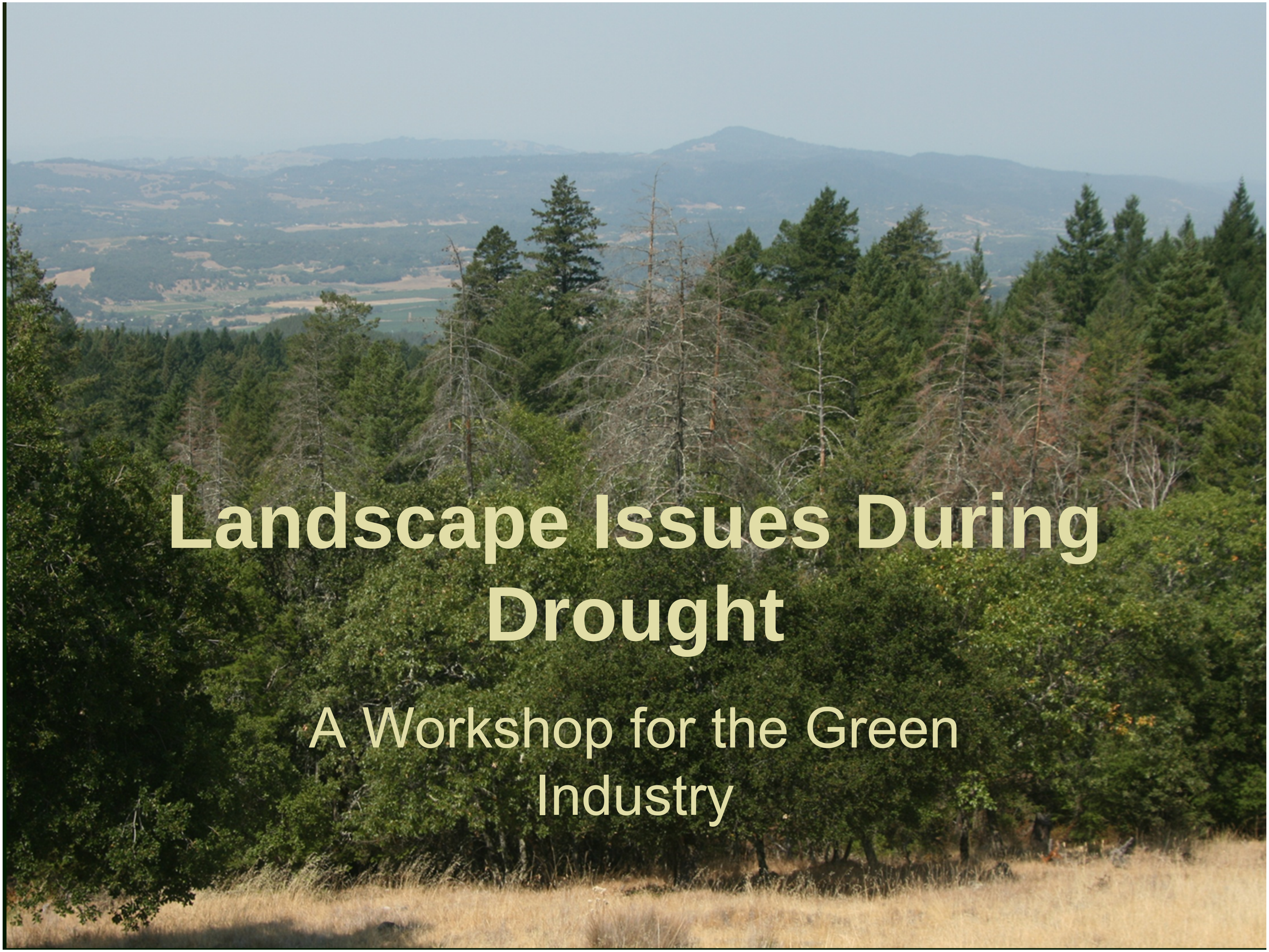


Landscape Issues During Drought

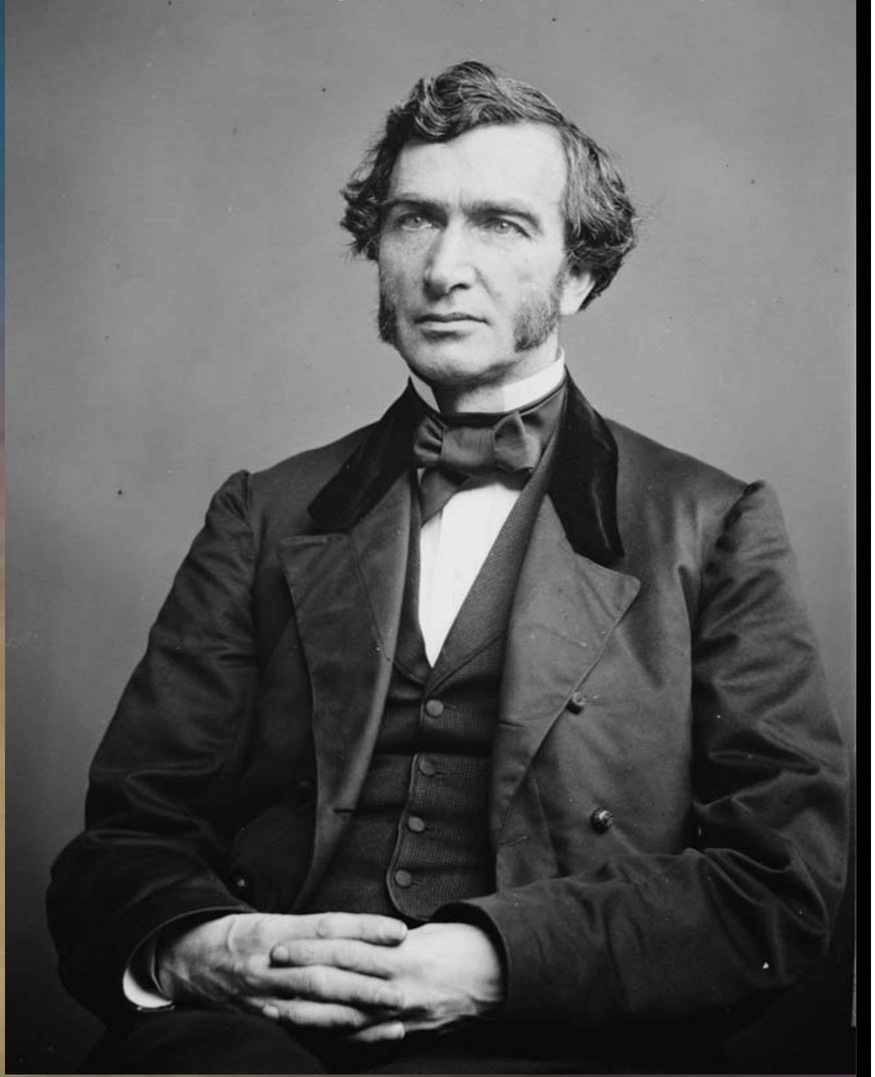
A Workshop for the Green Industry

The Morrill Act of 1862

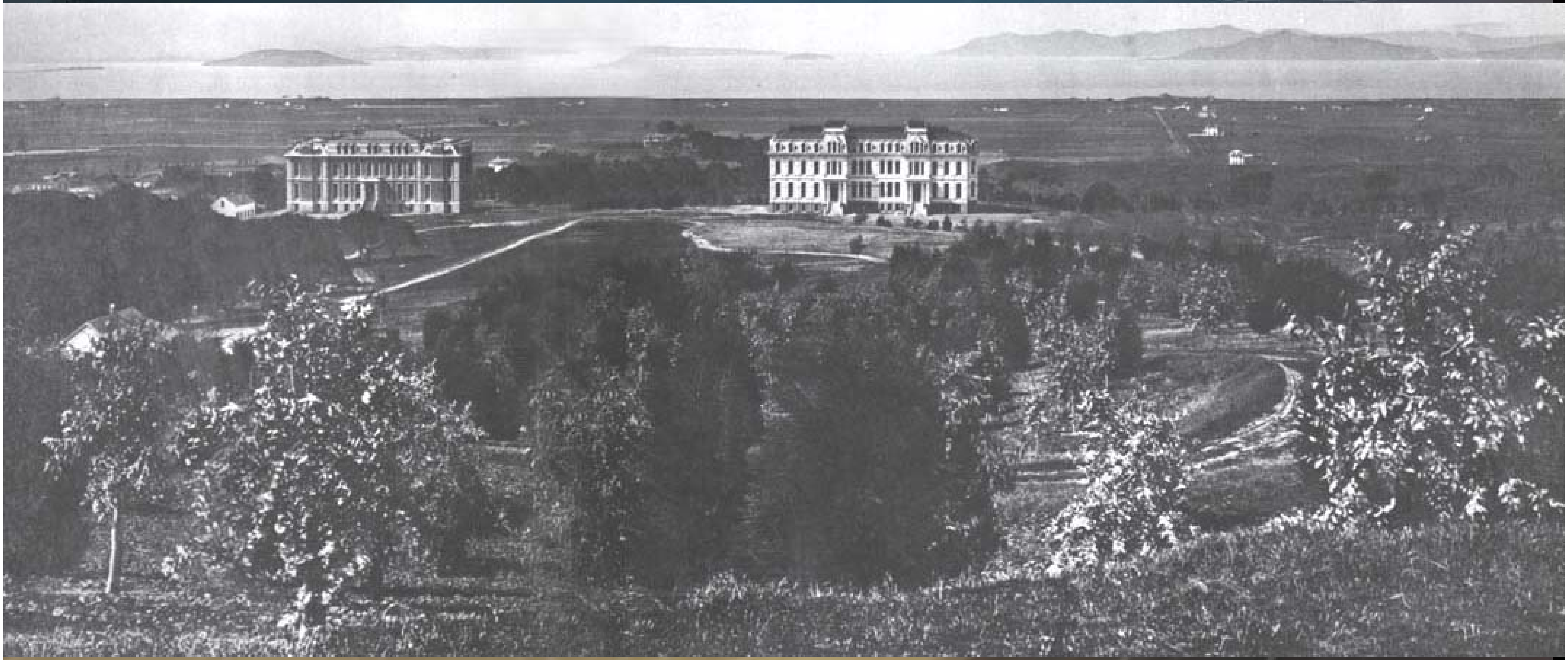
The Morrill Act , as passed by Congress and signed by President Lincoln on July 2, 1862, was intended for:

"... the endowment, support, and maintenance of at least one college [in each state] where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life."

Justin Morrill as photographed by Matthew Brady ca. 1865



"I would have learning more widely disseminated"



California founded its Land Grant University in the city of Berkeley in 1868

The Smith-Lever Act of 1914

In May 1914 the Smith-Lever Act established the system of cooperative extension services "in order to aid in diffusing among the people of the United States useful and practical information on subjects relating to agriculture and home economics, and to encourage the application of the same."

It was mandated that the cooperative extension services be located with the college in each state receiving benefits of the Morrill Act, and that "agricultural extension work shall be carried on in cooperation with the United States Department of Agriculture."

Senator Hoke Smith
(Georgia), ca. 1912


AGRICULTURAL EXTENSION SERVICE
U.S.
DEPT. OF AGR.
MARIN COUNTY
UNIV. OF
CALIFORNIA


CAUTION


May 8, 2014
Everyone is a scientist
Visit:
Beascientist.ucanr.edu
100
UC Cooperative Extension
University of California
Division of Agriculture and Natural Resources
On May 8, 2014, be a scientist for a day. Create a buzz. Get outside, record your observations, share your pictures, and tell us what's happening in your community.

On May 8, 2014 join the University of California in a one-day science project and tell us what you see and do. Your answers will help build a healthier future for you and your community.

UC Cooperative Extension
University of California
Division of Agriculture and Natural Resources

Pollinators

Food depends on pollinators. For three minutes count how many you see.

Water

In this record drought, UC has committed to reducing its water consumption by 20%. How are you conserving?

Food

Where is food grown in your community? Fill out our California food map.

How to participate

Visit **beascientist.ucanr.edu** to learn more about these projects and record your observations.

Drought effects on tree biology and management

Igor Lacan
ilacan@ucanr.edu

UC CE
University of California
Agriculture and Natural Resources
Cooperative Extension


Drought & trees:
ubiquitous & potentially damaging condition
Water and plants
review of the basics
How trees die from drought
& how to prevent it
The soil and roots show
how to keep it going…
Discussion

Drought:
no magic solutions

Drought points:

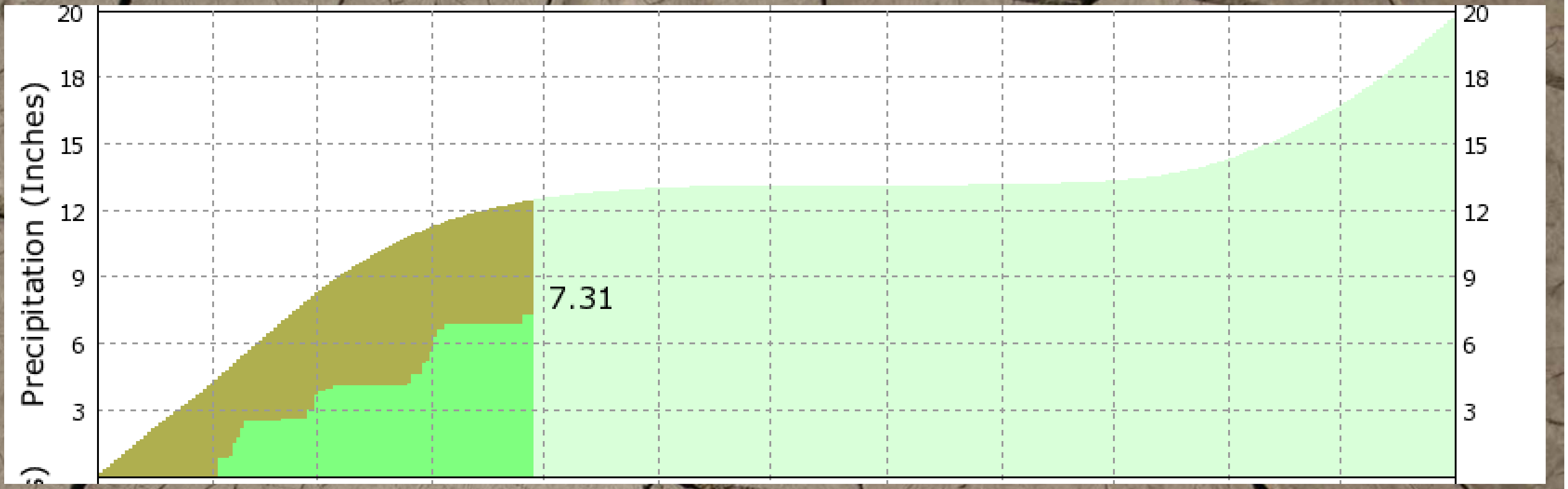
1) understand what is happening inside trees

