



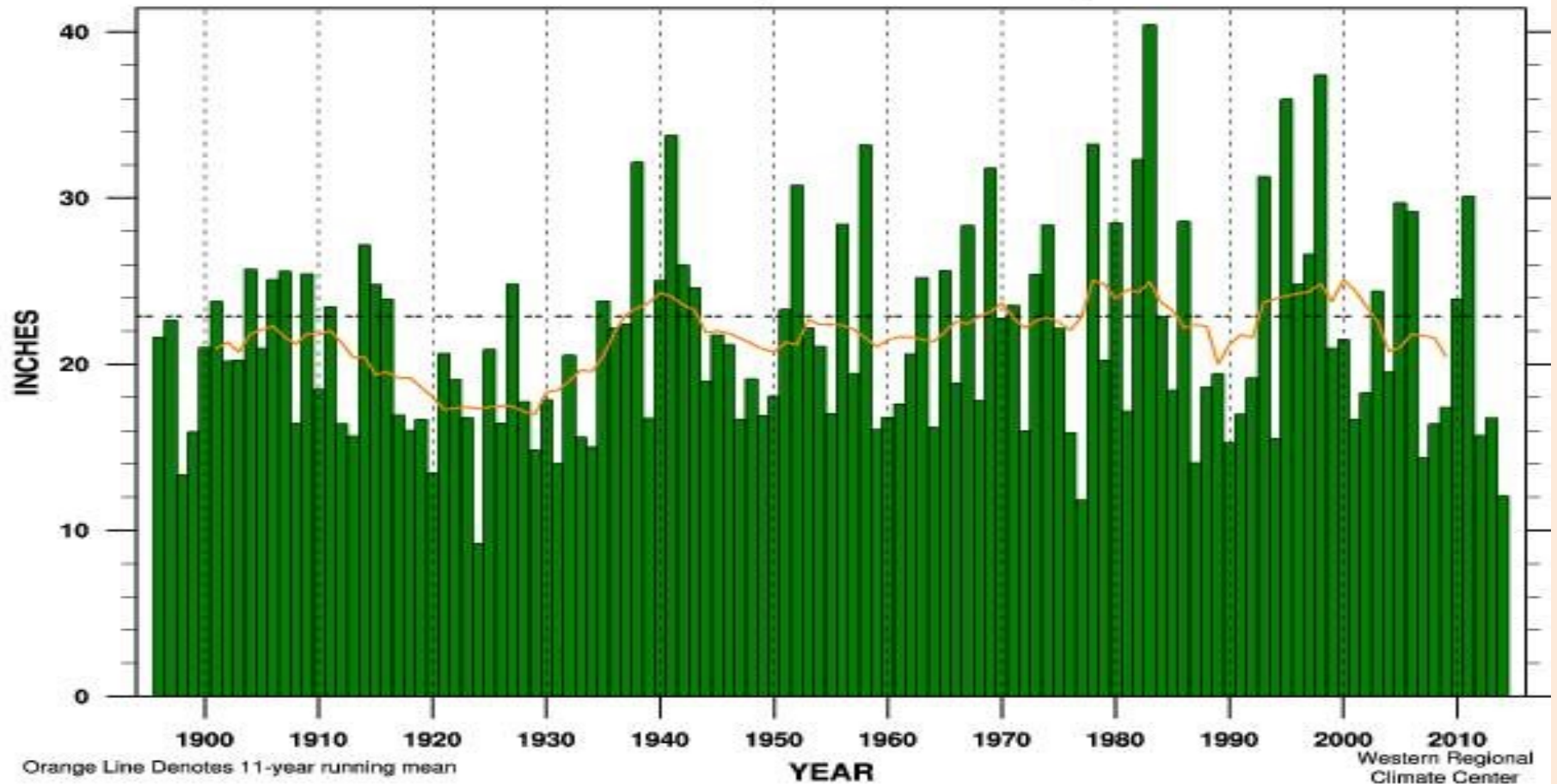
Drought –
Impacts on
Tree Health and
the Community
Managing Risk for City
Trees



