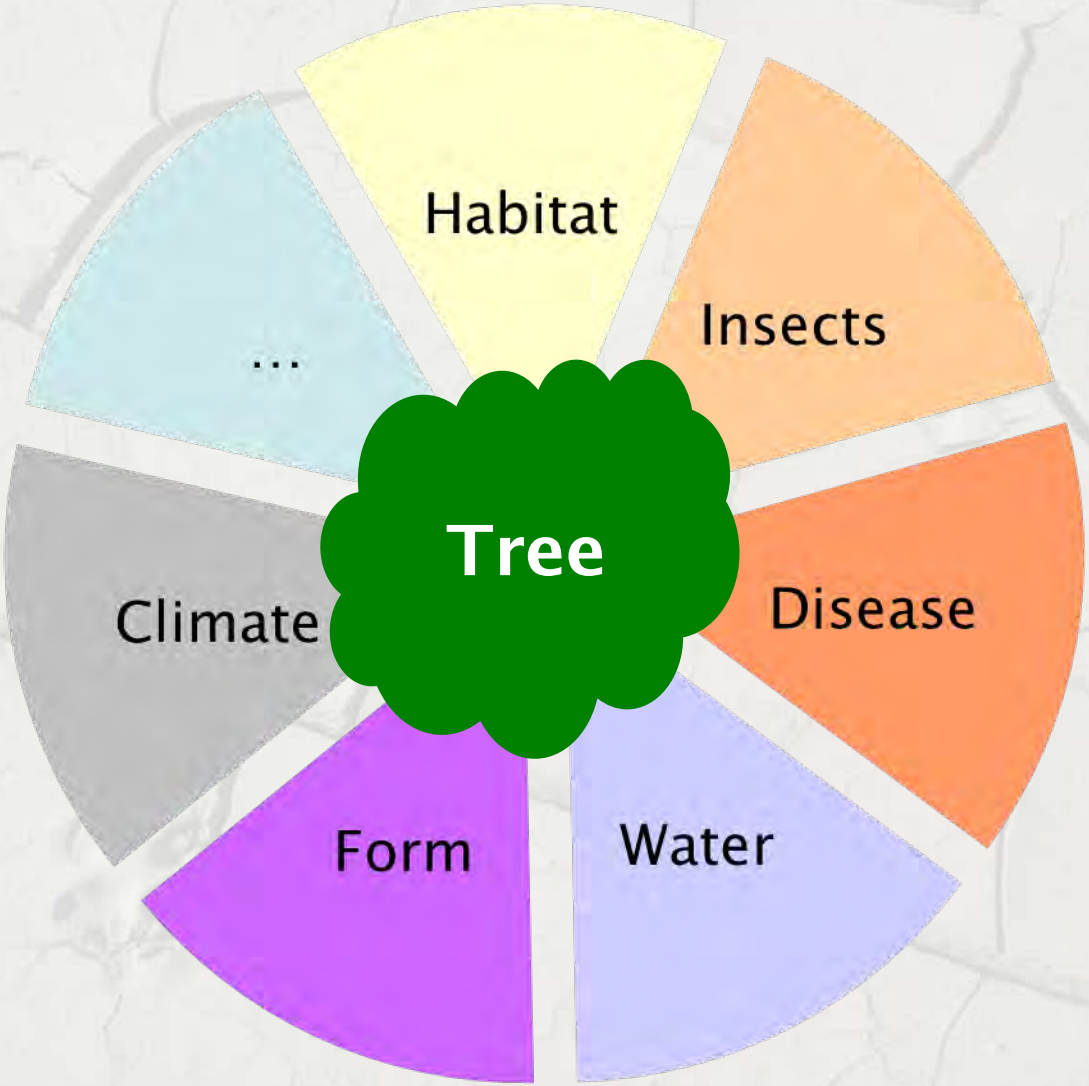
Mulch pitfalls: volcanoes

Tree species selection is a critical component of pest management

& must consider both the individual tree AND the other urban trees

Photos: USDA

Tree species selection 1: Individual considerations



Compare my trees' water use to other species: WUCOLS

ucanr.edu/sites/Wucols

ucanr.edu/sites/WUCOLS/

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WUCOLS IV
Water Use Classification of Landscape Species

- Home Page
- User Manual
- Plant Search Instructions
- Plant Search Database
- Download WUCOLS IV Plant List
- Download WUCOLS IV User Manual
- Water Requirements for Turfgrasses
- Partners
- Acknowledgements

Home Page

GETTING STARTED

If you are using the WUCOLS list for the first time, it is essential that you read the *User Manual*. The manual contains very important information regarding the evaluation process, categories of water needs, plant types, and climatic regions. It is necessary to know this information to use WUCOLS evaluations and the plant search tool appropriately. To access the *User Manual*, click on the tab (on left) and view specific topics.