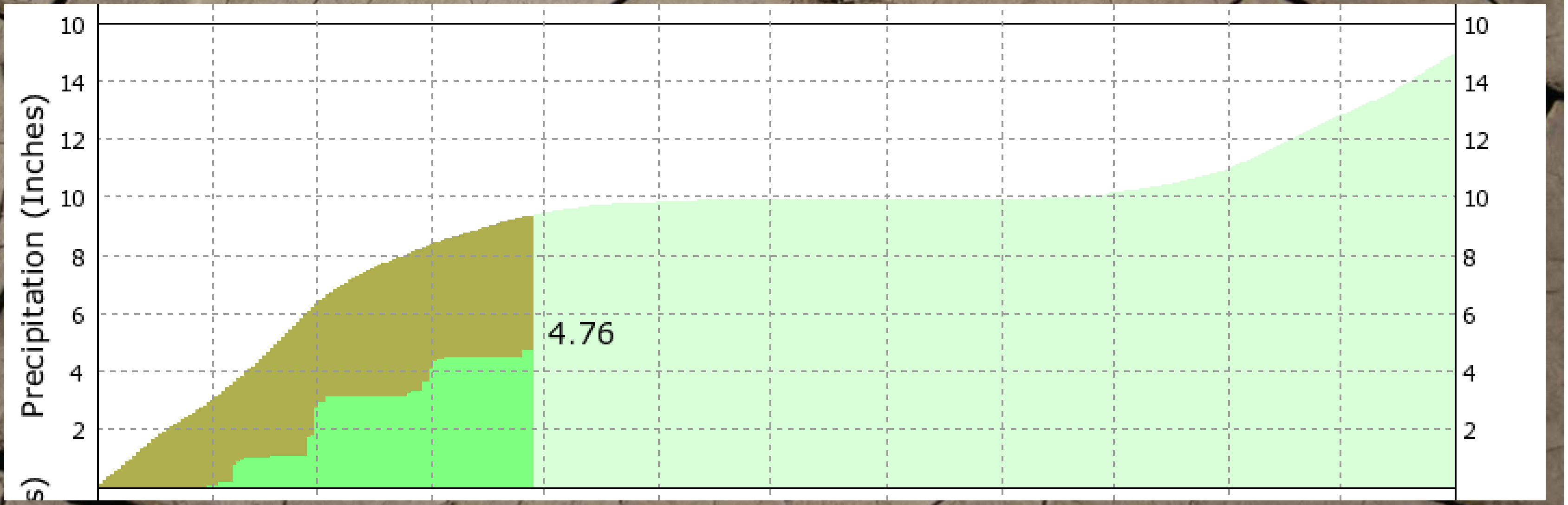
→ **Do not make things worse**

2) Understand your water demand, availability, soils

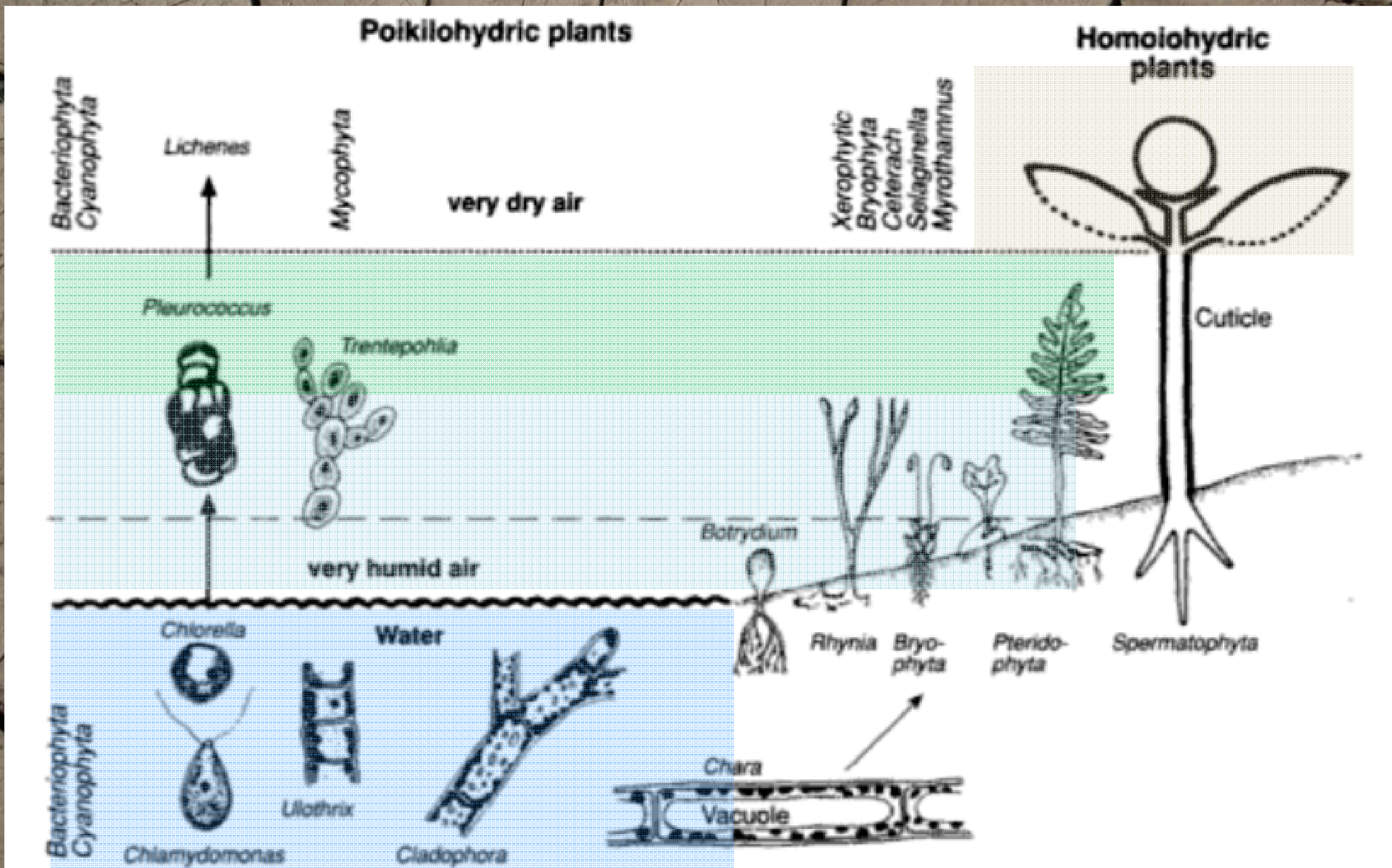
→ **Then adapt landscapes to drought**

Drought… (www.weather.gov)





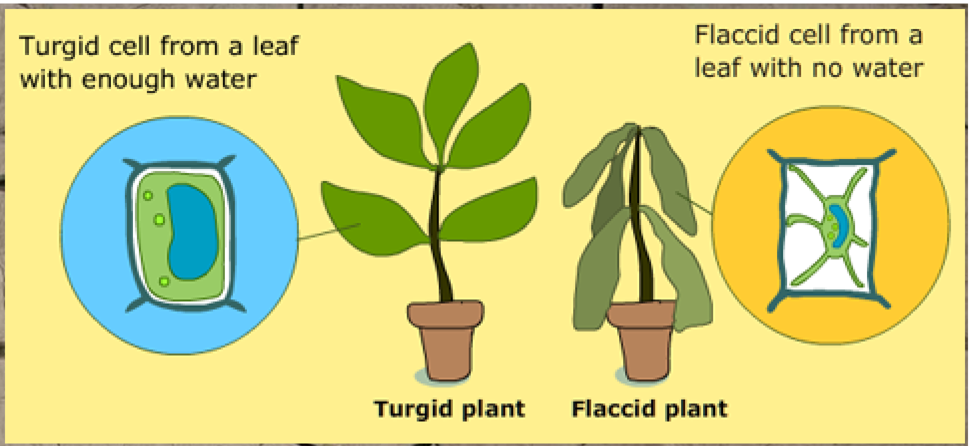
Some plants cannot die from drought…

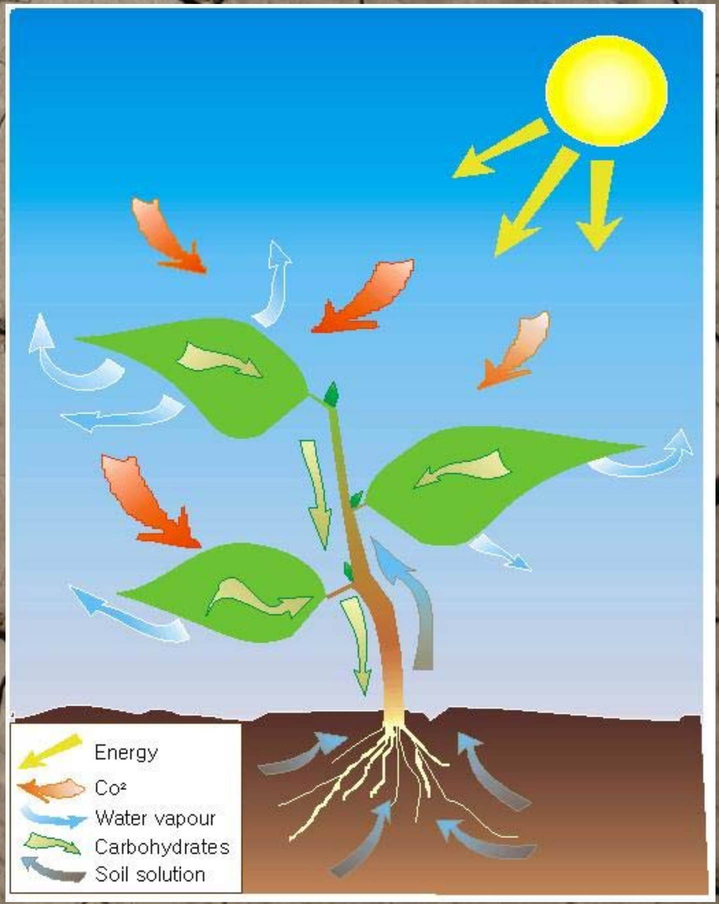


Plants need water… but why?

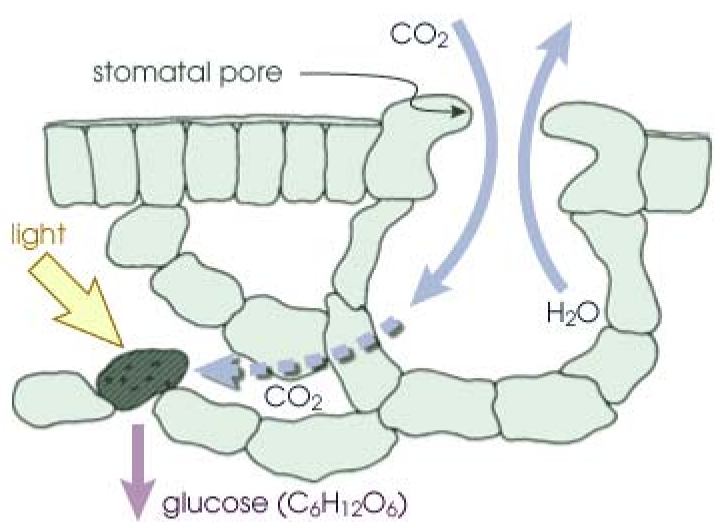
Some uses of water:

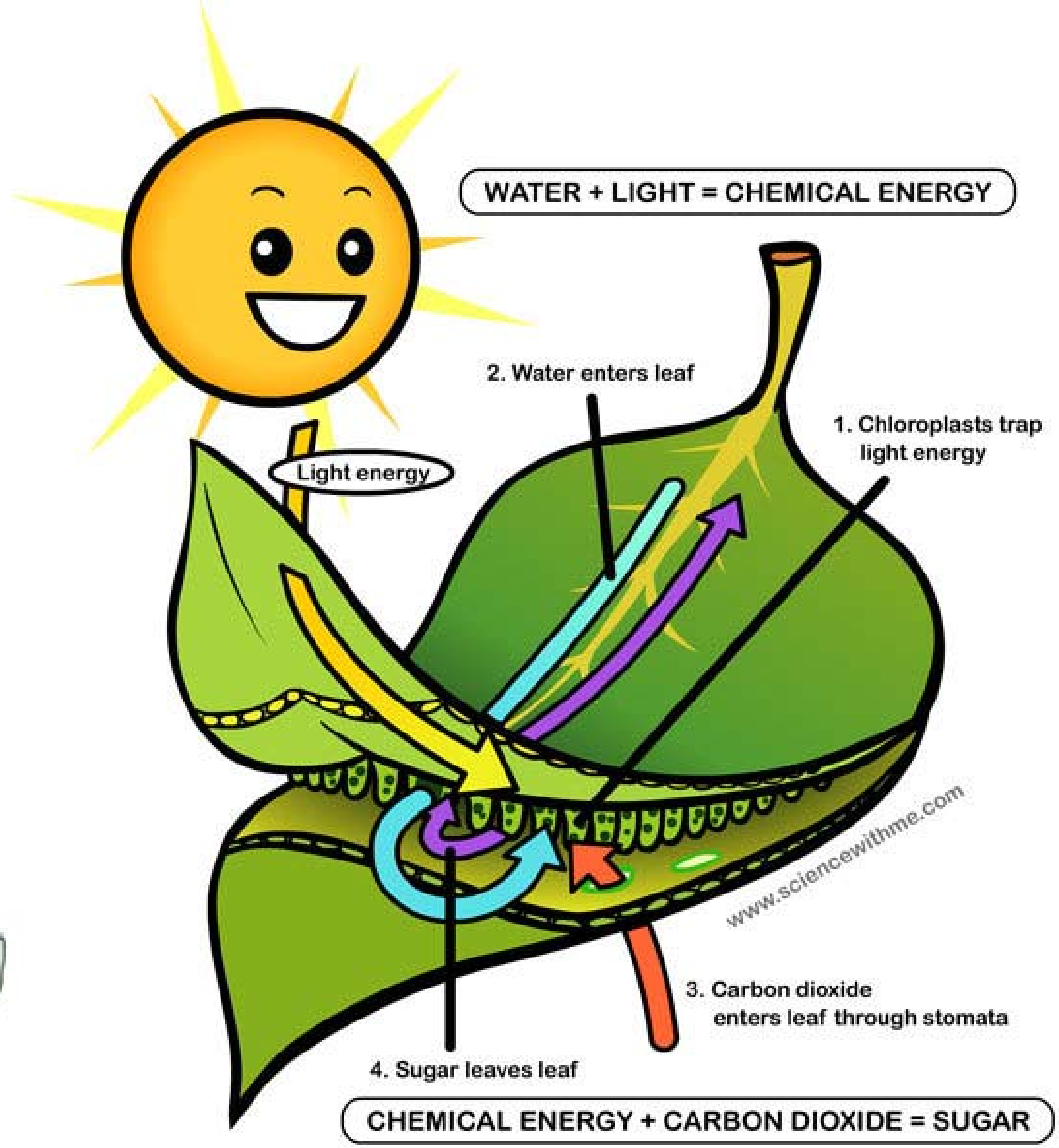
1) Turgor
2) Transport of solutes
3) Photosynthesis



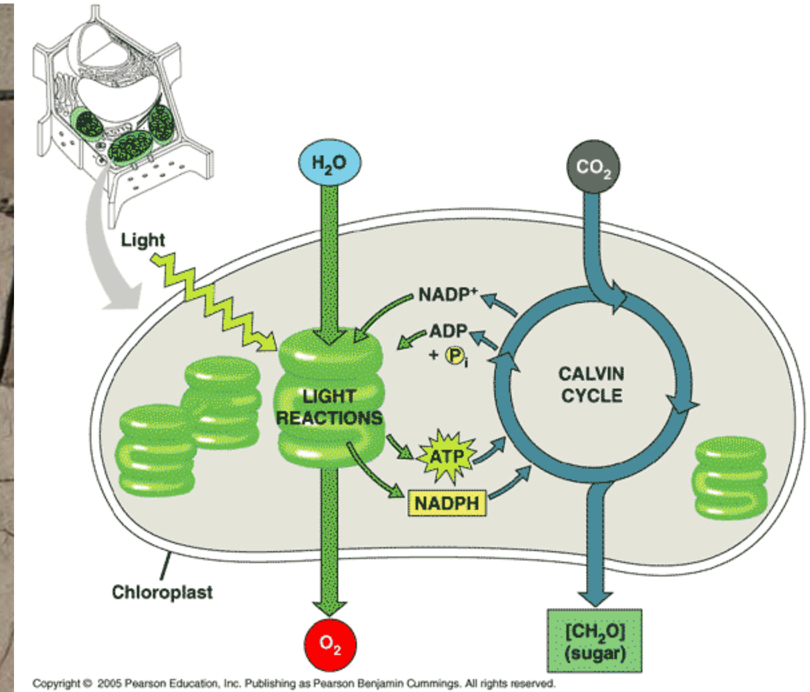


Photosynthesis I: CO_2 in, water out





Photosynthesis 2: plants use water to make food



$$6CO_2 + 12\ H_2O \xrightarrow[\text{plant enzymes}]{\text{LIGHT}} C_6H_{12}O_6 + 6O_2 + 6H_2O$$