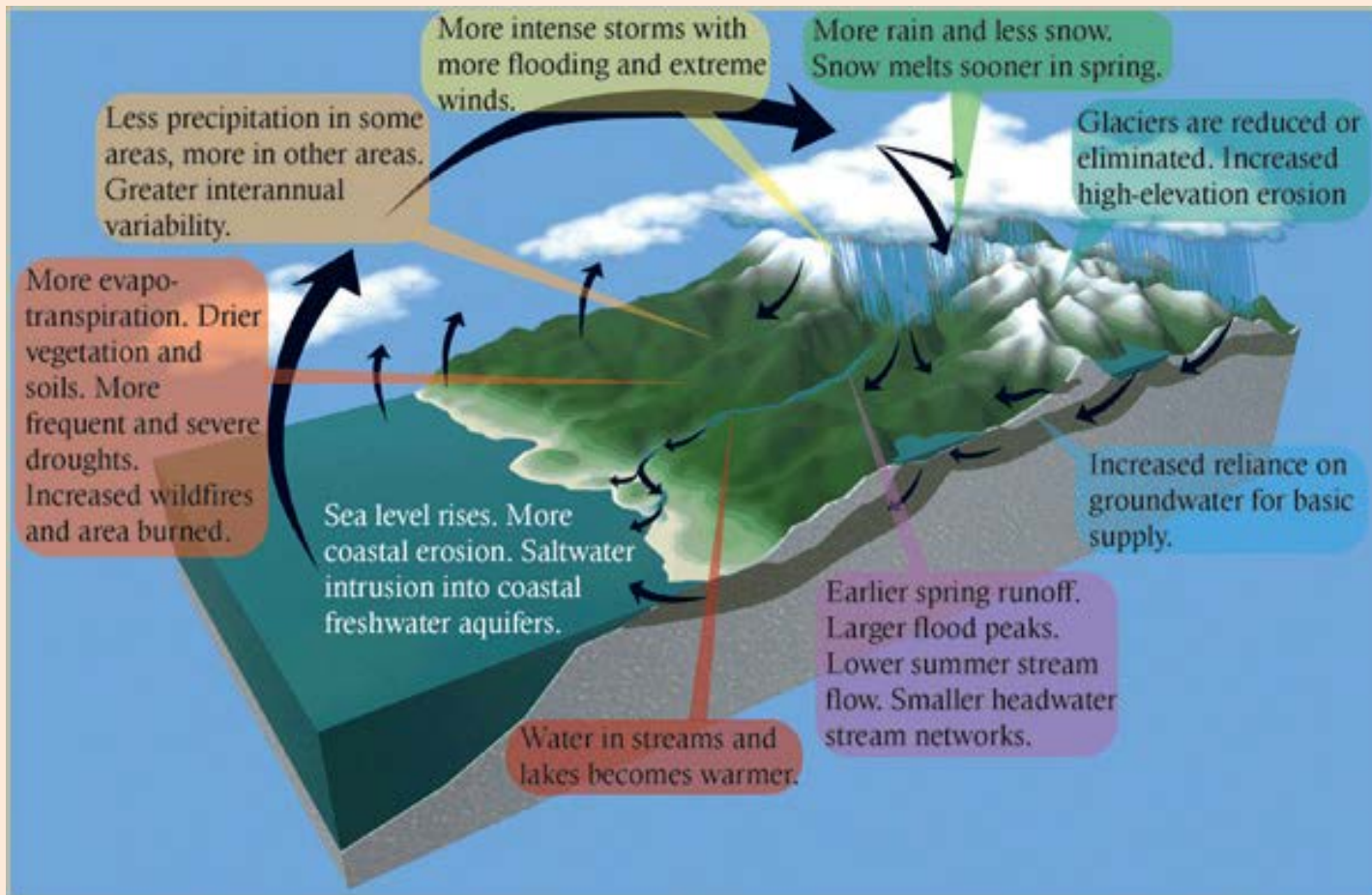
Western Juniper: drought-sensitive chronology
dating back to the AD 800s

Photo Credit: Henri D. Grissino-Mayer, Department of Geography, The University of Tennessee

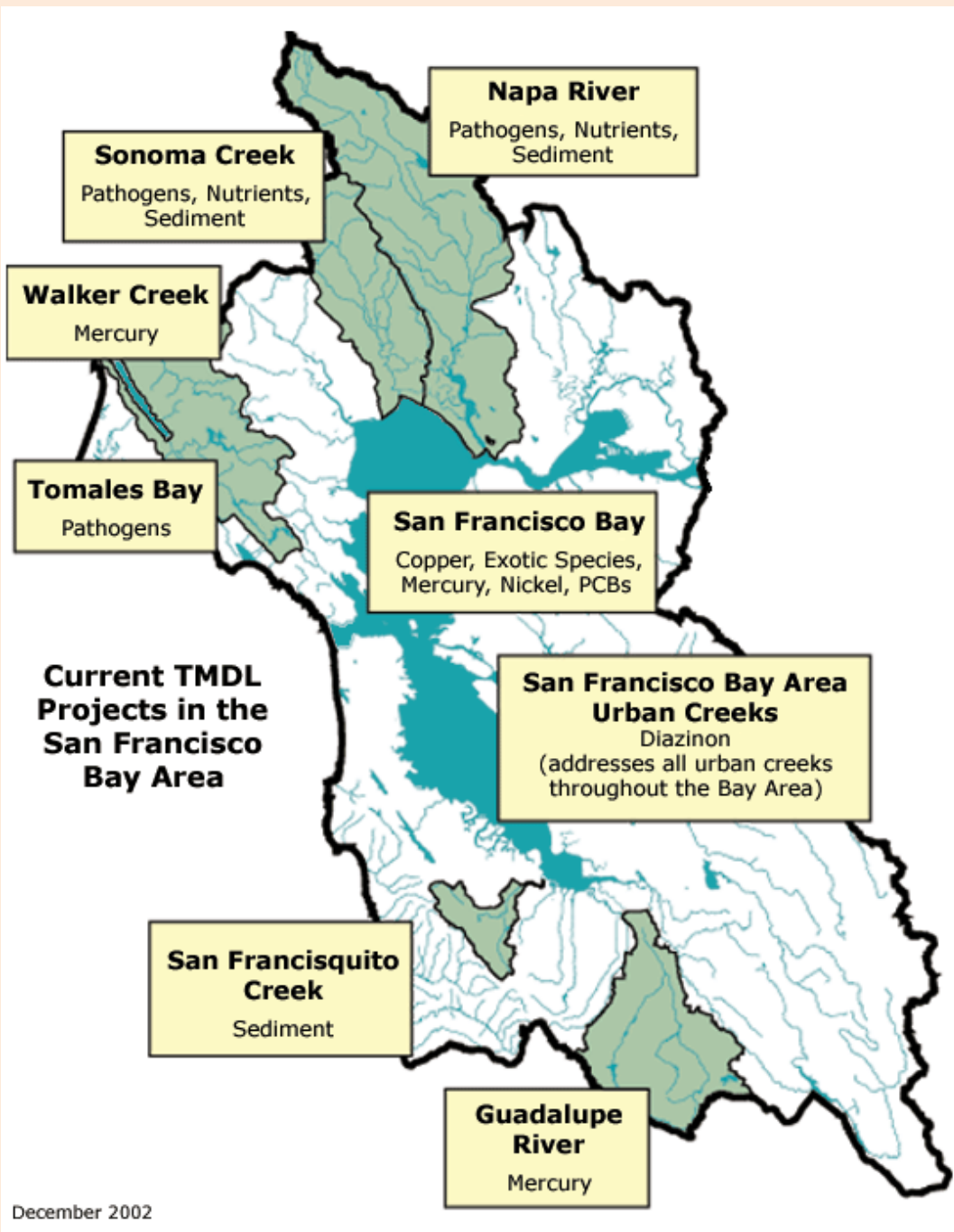
California Statewide Precipitation Oct-Sep