Water conservation is an essential consideration in the design and management of California landscapes. Effective strategies that increase water use efficiency must be identified and implemented. One key strategy to increase efficiency is

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WUCOLS categories

CATEGORIES OF WATER NEEDS

Category	Abbreviation	Percentage of ET_o
High	H	70–90
Moderate	M	40–60
Low	L	10–30
Very Low	VL	< 10

Fig. 2. Five-finger fern was assigned to the "high" water needs category in four regions.

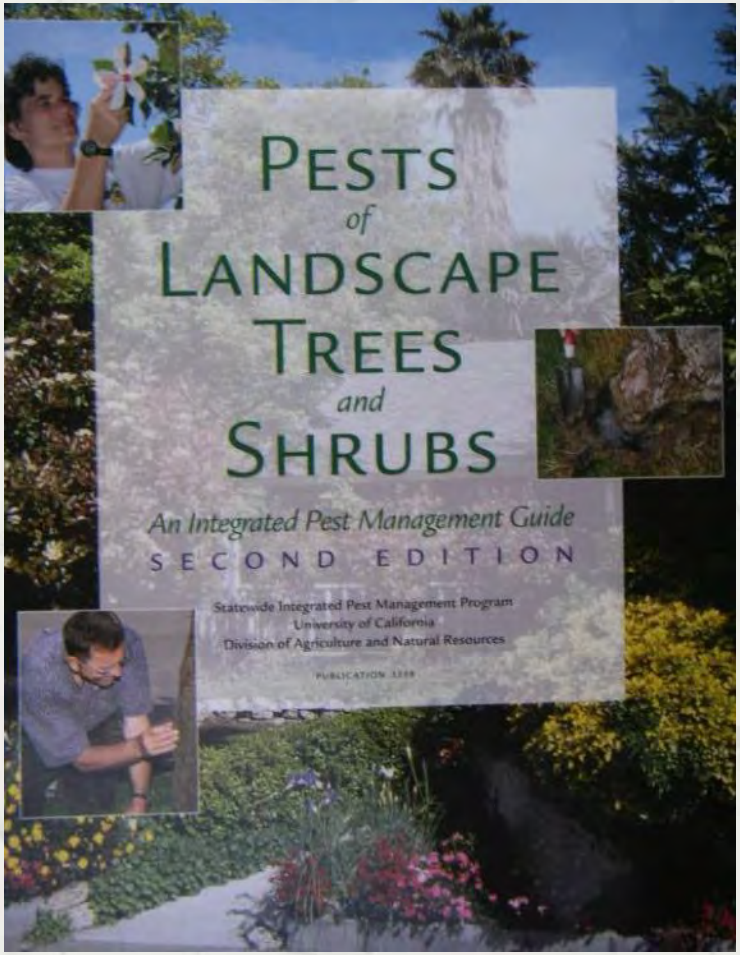
Tree species selection 2: considering all trees

Photo: Purdue Extension

Pest Vulnerability Matrix

Construction

1. Obtain pest-host information
2. Arrange in table, indicate severity
3. Verify local importance



Pest	London plane tree	Maple	Honey Locust	Callery pear	Linden	Zelkova	% Tree species affected	Proportion of tree population affected
Pest count >>>	5	6	3	1	2	2		
Proportion of all trees >>>	0.4	0.2	0.1	0.1	0.1	0.1		
Anthracnose (fungal disease)							50%	70%
Defoliating caterpillars							50%	70%
Soft scales (insect)							50%	70%
Aphids (other)							50%	70%
Asian longhorned beetle							33%	60%
Spider mites (combined)							33%	30%
Armillaria root rot or Oak root fungus.							17%	10%
Fireblight (bacterial disease)							17%	10%
Other native borers (combined)							17%	10%

“Making the 50+ Year Decision”

Ralph Mize, City Arborist emeritus, San José, CA

Drought: some UC resources

ipm.ucdavis.edu

ccuh.ucdavis.edu

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Enhancing urban living through horticulture

Located at the University of California, Davis, the **California Center for Urban Horticulture (CCUH)** draws upon the knowledge and expertise of our partners in academia, industry, and the public with a mission to help Californians

- develop more water-conserving, pest-resistant and disease-resistant home gardens
- create environmentally sound public landscapes and parks
- produce better plant materials for sustainable urban landscapes

We seek to address the state's growing water demands, increasing chemical inputs into the environment, and loss of wild lands in order to improve the quality of urban life.

News

San Jose Drought Workshop Presentations & Handouts Now Available!

Jun 18, 2015

Lake Tahoe Drought Workshop Presentations & Handouts Now Available!

Jun 08, 2015

More news...

Featured

NEW! Landscaping Resources During Drought!!

NEW! Landscape Irrigation Scheduling!

Results from Kurapia Irrigation Trial Available Now!

New article about the TRIC on the UCANR Master Gardener Website!

Low Water Use Landscaping Presentations from Nov 8th Available Here

Tree Ring Irrigation Contraption (TRIC): A New Way to Water Trees with Confidence

"Tree Ring Irrigation Contraption"

Loren Oki and Dave Fujino

- Calculates irrig. run time to wet a tree to 36" deep
- Input info for 1' spacing:
  - Canopy radius, soil type, no. of 100' drip lengths (Netafim)
- http://ccuh.ucdavis.edu/

ucanr.edu/sites/UrbanHort

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Welcome!