six molecules of carbon dioxide

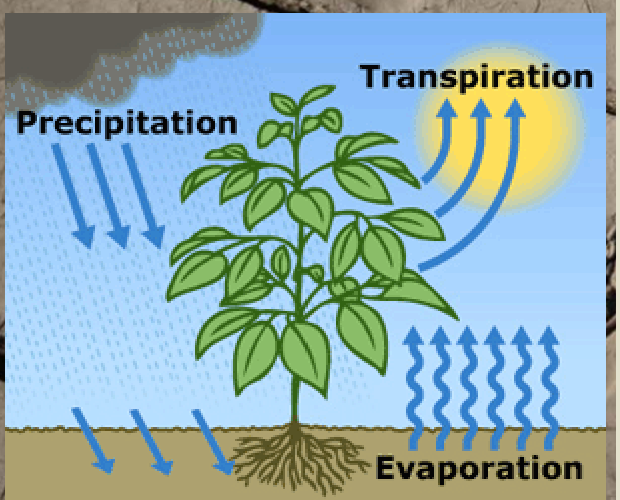
twelve molecules of water

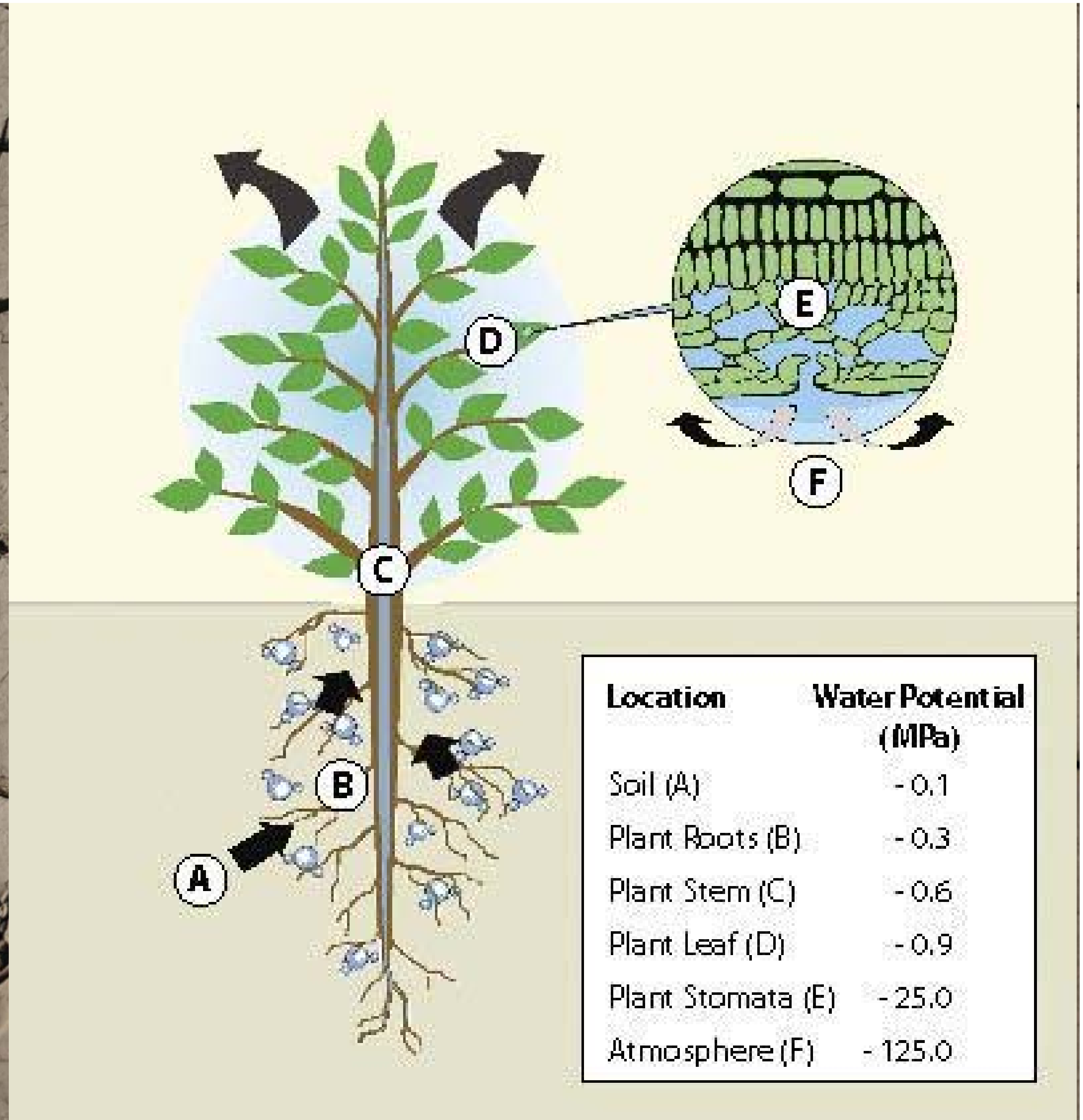
one molecule of glucose (plant biomass)

six molecules of oxygen

six molecules of water

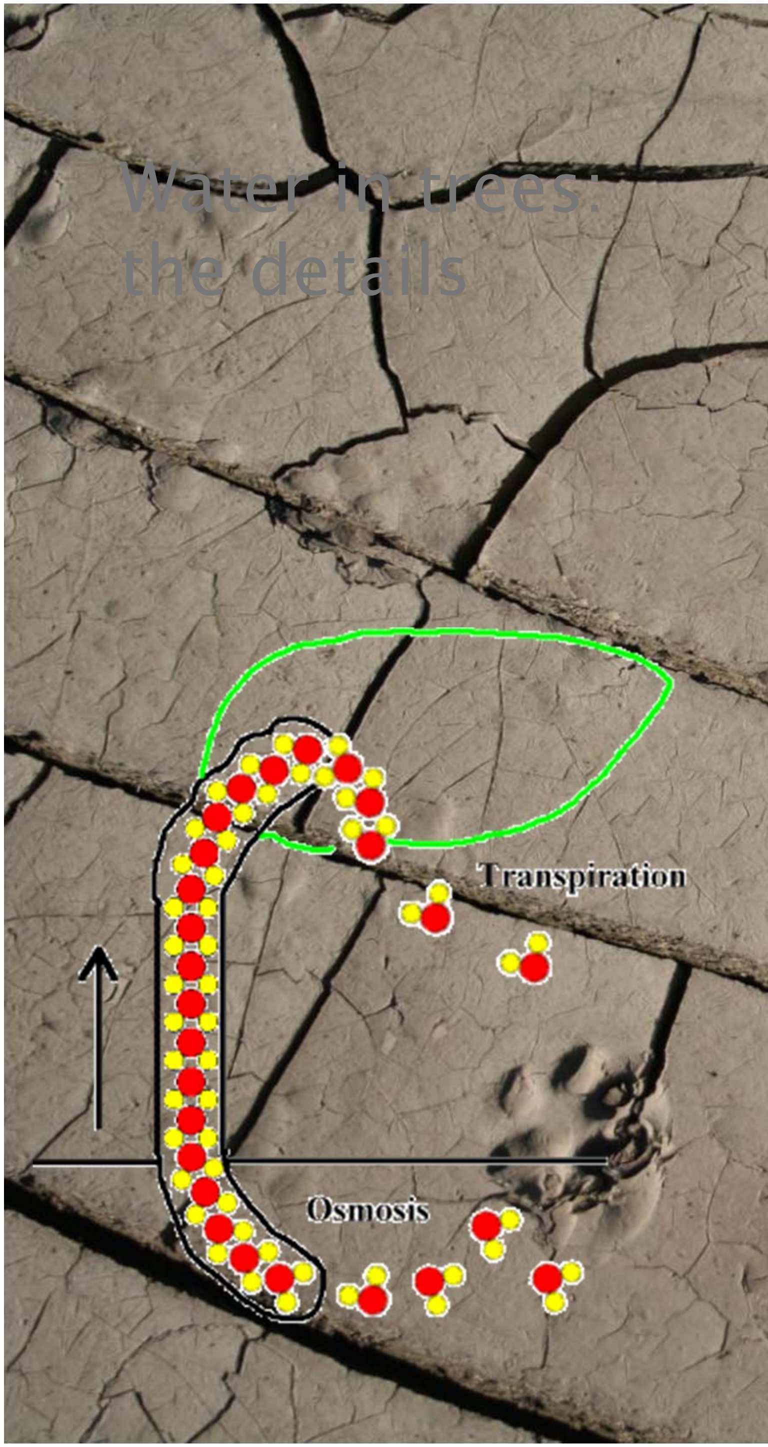
Water in trees: pulled through by evaporation





Location	Water Potential (MPa)
Soil (A)	- 0.1
Plant Roots (B)	- 0.3
Plant Stem (C)	- 0.6
Plant Leaf (D)	- 0.9
Plant Stomata (E)	- 25.0
Atmosphere (F)	- 125.0

Water in trees: the details



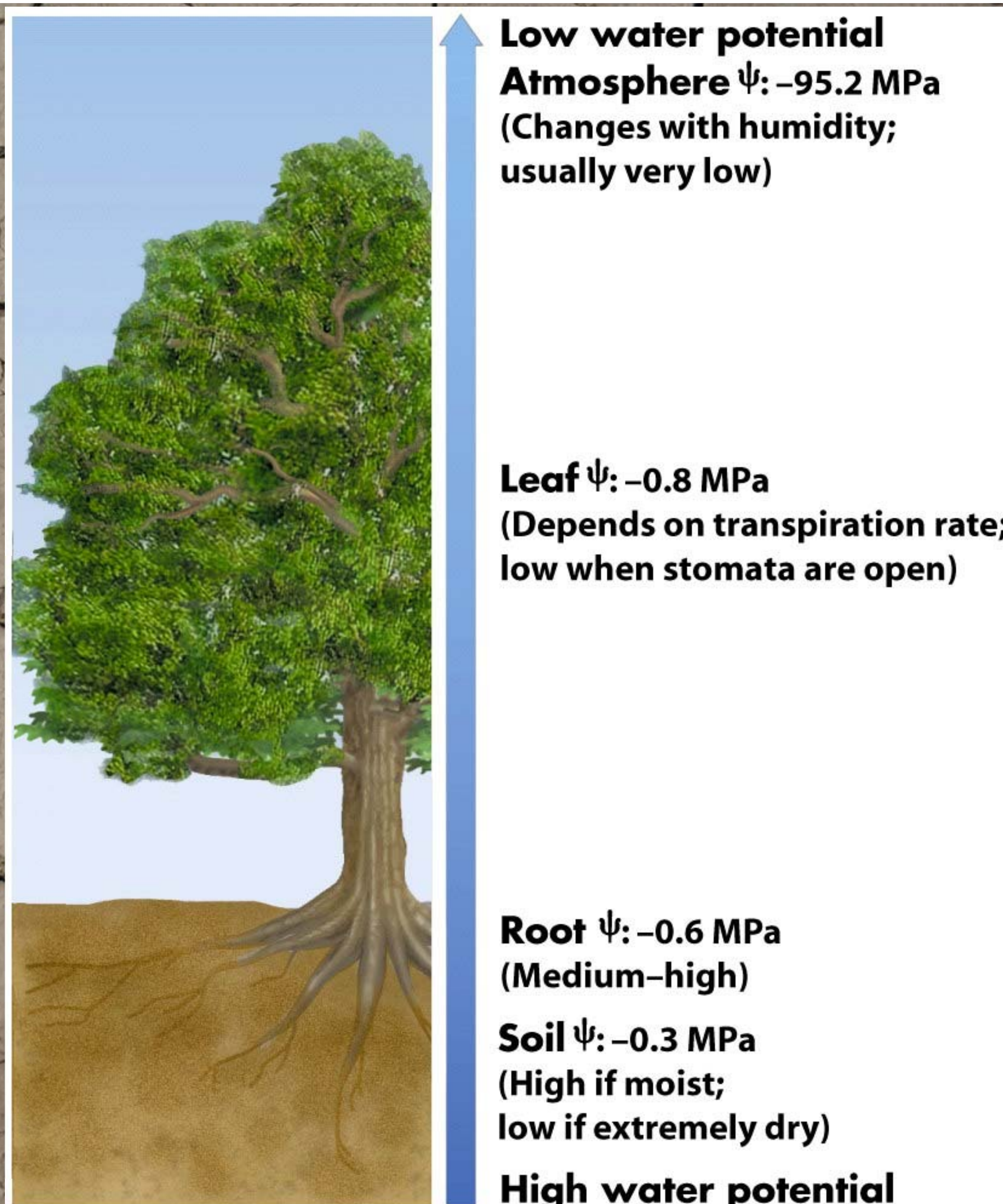
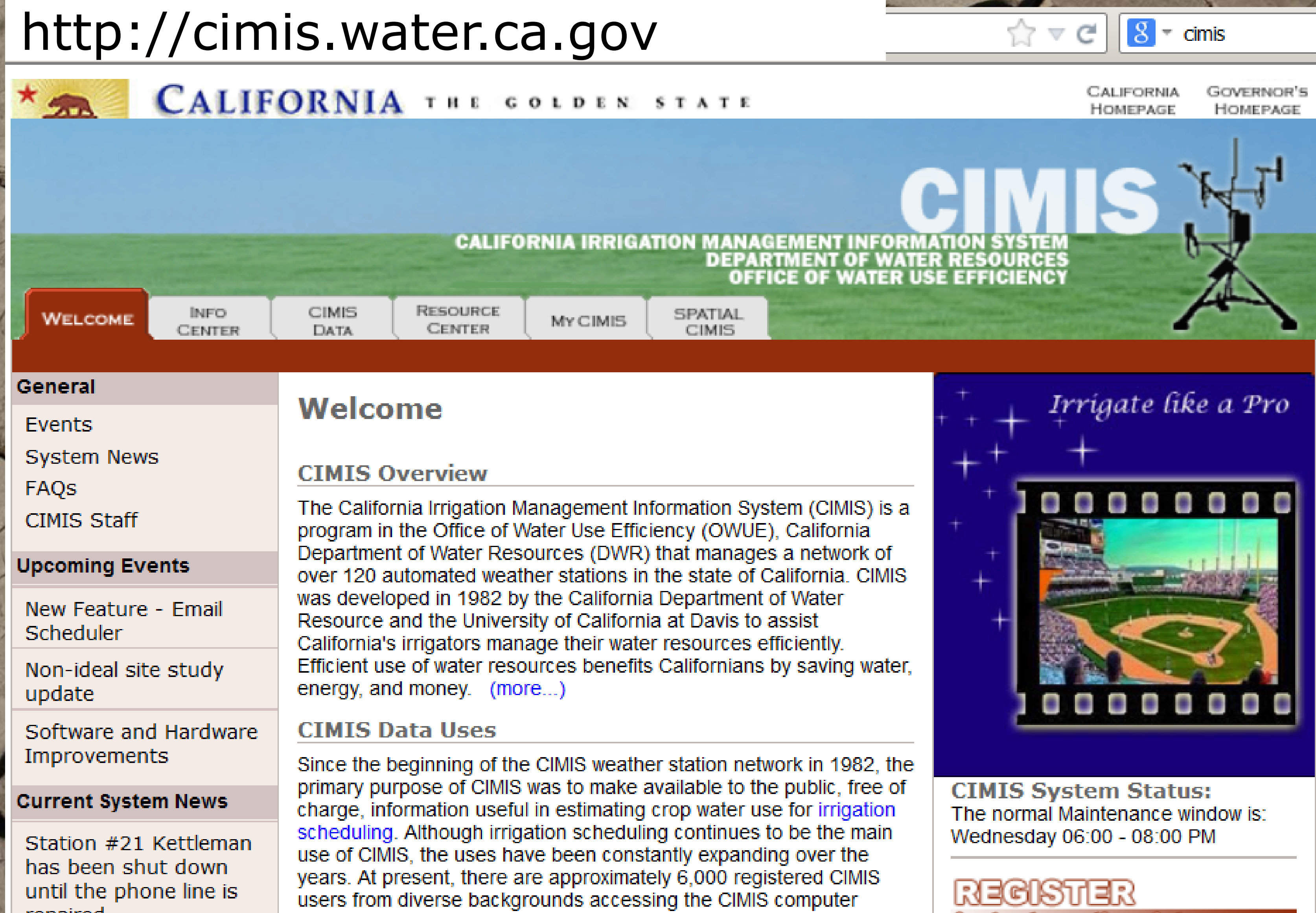


Figure 36-3 Biological Science, 2/e

How much water do we evaporate? CIMIS knows!

http://cimis.water.ca.gov

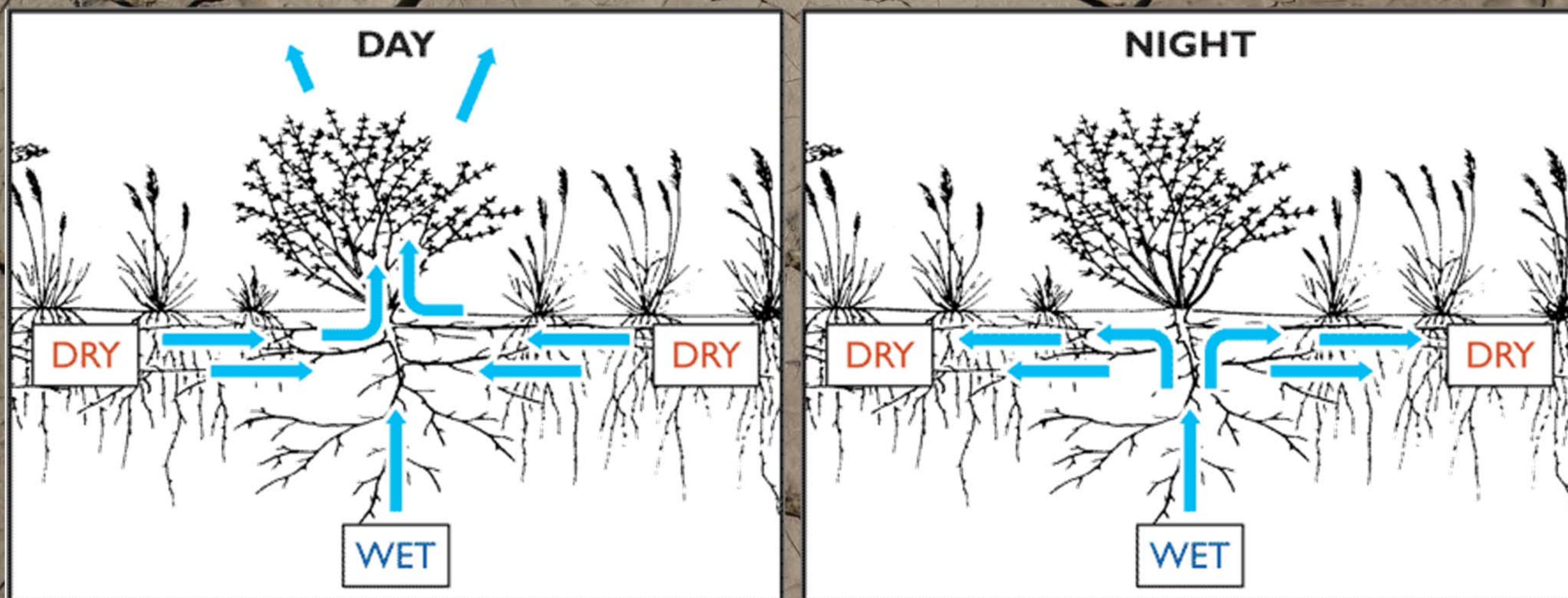


Example: how much water could have been used last week ("reference evapo-transpiration")