Linear Trend 1895-present	+ 2.45 ± 3.09 in.	(+ 10 ± 13%) per 100 yr	
Linear Trend 1949-present	- 2.06 ± 8.75 in.	(- 8 ± 38%) per 100 yr	
Linear Trend 1975-present	- 8.99 ± 21.46 in.	(- 39 ± 93%) per 100 yr	
Wettest Year	40.44 in. (176%)	in 1983	MEAN 22.90 in.
Driest Year	9.23 in. (40%)	in 1924	STDEV 6.53 in.
Oct-Sep	2014	12.05 in. (52%)	RANK 3 of 119

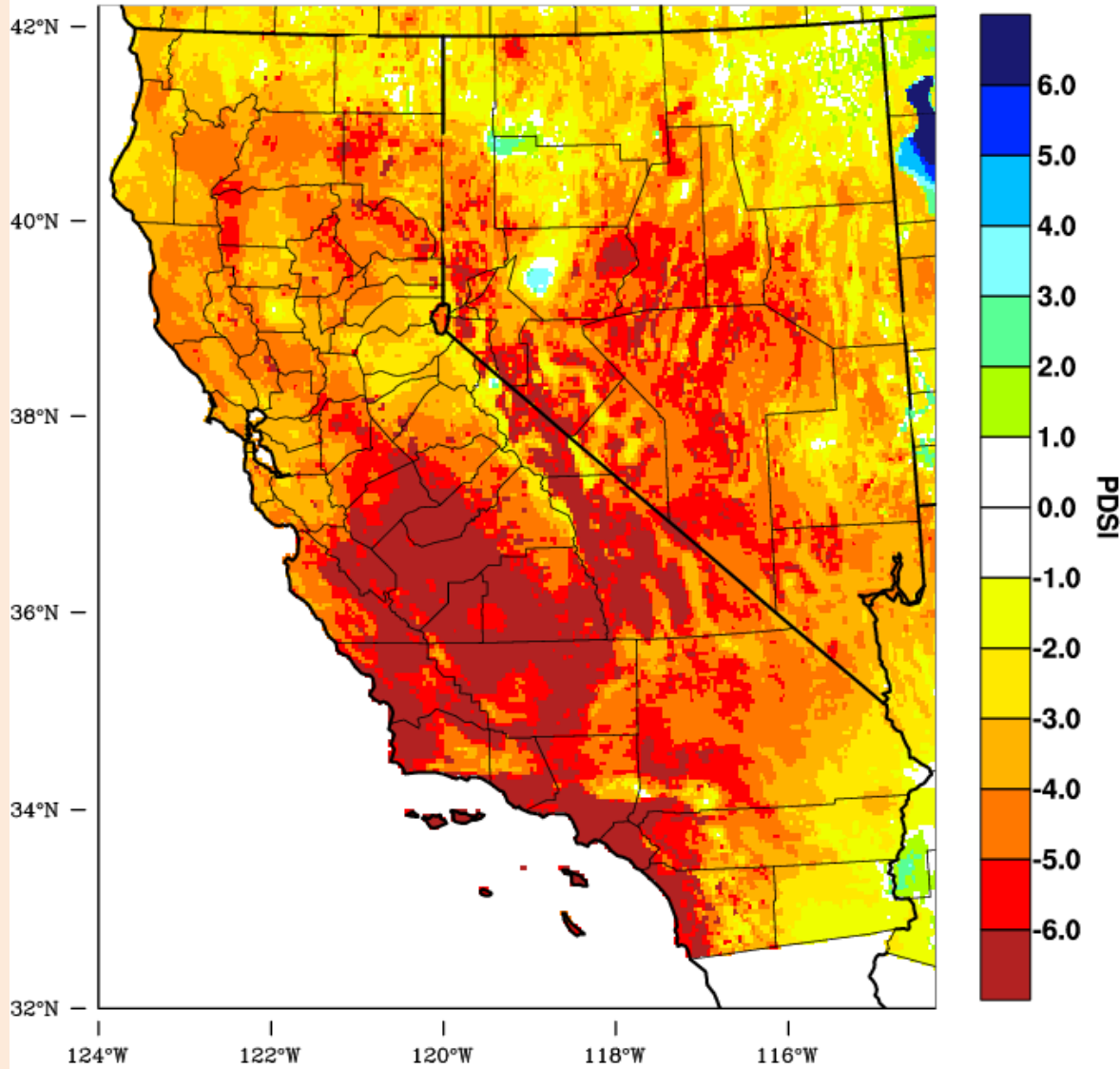


Graphic Credit: Furniss, M.J.; Reid, L.M.; Staab, B. 2008. Water Resources and Climate Change. (May 20, 2008). U.S. Department of Agriculture, Forest Service, Climate Change Resource Center. <http://www.fs.fed.us/ccrc/topics/water.shtml>