Welcome to the *Center for Landscape and Urban Horticulture (CLUH)*, an information resource of the University of California Cooperative Extension (UC Cooperative Extension). CLUH supports UC Cooperative Extension educational and applied research programs serving California's environmental horticulture industry.

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

Information is contributed by University of California Cooperative Extension scientists. All content is reviewed by these or other experts to assure it is authoritative and science-based. Featured are fact sheets, newsletters, reports, commentary, and web links.

Does the site you manage have a water budget or water conservation goal that seems impossible to meet? Read about Five Simple Steps for Conserving Landscape Water.

Dennis Pittenger's Bakersfield presentations on February 11, 2014

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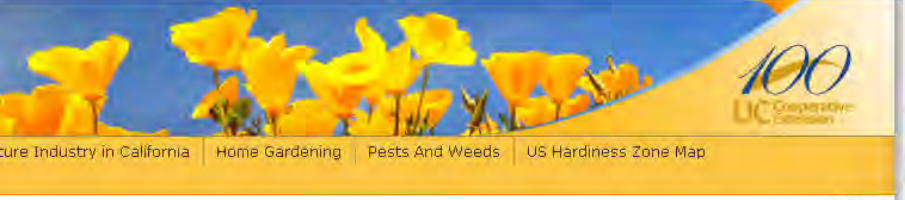
ucanr.edu/sites/UrbanHort



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PRINT

Easy Calculators for Estimating Landscape Water Needs

Getting Estimates of Landscape Water Needs

The following pages contain calculators that generate water need estimates for different types of lawns/turf and landscape plants. The calculators are based on field research findings and offer estimated amounts of water particular types of plants need in order to provide acceptable landscape performance.

Use the calculator results as starting points for the amount of water a
Monitor plant performance for a few weeks. If plants appear to be stre
increase the water amount; if plants appear to be over-watered or if t
greater water conservation is desired, then decrease the water amoun
gradually in increments of 10% or less.

Separate calculators deal with different types of plant materials and se
for:

- lawns/turfgrasses.
- mass plantings of non-turf perennial groundcovers.
- beds or mass plantings of annual and perennal flower and similar
- individual trees or shrubs.
- groupings of trees or shrubs.

(It is assumed the plants are established in the landsca

To use these irrigation estimators, you simply need to determine the ty
then enter the size of plant or planted area and the daily reference ev
your location. Follow the link in the estimator instructions to obtain rel
uncertain what they are. Enter a historic average daily ETo or anticipa
of the period if you are using the estimator to predict water needs for
period. For the most accurate irrigation need estimates, enter a curren
value that represents the calendar period of interest. Historic and real-
locations can be found at the CIMIS web site.

Irrigation Calculators
(may not work with Excel 2008 on Macin

Lawn/Turfgrass Irrigation Calculator

Landscape Irrigation Estimator-mass planting or beds of annual & peren

Landscape Irrigation Estimator - non-turf perennial groundcovers

Landscape Irrigation Estimator-individual trees & shrubs

Landscape Irrigation Estimator-groupings & mass plantings of trees and

Landscape Irrigation Estimator

Water needed by plantings of *non-turf perennial groundcovers*

Step 1:
Double click the blue box and input the area of the planting in square feet, then press "Enter". The measurement should be based on the rough dimensions (length x width) of the entire area of the planting. If the planting is irregularly shaped, consider dividing it into approximate rectangular sections and adding together their areas to get a more accurate measure of the total area. There is no need to separate out areas occupied by trees and shrubs mixed in the planting.

Step 2:
Double click the green box. Input the daily reference evapotranspiration (ETo) in inches for the period, then press "Enter".
To find out the ETo for your area of California, go to http://wwwcimis.water.ca.gov/cimis/data.jsp
and use either the real time daily values numbers or an average historical daily value for the time period. If you are projecting a future irrigation schedule, input an average real-time or historical daily ETo based on the most recent 5 to 7 day period or input your best guess. Just be sure to enter a daily ETo number, not a weekly or monthly figure.

Step 3:
The Estimator will provide the estimated plant water need in gallons and inches per day and per week based on the daily ETo value input. Use the number to set your irrigation runtime and schedule based on the performance characteristics of your irrigation system.

Step 4:
Evaluate plant response after a week or so and increase irrigation if the appearance of plants appears to be declining below your expectations as a result of the irrigation amount. If plants meet or exceed your expectations and you want to conserve irrigation water, you can reduce the irrigation amount slightly or extend the interval between irrigation days slightly and re-evaluate plant response. Adjust irrigation amount in increments of no more than 10% and adjust irrigation intervals in one-day increments.

Area of planting in square feet	ET_o average per day	Gallons per day	Gallons per week	Inches per week
100	0.18	5.61	39.27	0.63

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