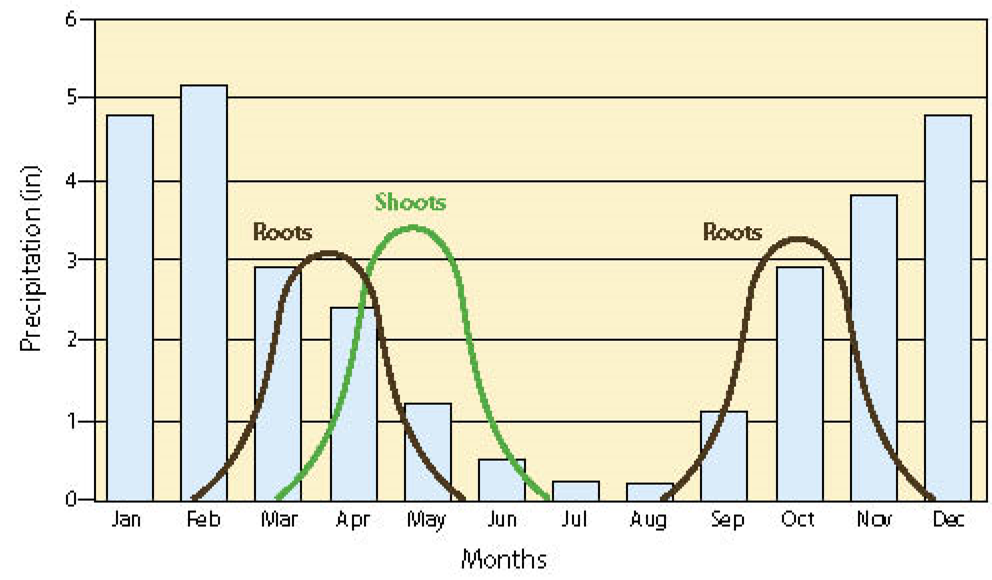
Gilroy - San Francisco Bay - Station 211

Date	CIMIS ETo (in)	Precip (in)	Sol Rad (Ly/day)	Avg Vap (mBars)	Max Air Temp (°F)	Min Air Temp (°F)	Avg Air Temp (°F)	Max Rel Hum (%)	Min Rel Hum (%)	Avg Rel Hum (%)	Dew Pt (°F)	Avg wSpd (MPH)	Wnd Run (miles)	Avg Soil Temp (°F)
04/01/2014	0.07	0.74	274	9.3	58.3	41.8	47.4	96	58	84	42.7	4.6	109.9	56.0
04/02/2014	0.15	0.01	529	9.3	63.7	40.2	50.7	99	50	73	42.6	4.2	102.5	56.4
04/03/2014	0.16	0.00	532	8.9	64.4	37.6	51.3	97	44	69	41.6	3.9	93.7	56.7
04/04/2014	0.05	0.24	227	10.5	58.7	43.0	49.8	95	69	86	45.8	3.4	81.9	56.9
04/05/2014	0.19	0.00	546	10.4	68.6	45.5	55.4	95	39	69	45.6	6.9	167.2	57.3
04/06/2014	0.18	0.00	567	11.4	78.5	41.0	59.4	96	38	66	48.0	3.8	90.7	57.9
Tots/Avgs	0.80	0.99	446	10.0	65.4	41.5	52.3	96	50	75	44.4	4.5	107.6	56.9

Hydraulic lift: an opportunity to evaluate the soil water "situation"



Water in trees: What happens during drought?

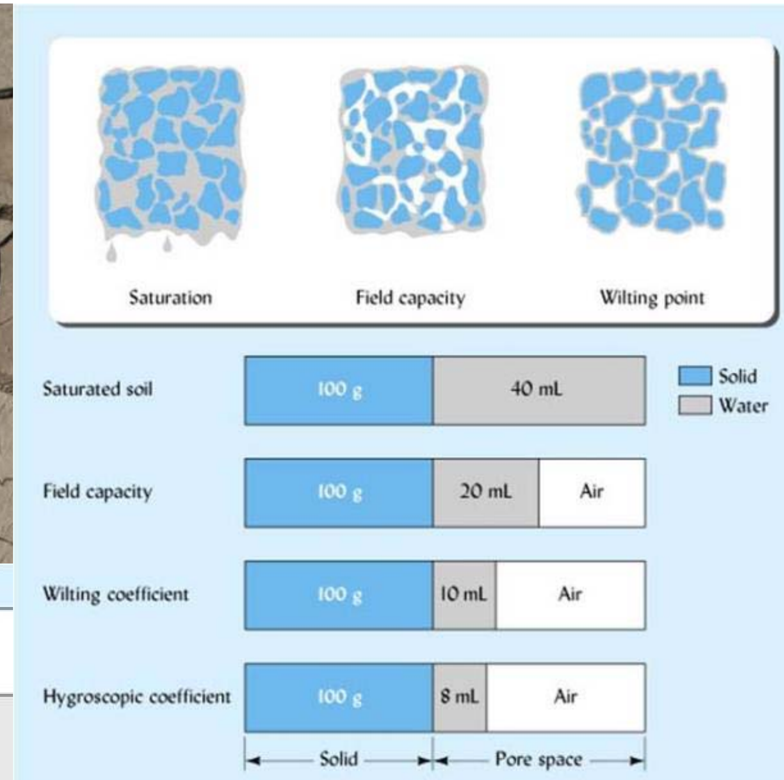


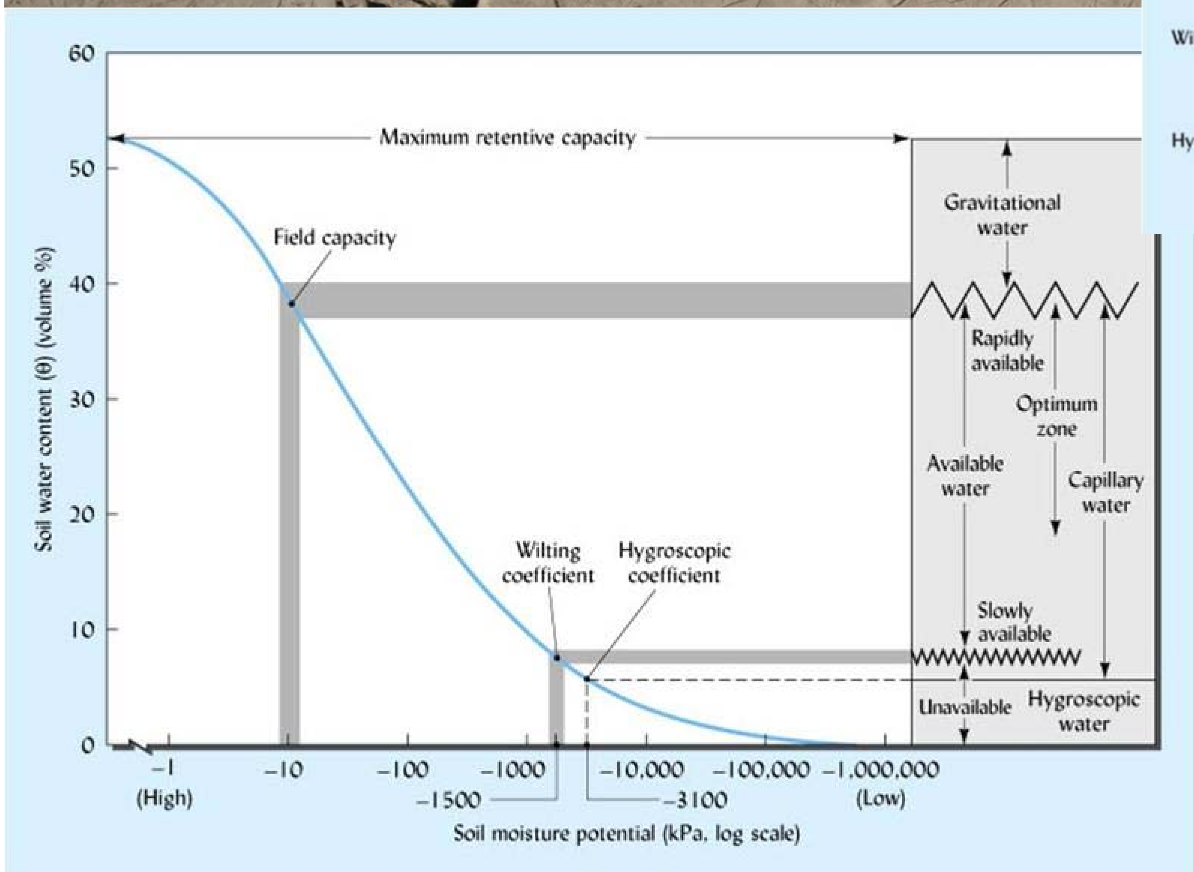
Prof Coder says
that during drought trees:

1. recognize ("sense") soil / root water availability problems.
2. chemically alter (osmotic) cell contents.
3. close stomates for longer periods.
4. increase absorbing root production.
5. Use up food storage reserves.
6. close-off or close-down root activities (suberize roots)
7. initiate foliage, branch and/or root senescence.
8. set-up abscission and compartment lines.
9. seal-off (allow to die) and shed tissues / organs unable to maintain health.

Water stress reduces growth (above and below ground)