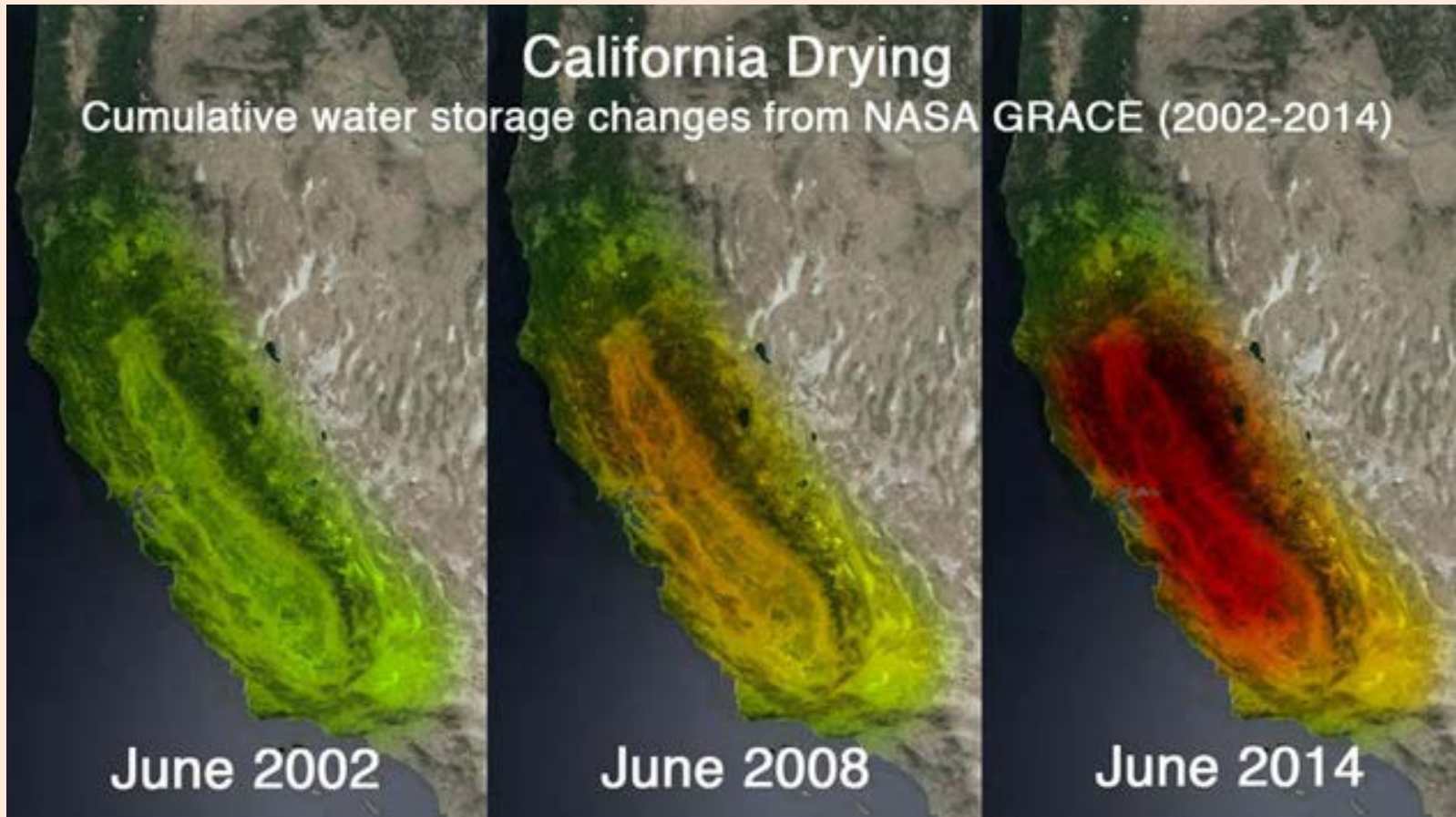
California - PDSI

June 2015



Palmer
Drought
Severity Index

Blue = Wet
Red = Dry



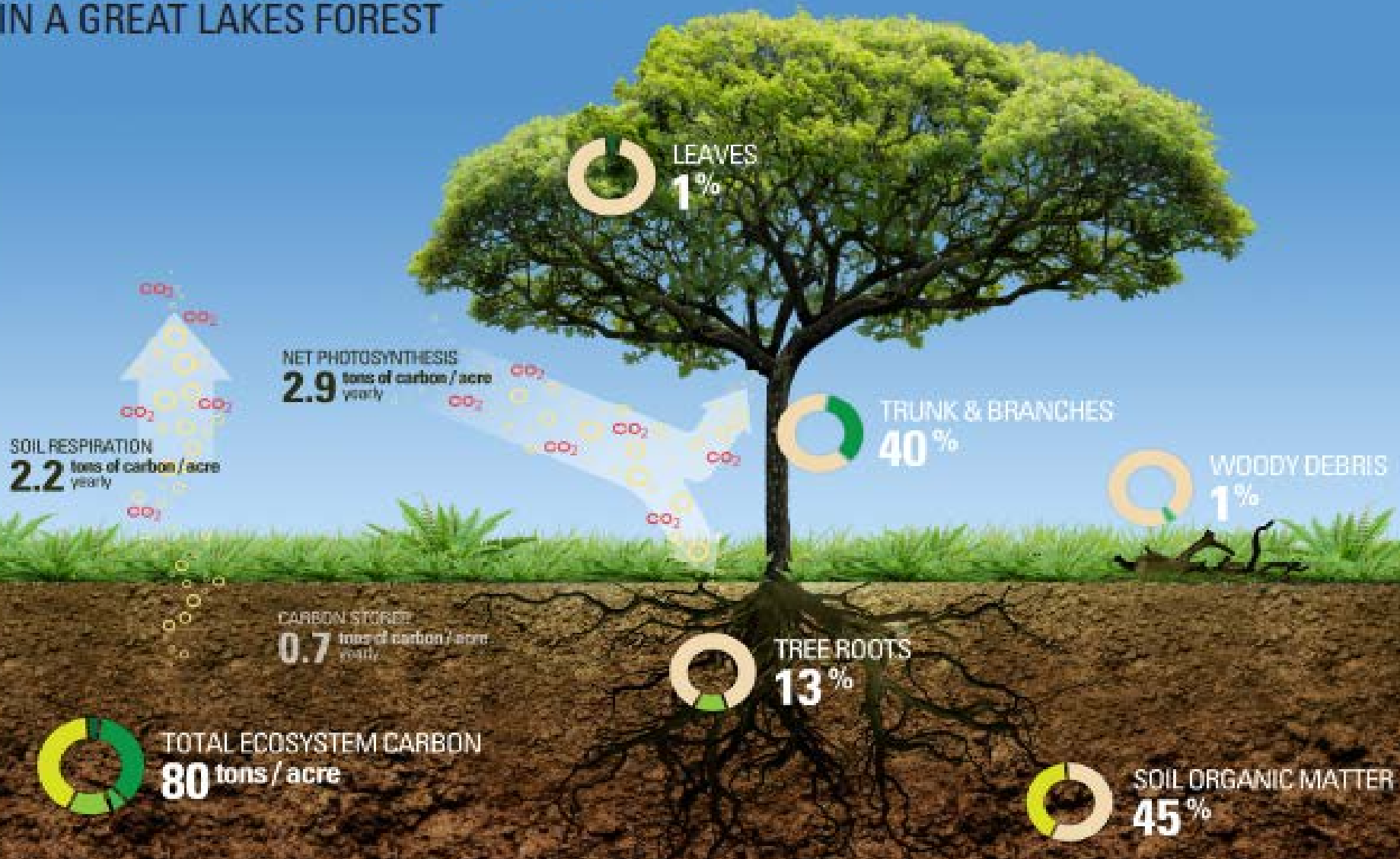
NASA research shows where groundwater withdrawals in California outpaced groundwater replenishment over the past 12 years.



Growing Quality of Life: Urban Trees, Birth Weight, and Crime
Dr. Geoffrey h. Donovan, Pacific Northwest Research Station ,USDA Forest Service, Portland