The soil-water-roots system

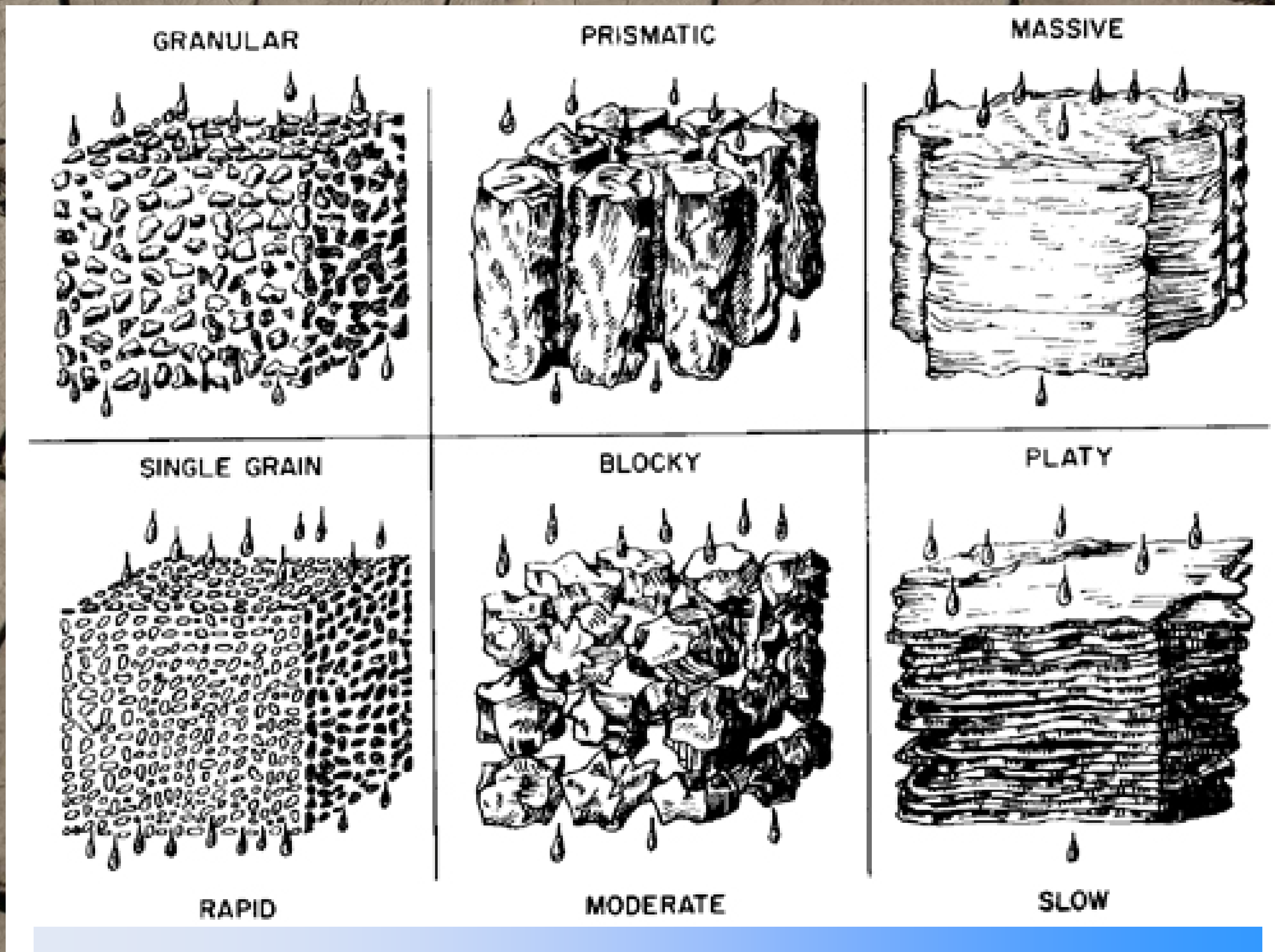




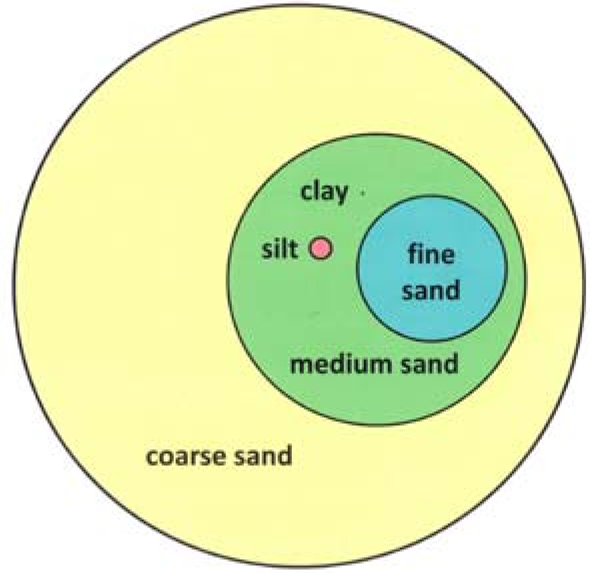
Water movement in soil

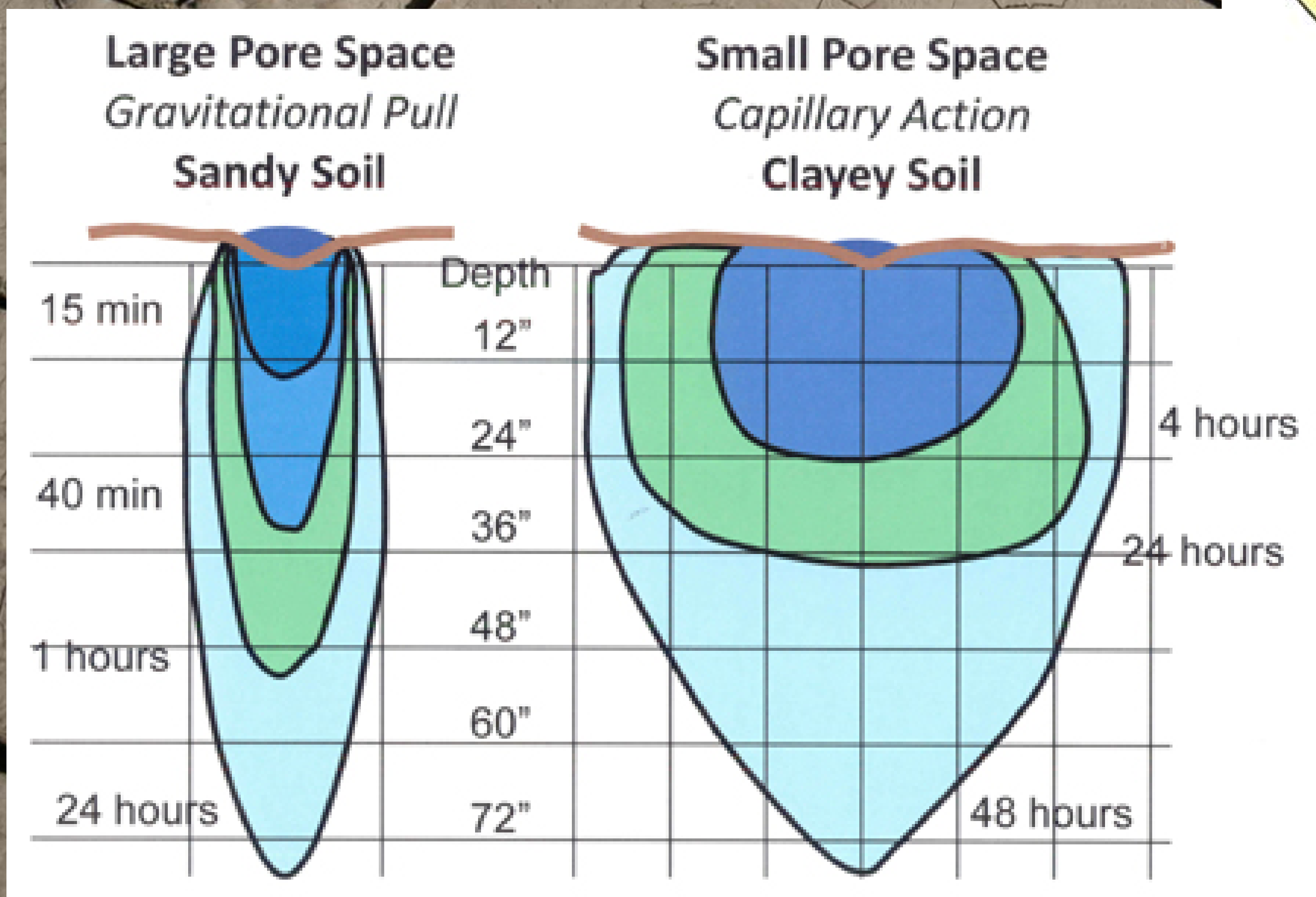
- http://www.youtube.com/watch?v=vmo0FRAVgkM

Water movement in soil 1:
soil structure (*yes we can*!)

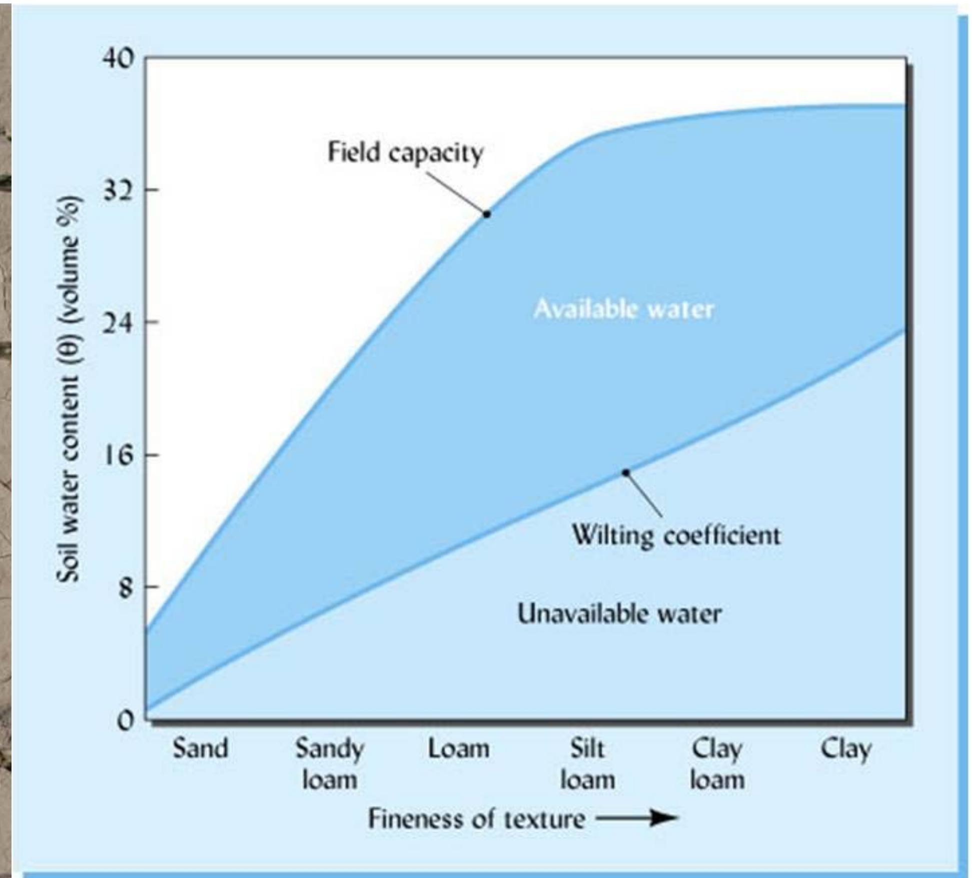


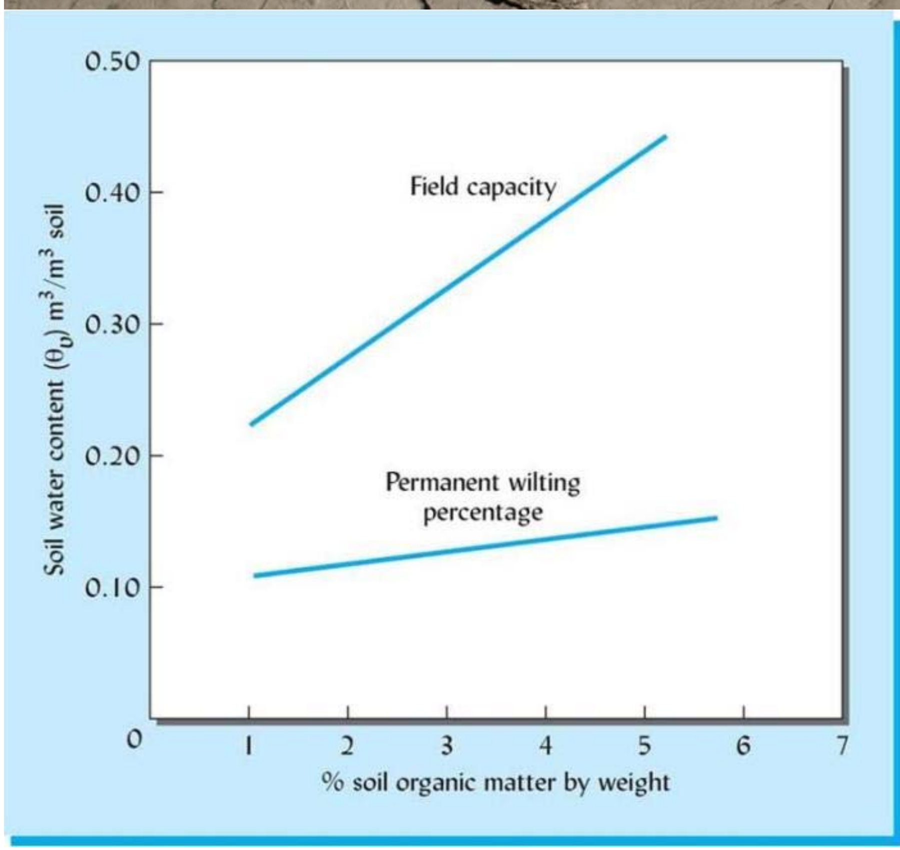
Water movement in soil 2: soil texture



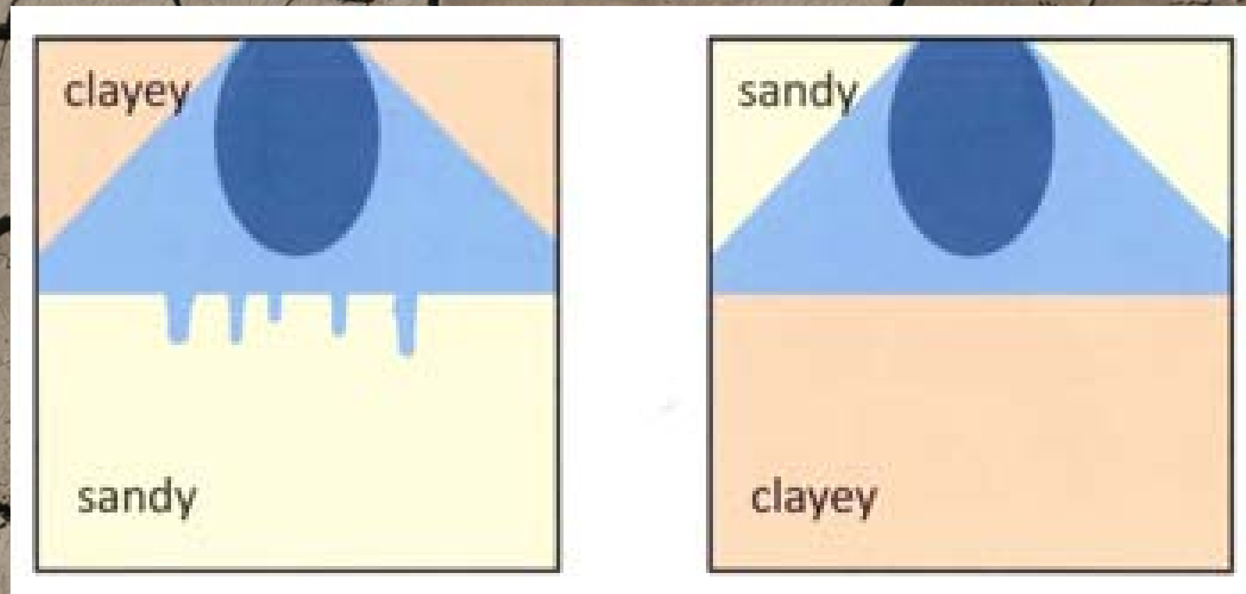


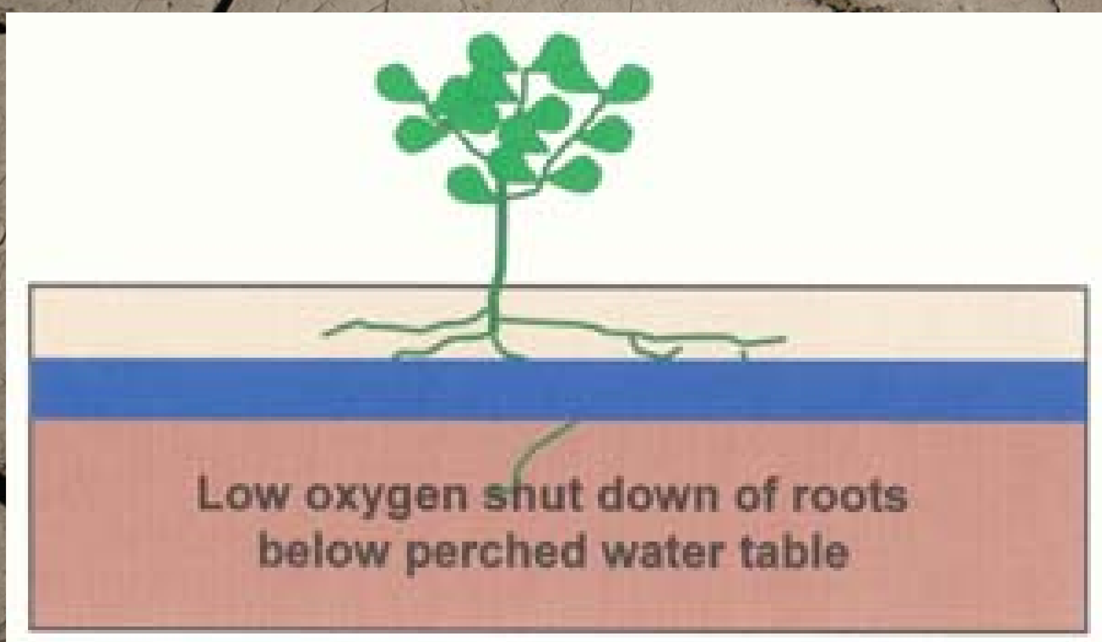
Water-holding capacity varies with soil texture and organic matter



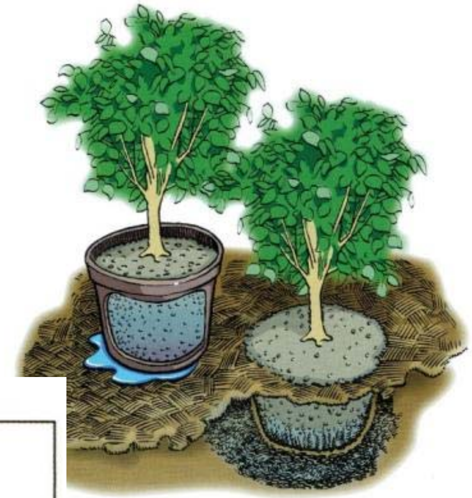


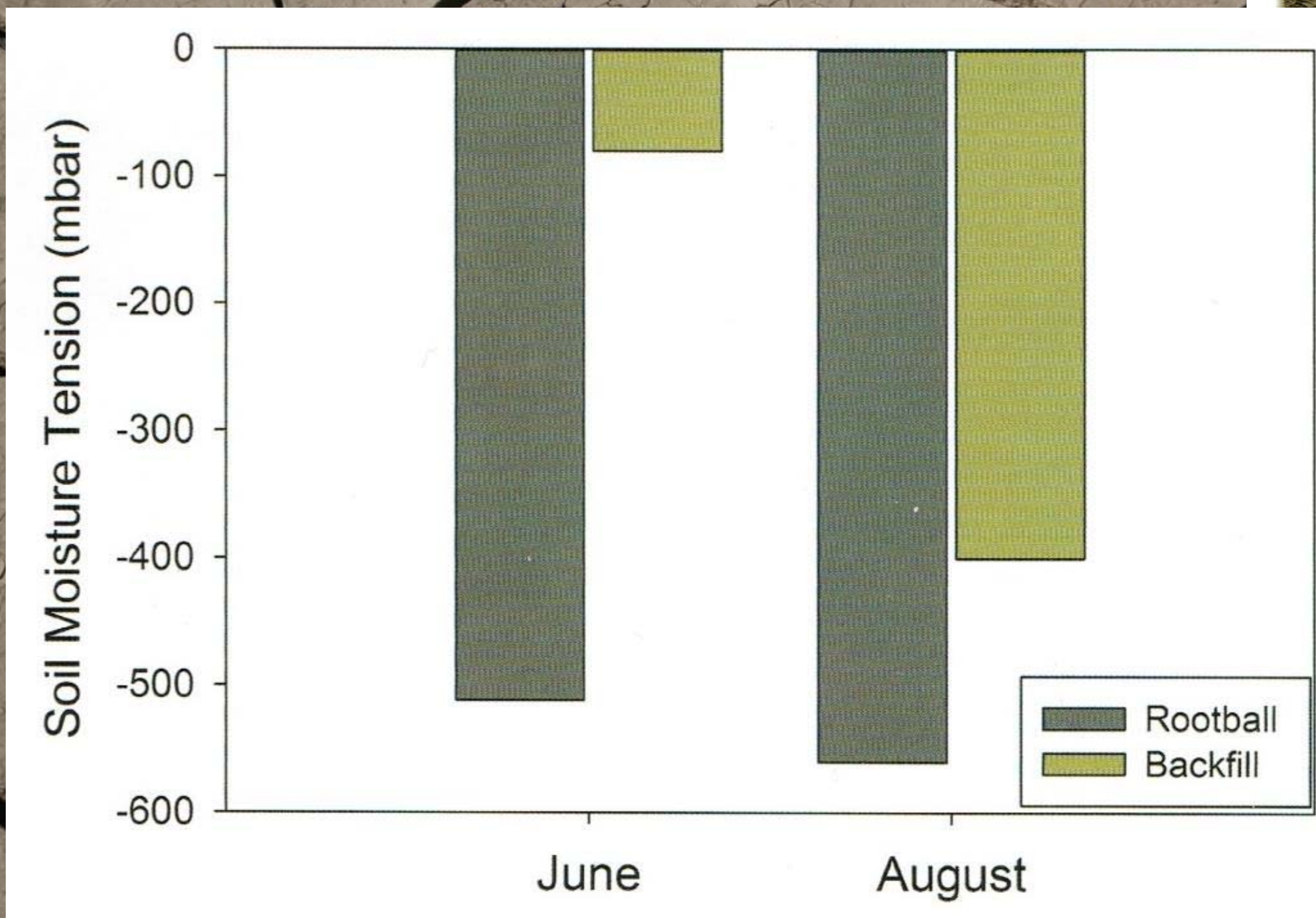
Water movement 3: Watch out for changes in soil texture!