CARBON STORAGE

IN A GREAT LAKES FOREST

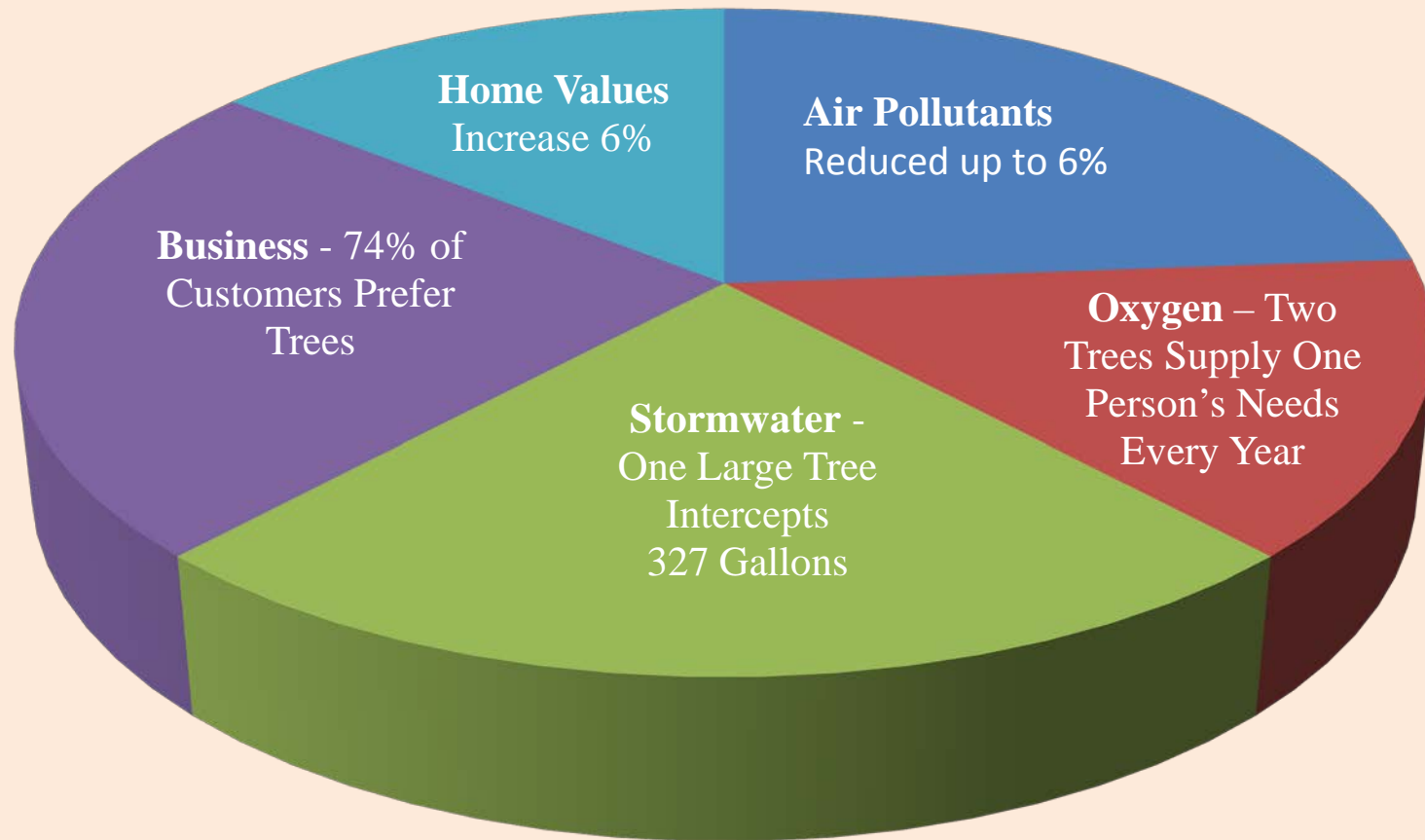


Graphic Credit: Christina Dierkes

“Accounting for Carbon in Great Lakes Forests”, OSU Webinar Series, 2011

Economic Benefits of Trees in Cities

Center for Urban Horticulture University of Washington, College of Forest Resources



1 Million Trees Planted in Los Angeles = \$1.64-\$1.95 Billion in Benefits over 35 Years

Los Angeles One Million Tree Canopy Cover Assessment Final Report: Drs. Greg McPherson and Jim Simpson Center for Urban Forest Research, Pacific Southwest Research Station, USDA Forest Service, Davis, CA and Drs. Qingfu Xiao and Chelsea Wu, Department of Land, Air, and Water Resources, University of California Davis March 31, 2007

Climate Change and Your Health: Rising Temperatures, Worsening Ozone Pollution

Table 1: Climate Penalty Factor Estimates

Locality/Region	Derived Climate Penalty Factor (ppb/°F)	Data Source
Los Angeles Basin	2—4.5	Taha 2001
Sacramento Valley	1.4—2	Taha 2001
Bay Area	1.8*,2.2	Steiner et al. 2006
Sacramento	1.8*,0.6	Steiner et al. 2006
Fresno	2.5*,0.6	Steiner et al. 2006
Midwest urban areas	>3	Hogrefe et al. 2004
Southern California	0.6–1.1	Wu et al. 2008

Table 2: Occurrences of Acute Respiratory Symptoms Associated with a 2 ppb Climate Penalty in 2020

State	Low	Central	High
ARIZONA	39,202	77,065	114,831
ARKANSAS	16,166	31,781	47,355
CALIFORNIA	225,208	442,724	659,684

Table 3: Total Costs for Health Impacts Associated with a 2 ppb Climate Penalty in 2020

State	Low	Central	High
ARIZONA	\$24,541,372	\$148,995,076	\$376,437,184
ARKANSAS	\$11,717,838	\$74,094,358	\$188,578,080
CALIFORNIA	\$122,327,848	\$729,189,387	\$1,833,793,408

INSIDE

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issue one hundred thirty seven / november 2011

"Science affects the way we think together."

Lewis Thomas

Growing Quality of Life: Urban Trees, Birth Weight, and Crime



A study in Portland, Oregon, found a relationship between tree cover within 50 meters of an expectant mother's house and a reduced risk of her baby being born underweight. Houses fronted by more street trees experienced lower crime rates than houses without street trees.

"The best time to plant a tree was 20 years ago. The next best time is now."
—Chinese proverb

Choosing a jogging route down a tree-lined street, walking the dog to a neighborhood park, or simply being entertained by the front-yard drama between squirrels and crows: urban trees and green spaces can enhance quality of life for a city-dweller in many ways. Trees also have a measurable economic value. The September 2010 issue of *Science Findings* featured a study in Portland, Oregon, by Geoffrey Donovan showing that a tree in front of a home increased that home's sale price by more than \$7,000, and that it also increased the value of the homes around it.