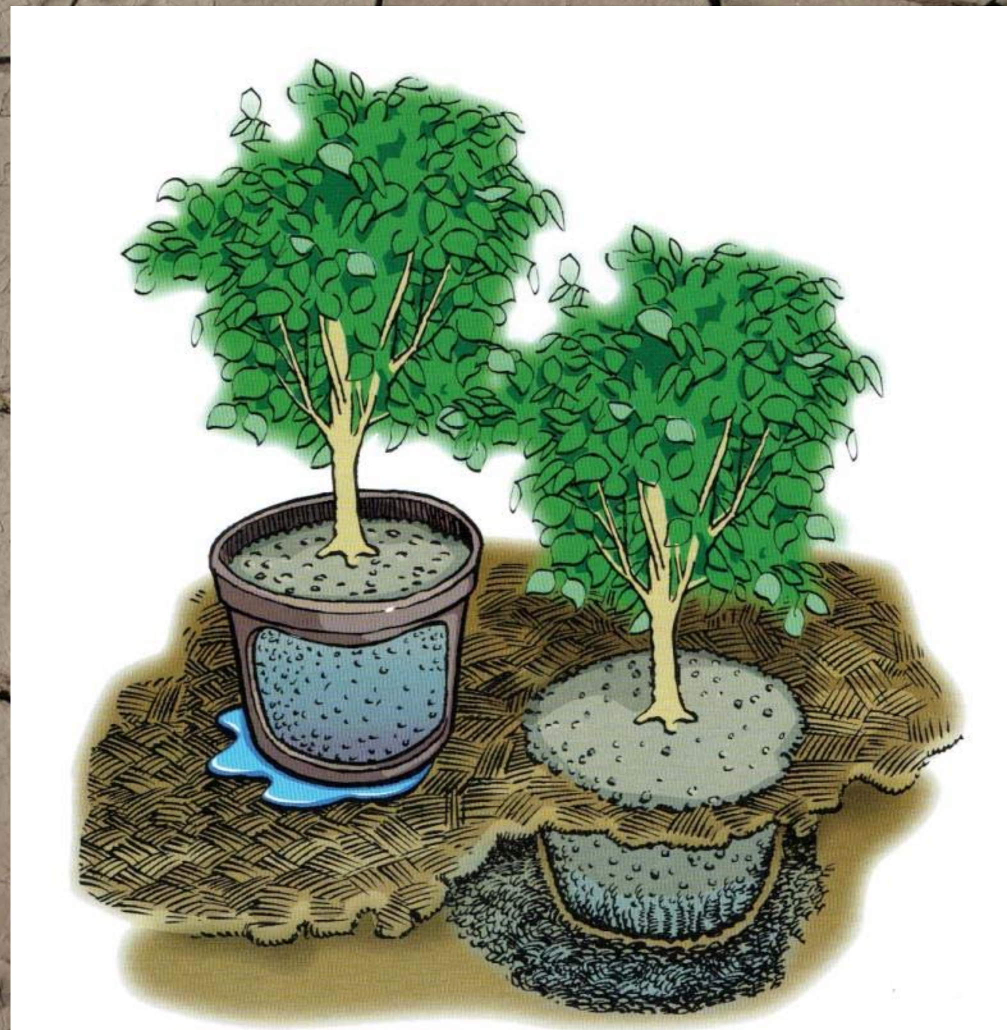
New trees only get water from the root ball soil





Suggestion: Plant a smal(er) tree during drought

Soil texture difference – watch out!

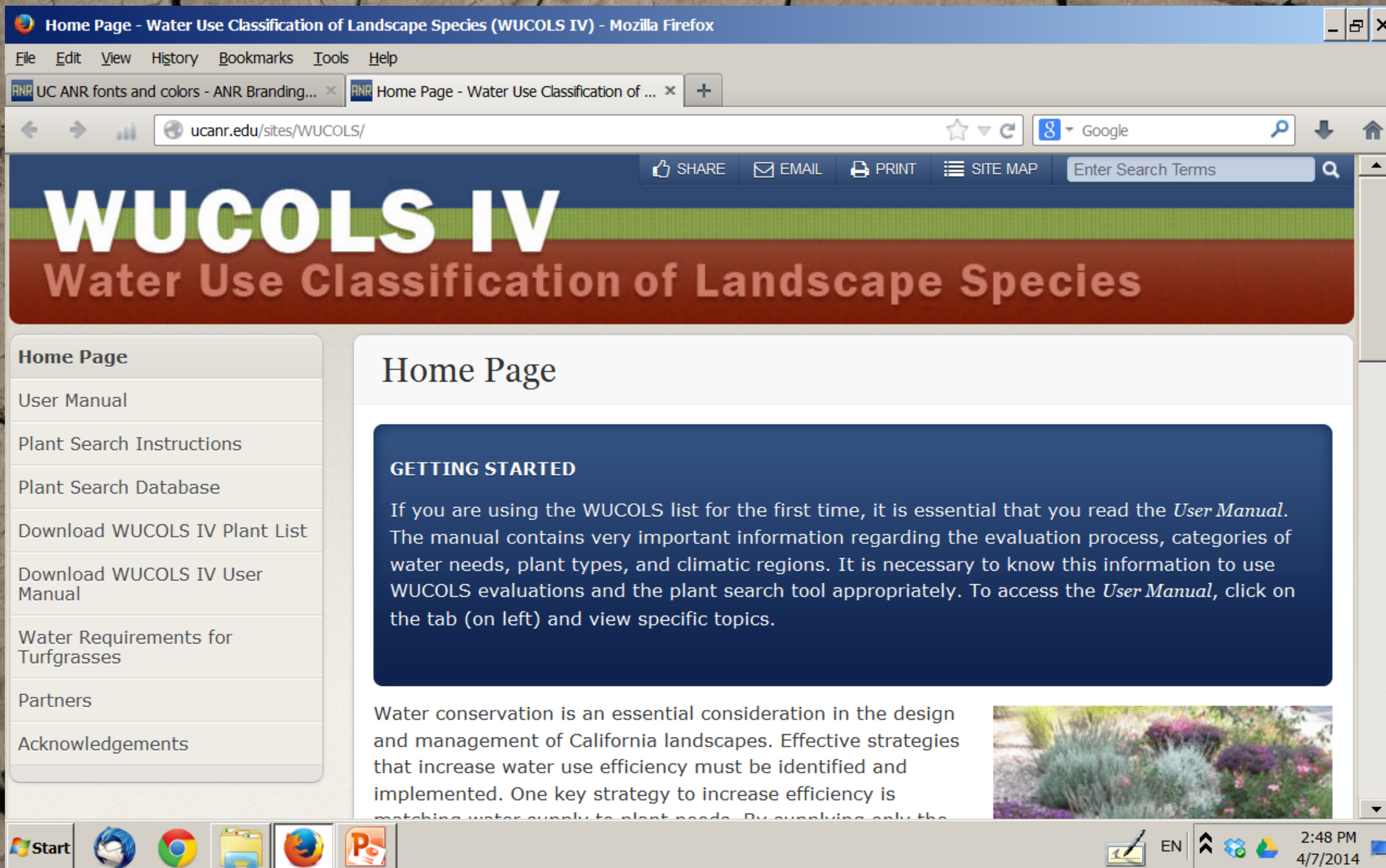


Mulch!

← Tree roots do better under mulch

Mulch pitfalls: volcanoes

How does my tree compare to turf: WUCOLS



WUCOLS categories

CATEGORIES OF WATER NEEDS

Category	Abbreviation	Percentage of ET_0
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.

Participate in tree failure research!

www.WoodDecay.org

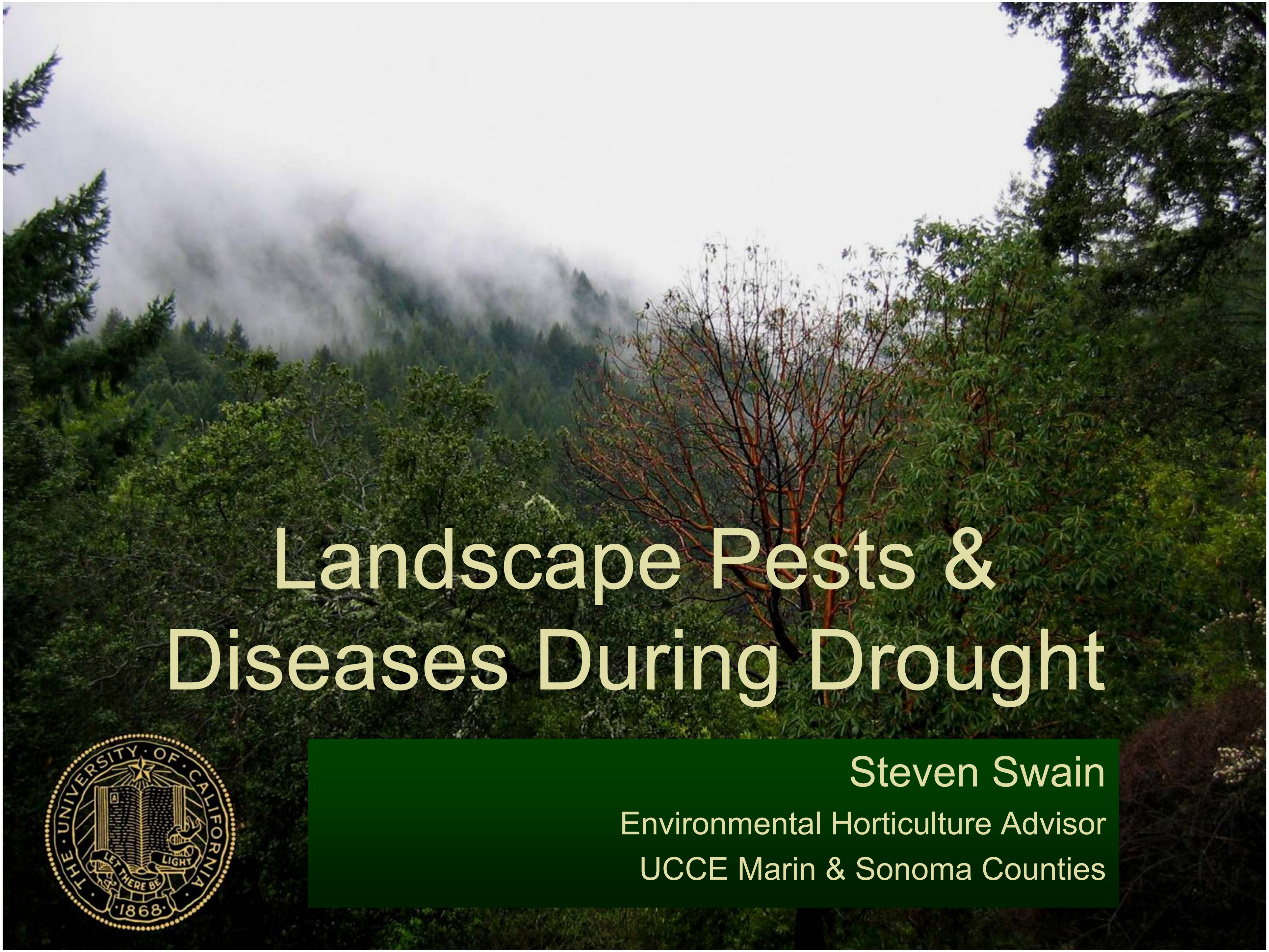
Tree failure?

Have the wood from your failed tree
tested for wood-decay fungi AT NO COST to you!

Mail a small sample to Dr. Garbelotto's lab,
and 6-8 weeks later receive results of the fungal assay,
informing you about the presence (or absence) of wood-decay
fungi in the failed wood.

For more details, contact Igor: ilacan@ucanr.edu


UC
CE
University of California
Agriculture and Natural Resources
Cooperative Extension
ilacan@ucanr.edu
510 684 4323

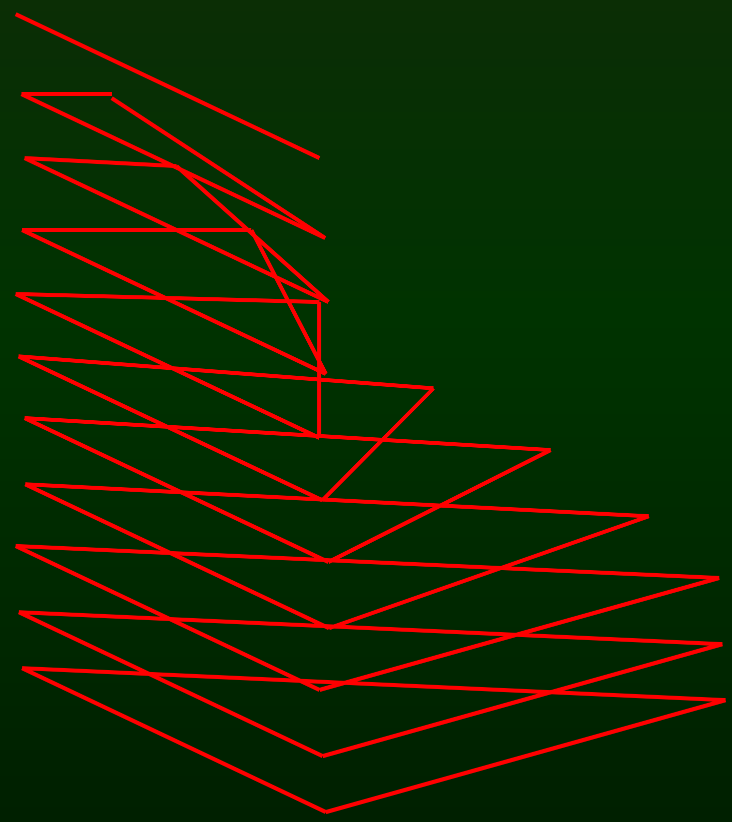


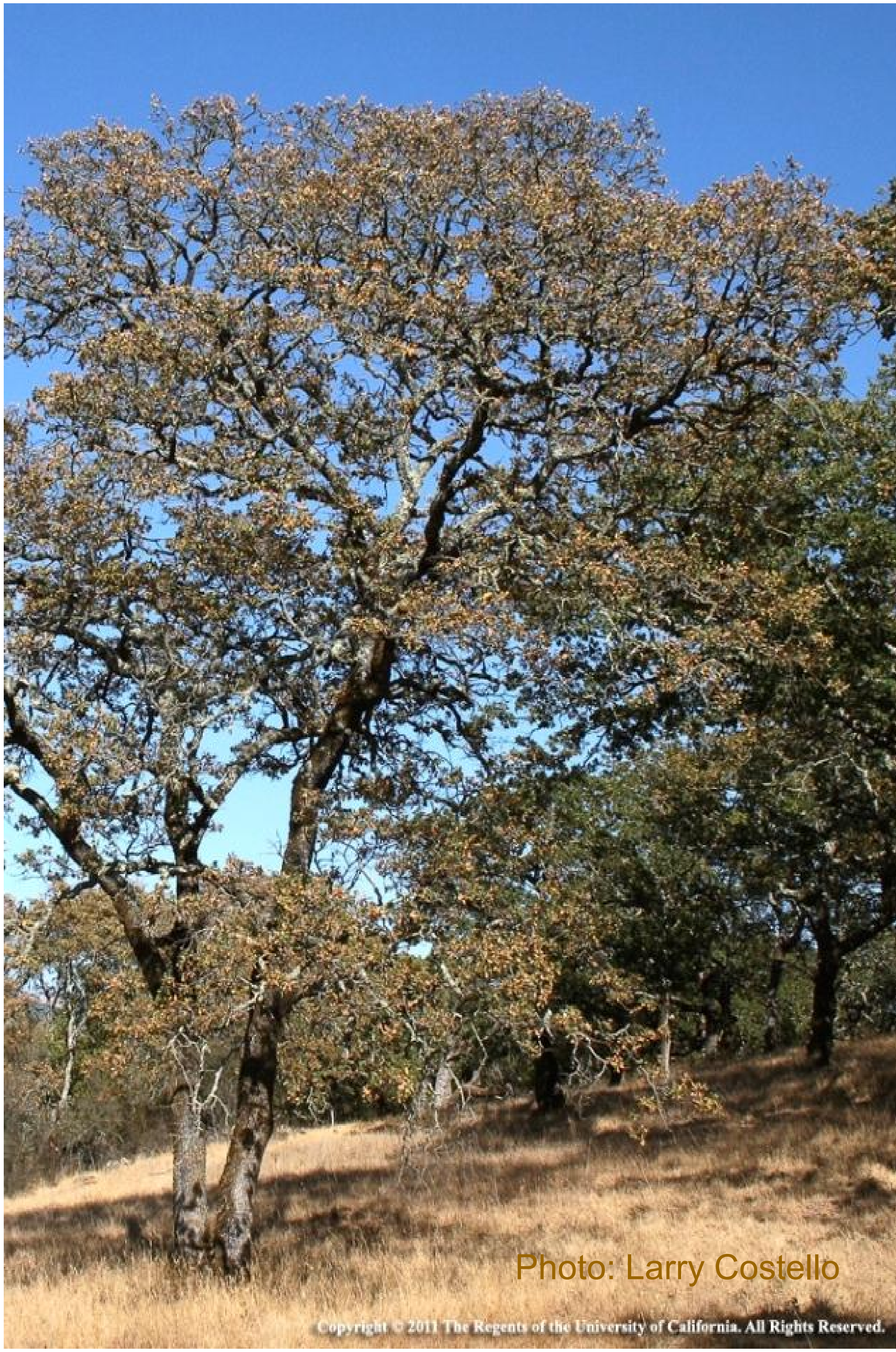
Landscape Pests & Diseases During Drought

Steven Swain
Environmental Horticulture Advisor
UCCE Marin & Sonoma Counties

What do we need to know?

- Environment
  - Weather
  - Site history
- Plant
  - Ecology
- Pest or Pathogen
  - Ecology
- To control the disease, we don't have to control all of these, just one
- This happens over time





Tree biology

- Drought deciduous
  - Blue oak
  - Buckeye
  - Water retention and nutrient storage
- *Not* drought deciduous
  - Evergreens / conifers
- Frost damage
  - Eucalyptus
- Aesthetic damage ≠ biological threat
- A quick tour of drought associated pests & pathogens

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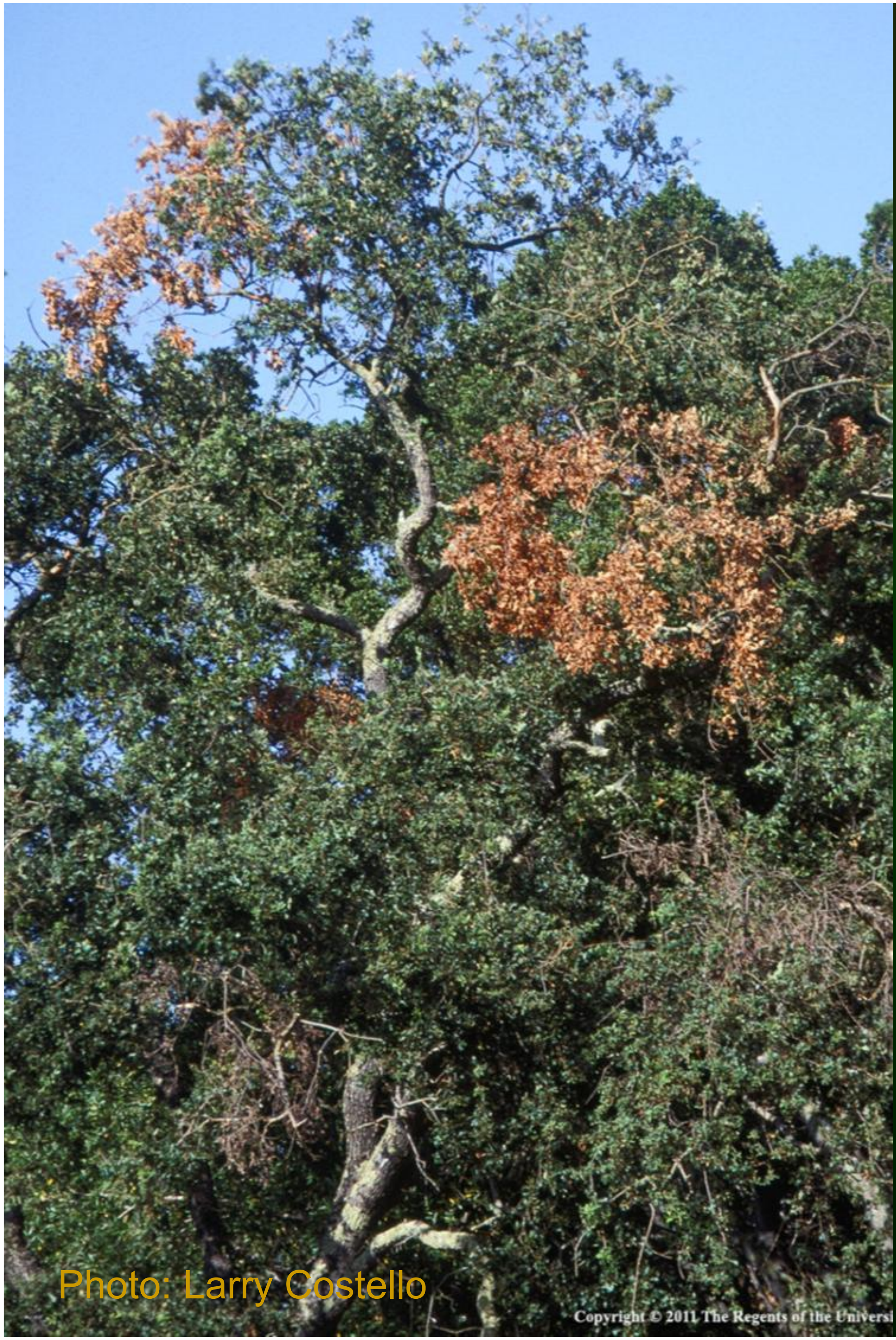
- A quick tour of drought associated pests & pathogens

Pests & Diseases

- Primary pathogens
  - Attack regardless of the state of the tree's health
    - Tend to be exotics
  - Prefer healthy trees
  - Treatment difficult
- Opportunistic pathogens
  - Attack weakened trees
    - Tend to be natives
  - Improve conditions



Botryosphaeria (Diplodia)

- Opportunistic
- Huge host range
  - Oaks (Diplodia)
  - Redwoods, Sequoias, other conifers (Botryosphaeria)
  - Madrone, Manzanitas
  - … and on …
- Improve growing conditions
- Consult UC IPM

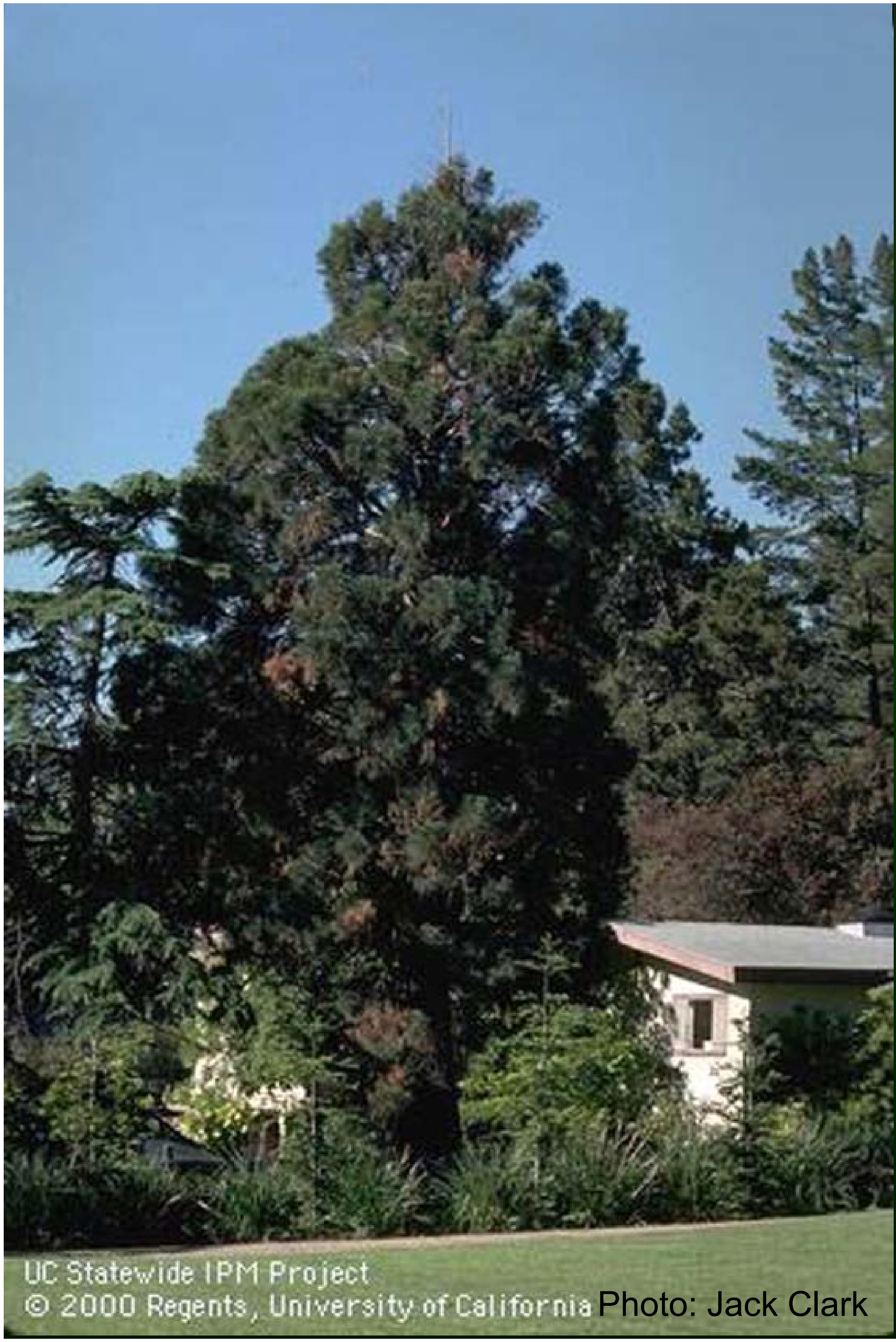


Photo: Jack Clark

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Phytophthora

- Sudden oak death
  - Primary
  - Not much spread in drought
  - Infected oaks and tanoaks tend to die in drought

Phytophthora

- Other species more worrisome
  - e.g., P. cinnamomi
  - Many more being discovered
- Most are soil borne
- All require water to infect
- Thrive in “Drench and Drought” irrigation
  - Know your plants
  - Monitor your soil
  - Let things dry without stressing the plant

Armillaria (oak root rot)

- Opportunist > Primary
- Common in California soils
- Likes:
  - Summer irrigation
    - Consistently warm moist conditions
    - Droughts, hot summers
    - Vineyards
    - Lawns
  - Injured roots
    - Especially larger roots
- Fungicides ineffective

Armillaria

- "Oak Root Rot"
- White mycelia
- Usually bark is soft where disease is advanced
- Smells like fresh mushrooms
  - Often subtle
- Sometimes clumps of tan mushrooms
  - White spores


SPEED
LIMIT
25



Armillaria Management

- Water
  - Timing, amount, and location
  - Let things dry
- Chemical Tx not shown effective
  - Despite labels
- Removal
- Air spade
  - If caught early enough

Verticillium

- Soil borne wilt
- Opportunistic
- Wide host range
  - Maples
  - Olives (no black streaks)
  - Strawberries
  - Tomatoes
  - Several weed species
- Provide optimal growing conditions

Ambrosia beetle

- California native
- Farms the *Ambrosiella* fungus
- They kill drought stressed oaks
- No curative treatment

Ambrosia beetle

- California native
- Farms the *Ambrosiella* fungus
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- No curative treatment

Ambrosia beetle

- The last part of SOD
- Don't need *Phytophthora* to kill trees
  - See and smell drought stress
    - Outbreaks in low rainfall years
    - Deep, infrequent summer water
    - Preventative pyrethroid insecticides
- Tunnels may flux

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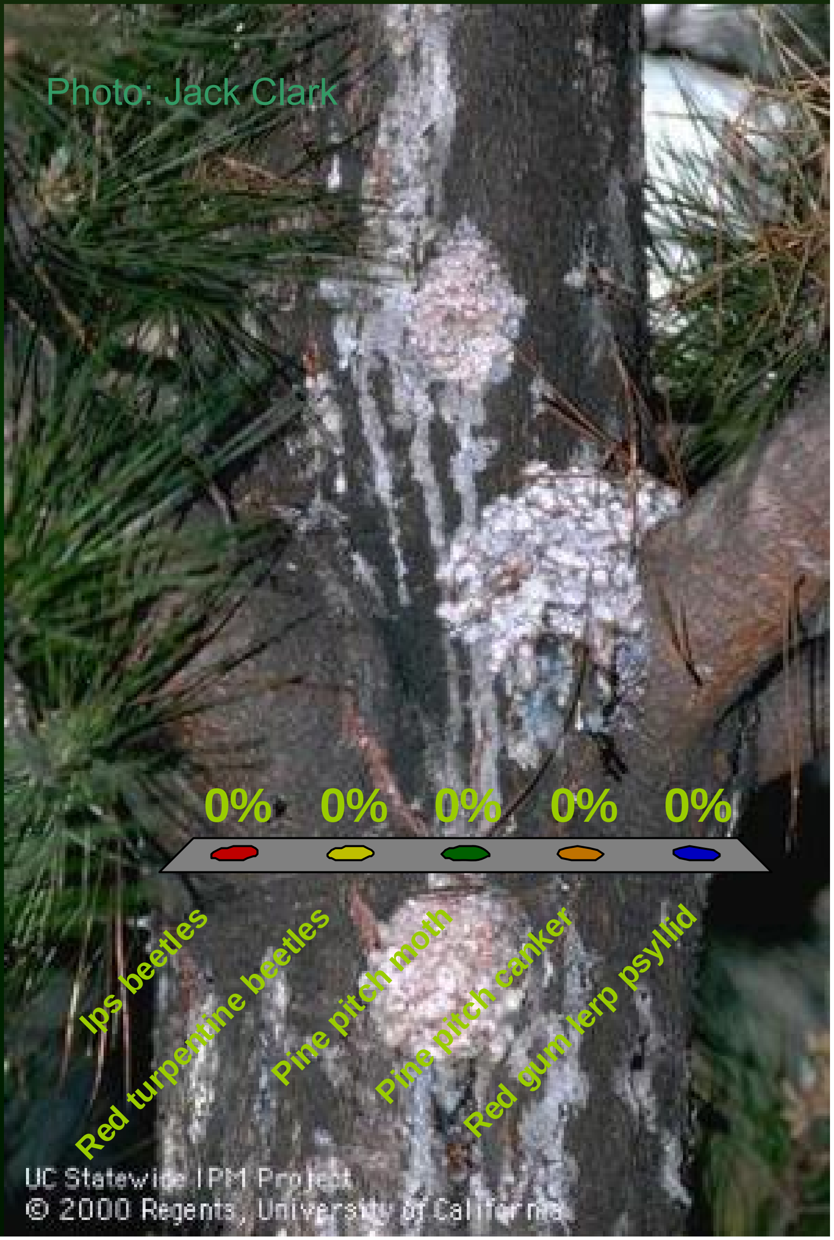
Longhorned Eucalyptus borer

- Attacks drought stressed soft barked Eucalyptus
  - Blue gum
  - *E. viminalis*
- Damage not always lethal
  - Branch dieback
  - Trees flood tunnels as defense
  - No water, no defense

This Monterey pine is infested with:

A. Ips beetles
B. Red turpentine beetles
C. Pine pitch moth
D. Pine pitch canker
E. Red gum lerp psyllid



Conifers and beetles

- Monterey pine
  - Five spined Ips
    Ips paracofusus
    - Attack higher in the canopy
    - High kill rate
  - Distinctive Y shaped galleries
- Red turpentine beetle
  Dendroctonus valens
    - Low kill rate
    - Red tunnel entrances at tree base
      - Turn white with age
  - Provide good cultural care

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Conifers and beetles

- Pitch masses caused by the pine pitch moth, *Synanthedon sequoiae*
  - Sometimes confused with red turpentine beetle damage
- Rarely cause significant damage
  - Most frequently found on stressed trees
- Prune trees October through January
- Appropriate water
  - Typically 1x / month to 1 foot deep

Conifers and beetles

- Douglas fir invades oak woodlands in normal years
  - Saplings don’t require a lot of water
  - Big trees do

Conifers and beetles

- Douglas fir engraver

Dendroctonus brevicomus

  - Attacks Douglas fir on sub-optimal sites
  - Outbreaks occur in dry years
  - Almost routine occurrence in California

Conifers and beetles

- Thuja
  - Adapted to some summer rain
- Cypress Bark Beetle *Phloeosinus cupressi*
  - Adults attack tender twig ends
    - Flagging
  - Females lay eggs at branch junctions
    - Larvae kill branches