But Donovan, an economist and research forester with the Pacific Northwest Research Station, says the value of urban trees goes beyond dollars and cents.

"Urban residents treasure their trees and green spaces. Each person might articulate a different reason for this, but most would agree that trees can make a neighborhood a more desirable place to live," he says.

Given this premise, Donovan set out to measure just how beneficial trees are to our health, our sense of well-being, and the safety of our homes. He and his collaborators designed two studies in Portland. The first looked for a connection between urban trees and birth outcomes. The second looked at the relationship between urban trees and crime.

IN SUMMARY

City dwellers can find many reasons to value neighborhood trees. Urban greenery provides relief from the built environment that many people find appealing. In fact, a previous study found that a tree in front of a home increased that home's sale price by more than \$7,000. Two new studies explore the measurable effects that urban trees and green spaces have on human health and crime rates.

Geoffrey Donovan, an economist and research forester with the Pacific Northwest Research Station, used public health data, crime statistics, tax records, aerial photos, and other information in the two recent studies. He found that women who live in houses with more trees are less likely to have underweight babies. The study on crime revealed a more complex relationship. Larger trees, including trees located near the street, are associated with a lower incidence of property crimes. Larger numbers of smaller trees—especially trees planted near the home, which may provide a screen for burglars—are associated with higher crime.

Cities within the Portland, Oregon, metropolitan area are using this information as they rewrite street tree regulations. Likewise, local crime prevention programs and tree planting advocates are sharing the findings with urban residents.

Trees enhance Quality of life

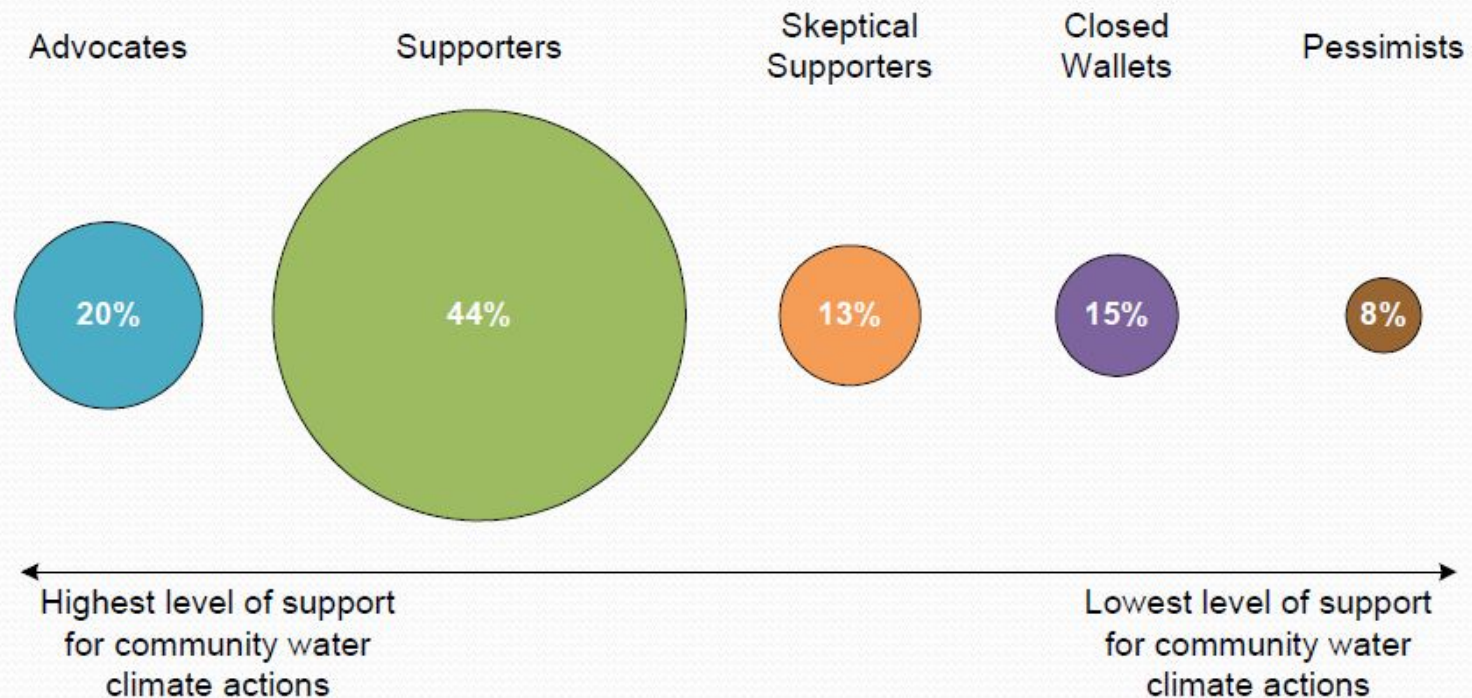
Just a few of the services provided by neighborhood trees:

- Make communities healthier
- Improve safety
- Increase property value
- Reduce storm water runoff
- Encourage outdoor activity
- Nurture wildlife
- Cool buildings
- Improve air quality
- Recharge groundwater
- Prevent soil erosion
- Absorb greenhouse gases
- Mitigate ground level ozone

*The single biggest problem in
communication is the illusion
that it has taken place.*

George Bernard Shaw

Five Americas for “Community Water and Climate Change”



How did the City of Melbourne respond to the 10-year Millennium Drought?

MELBOURNE'S URBAN FOREST



60,000

COUNCIL TREES



\$650m

AMENITY VALUE



22%

CANOPY COVER

LOW DIVERSITY
Just three species - plane, elm and red river gum make up more than 35% of Melbourne's trees



AGEING
Some of our grandest trees are nearing the end of their lives



HIGH VULNERABILITY

Fitzroy Gardens now



CITY OF MELBOURNE EXPECTS TO LOSE

- 27% of trees in 10 years
- 44% of trees in 20 years

If no action is taken



CHALLENGES

Pests & Disease

Myrtle rust could affect almost 45% of Melbourne's trees

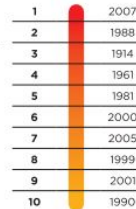


Climate change

Victoria's temperatures are predicted to increase into the future

Victoria has recorded five of its ten hottest years since 1999**

**Ranked according to average daily temperature



Increasing Population & Density



THE FUTURE

OUR VISION

The City of Melbourne's urban forest will be resilient, healthy and diverse and will contribute to the health and wellbeing of our community and to the creation of a liveable city.

URBAN FOREST STRATEGY TARGETS

1. Increase canopy cover - 40 per cent by 2040.
2. Increase diversity - no more than 5% of one tree species, 10% one genus, 20% one family.
3. Improve vegetation health - 90 per cent of tree population healthy by 2040.
 4. Improve soil moisture.
 5. Improve biodiversity.
6. Inform and consult with the community.



GREEN INFRASTRUCTURE / LOW IMPACT DESIGN



- Tree Boxes
- Rain Gardens
- Vegetated Swales
- Pocket Wetlands
- Median Strips
- Infiltration Planters
- Porous And Permeable Pavements
- Vegetated Swales



Caring for Trees in a Dry Climate

Credit: Colorado State Cooperative Extension

- Mulch
- Do not fertilize
- Keep your trees healthy and pest free
- Postpone construction activities near your tree
- Properly prune trees and shrubs to improve structure
- Generally, water one to two times per month October-March

Priority 1

- Water trees most vulnerable and affected by dry conditions (restricted root zone, adjacent to heat islands, south-facing slopes)
- Newly planted and young trees (rule of thumb: one full year per inch of trunk diameter to get established. Ex. It will take 3 years for a 3" caliper tree to establish itself)

Priority 2

- Established, drought tolerant species
- Areas with access to supplemental ground water
- Volunteer trees (self-seeded) or "weed" trees typically have extensive root systems

EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION

issued by

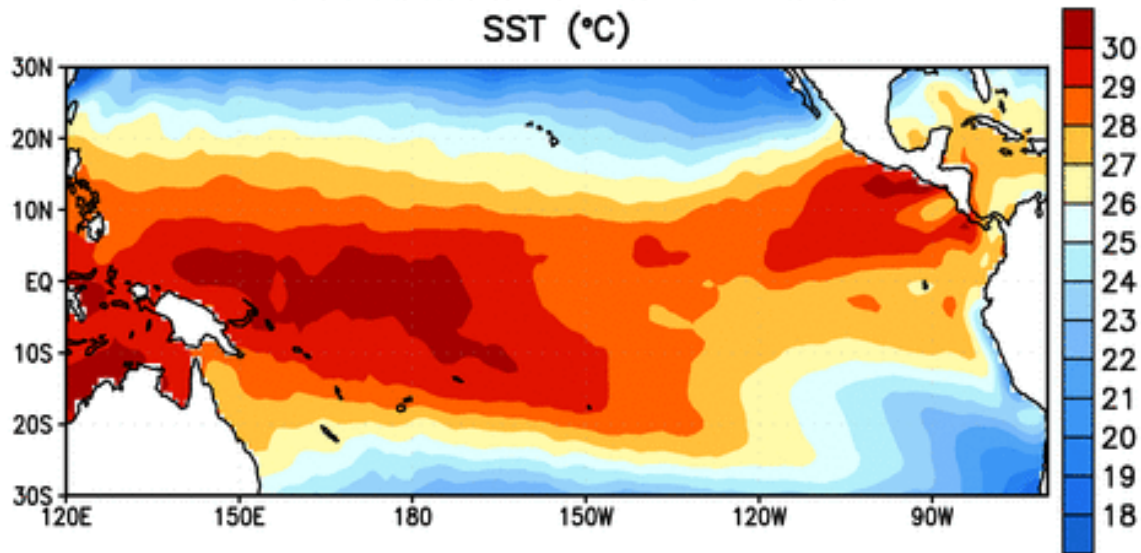
**CLIMATE PREDICTION CENTER/NCEP/NWS
and the International Research Institute for Climate and Society**

11 June 2015

ENSO Alert System Status: **El Niño Advisory**

Synopsis: There is a greater than 90% chance that El Niño will continue through Northern Hemisphere fall 2015, and around an 85% chance it will last through the 2015-16 winter.

Week centered on 15 APR 2015
SST (°C)





**MARIN MUNICIPAL
WATER DISTRICT**

“The best time to plant a tree was 20
years ago. The next best time is now.”
—Chinese proverb

Dan Carney (415) 945-1522 dcarney@marinwater.org

Questions?