Conifers and beetles

- Western Cedar Borer *Trachykele blondeli*
  - Females lay eggs under loose bark
  - Larvae tunnel in trunk
    - Tree turns a dull green
    - Frass packed tunnels
    - Pupate just under bark
    - D shaped exit holes

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Bronze Birch Borer
Agrilus anxius

- Birches are riparian species
  - Looked good despite inadequate water
  - Common landscape tree
- BBB introduced around 1990
- Simlar lifecycle to Western cedar borer
  - Frass packed galleries
  - Oblong exit holes

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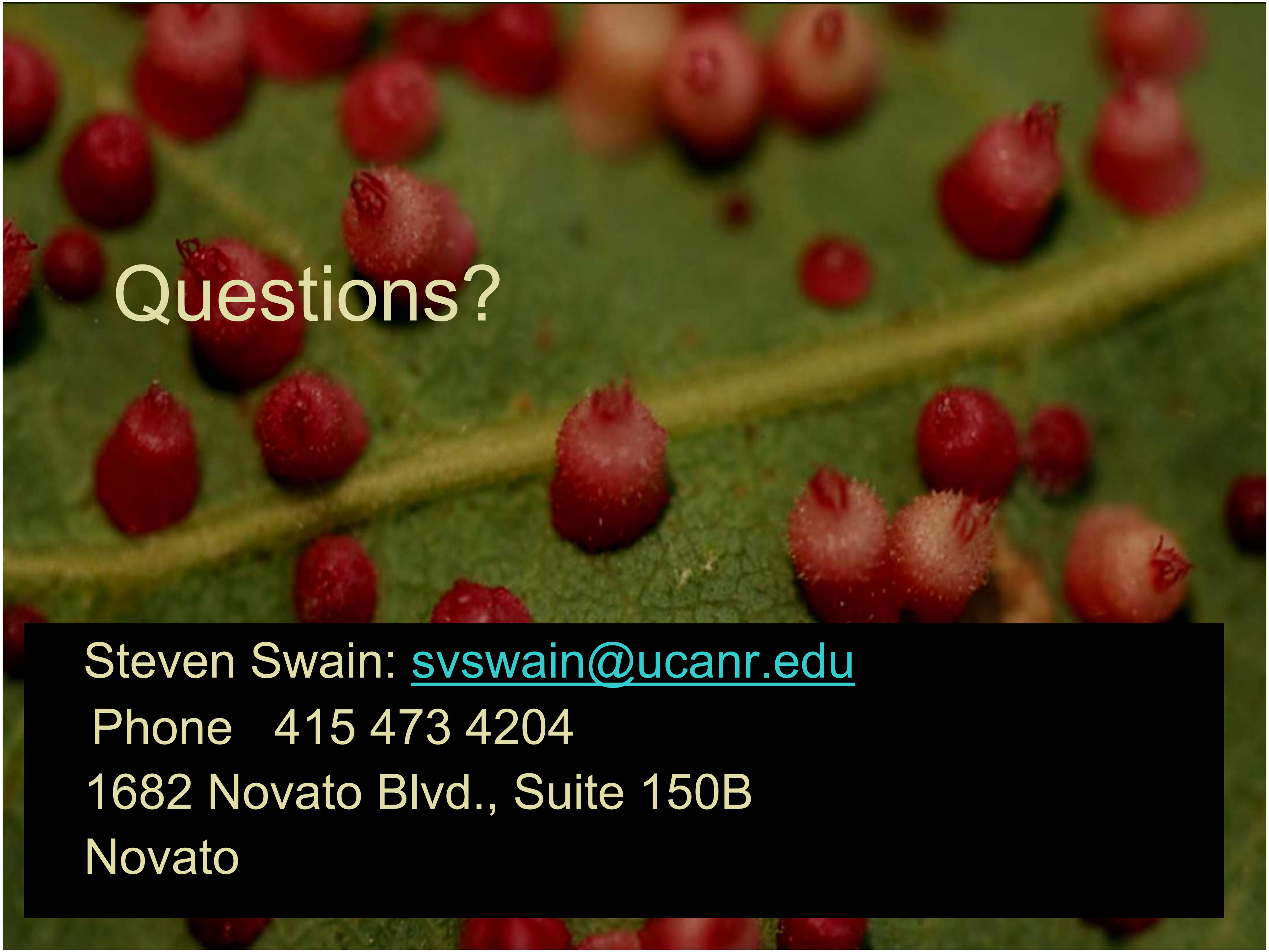
  - Oblong exit holes

Read Your Soil

- Direct sampling lets you know:
  - Where the roots are
  - Where the water is
- Trees manage water
  - Dry 12” down?
    - No water to manage
    - Irrigate near dripline
    - Monitor!

Landscape plants are tough

- Pathogens need an angle to survive
- Opportunistic pathogens and pests attack stressed trees (we give 'em plenty)
- Primary pathogens attack other trees in certain specific cases
  - Warm, moist soils; etc.
- Diagnosing the problem
  - The disease triangle
  - UC IPM: http://www.ipm.ucdavis.edu/

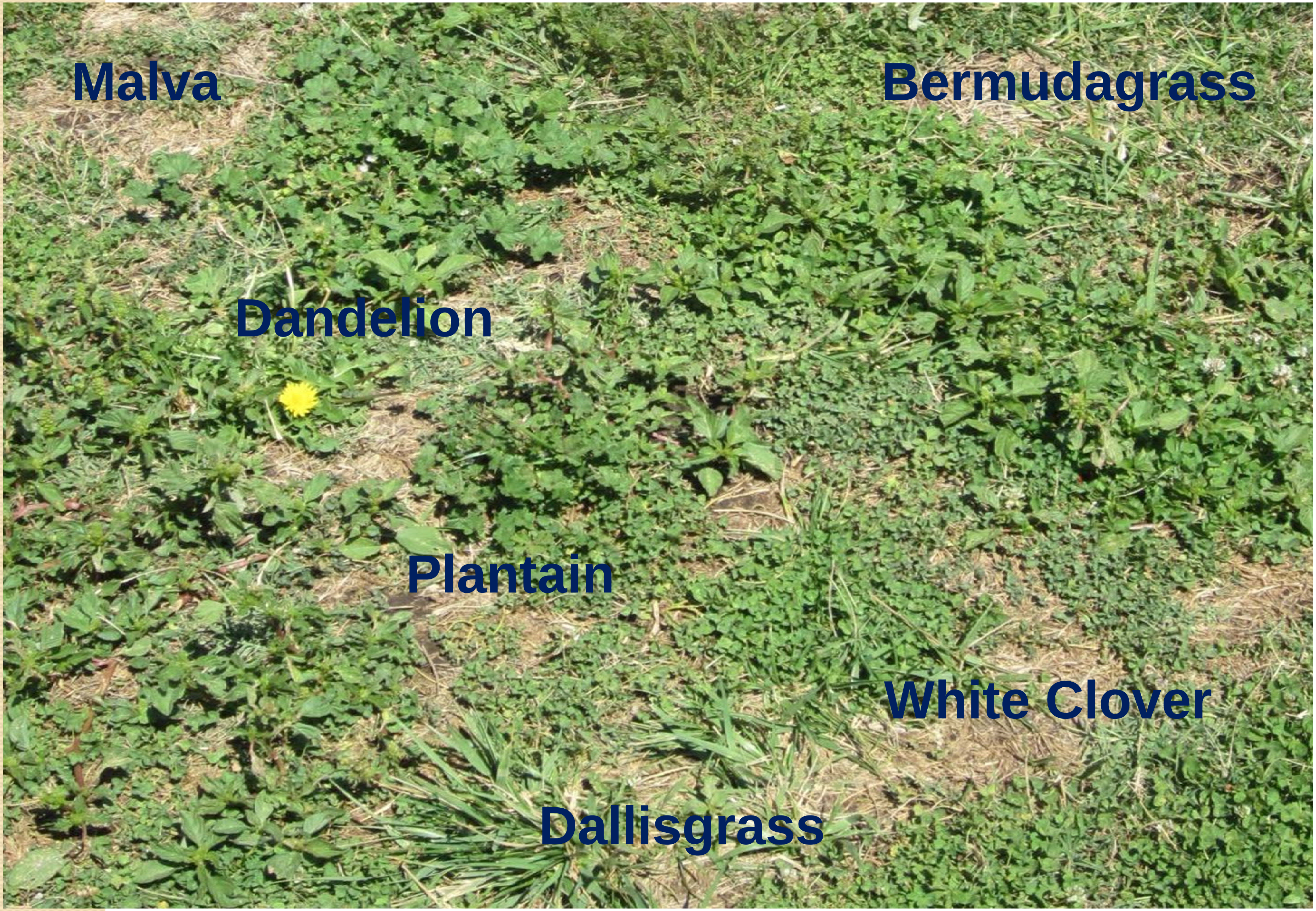


Questions?

Steven Swain: svswain@ucanr.edu
Phone 415 473 4204
1682 Novato Blvd., Suite 150B
Novato


Weed Management Under
Drought Conditions
John Roncoroni
UCCE Weed Science Advisor
& UCIPM Affiliate Advisor
Landscape Issues during Drought
Workshop for the Green Industry
May 1, 2014 San Rafael, CA

WHAT DO DROUGHT CONDITIONS LOOK LIKE?


Malva
Bermudagrass
Dandelion
Plantain
White Clover
Dallisgrass


Plantain

Prostrate Knotweed


Managing Weeds Under Drought Conditions

Things to Consider:

- Which weeds will survive?
- How do drought conditions effect control?
- How will control methods effect weed species makeup?

Managing Weeds Under Drought Conditions

Things to Consider:

- Which weeds will survive?

Managing Weeds Under Drought Conditions

Things to Consider:

- Which weeds will survive?
  - Weeds with an extensive root systems- usually perennials-but not always
  - Weeds adapted for growing in dry areas-usually grow in compacted soils.


UC Statewide IPM Project
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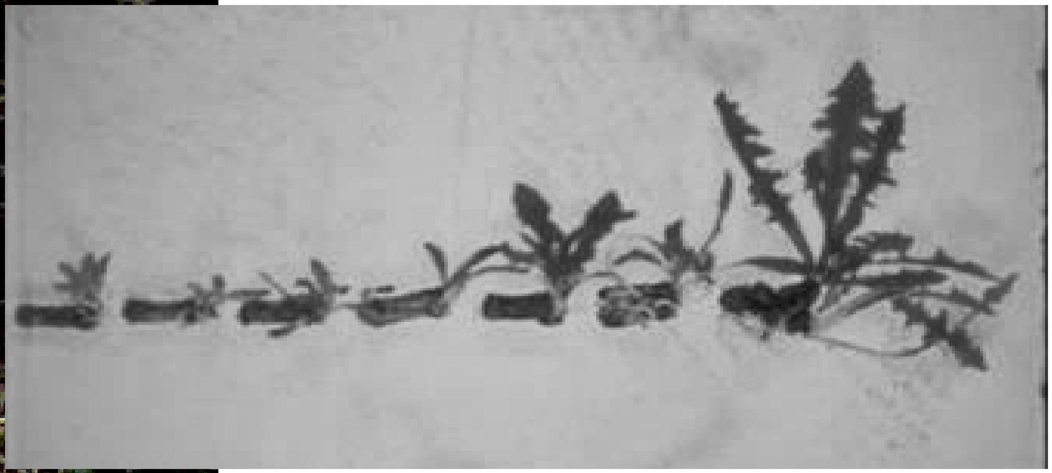


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C065-03

Dandelion

Taraxacum officinale

- Perennial-grow almost year round
- Each Plant can produce thousands of seeds-
- Control plants when small before they become perennial-roots can resprout if not completely removed


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Broadleaf plantain

Plantago major

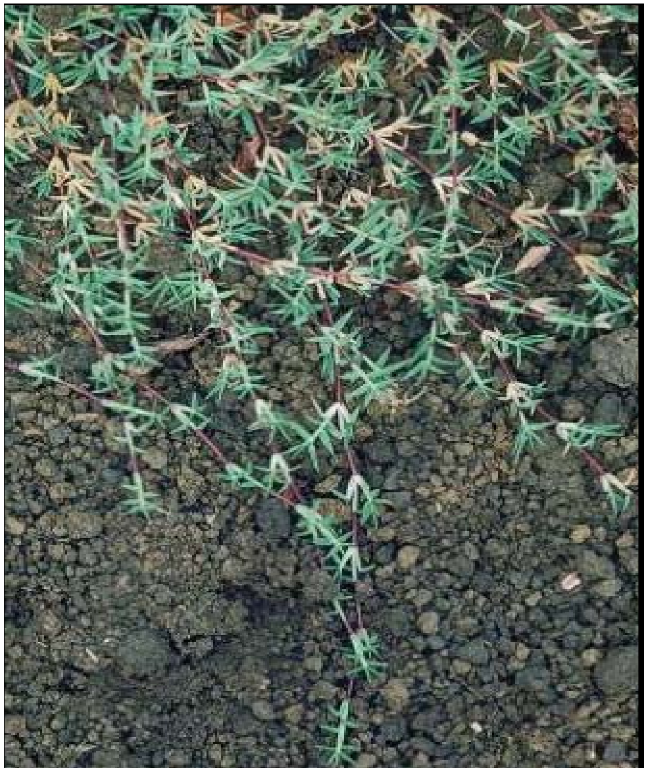
- Rosette-forming perennial.
- Short, thick taproot. Reproduces by seed. Germinates best in wet areas, but after establishment can tolerate very dry conditions.
- *Sign of irregular irrigation*. If you have this weed in your lawn check sprinklers for consistency. Check pipes for leaks.

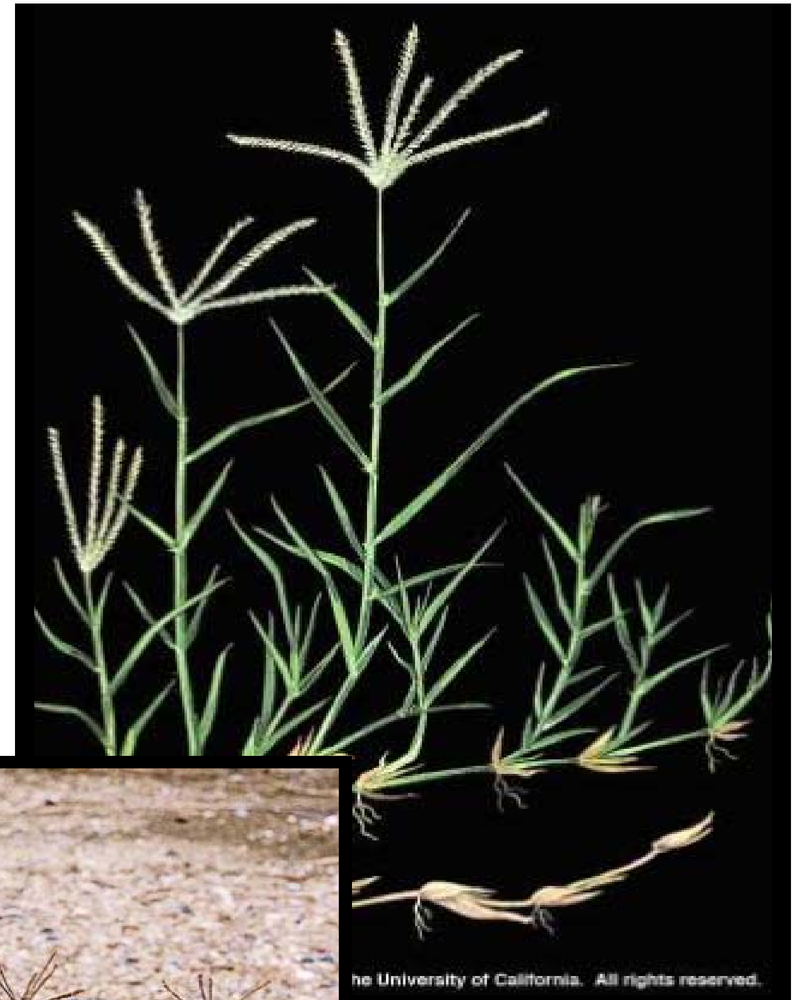



Bermuda Buttercup

Oxalis pes-capri

- Bulbs germinate in fall after first rain. Foliage dies and bulbs become dormant as temperatures rise in late spring and summer
- Plants in California very rarely produce seeds
- Forms a single, short underground vertical stem
- Small, whitish bulblets develop on the stems at the base of the rosette of leaves and new bulbs form underground.
- Repeated cultivation before bulbs are developed may reduce infestation

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Bermudagrass

Cynodon dactylon

- Perennial Grass-
  - Spreads by Stolon, Rhizome and Seeds
- Growth is reduced by shade
- Will go dormant in winter
- Can be controlled by drying out in summer… not easily-
- Drought tolerant because of extensive root system and above ground morphology


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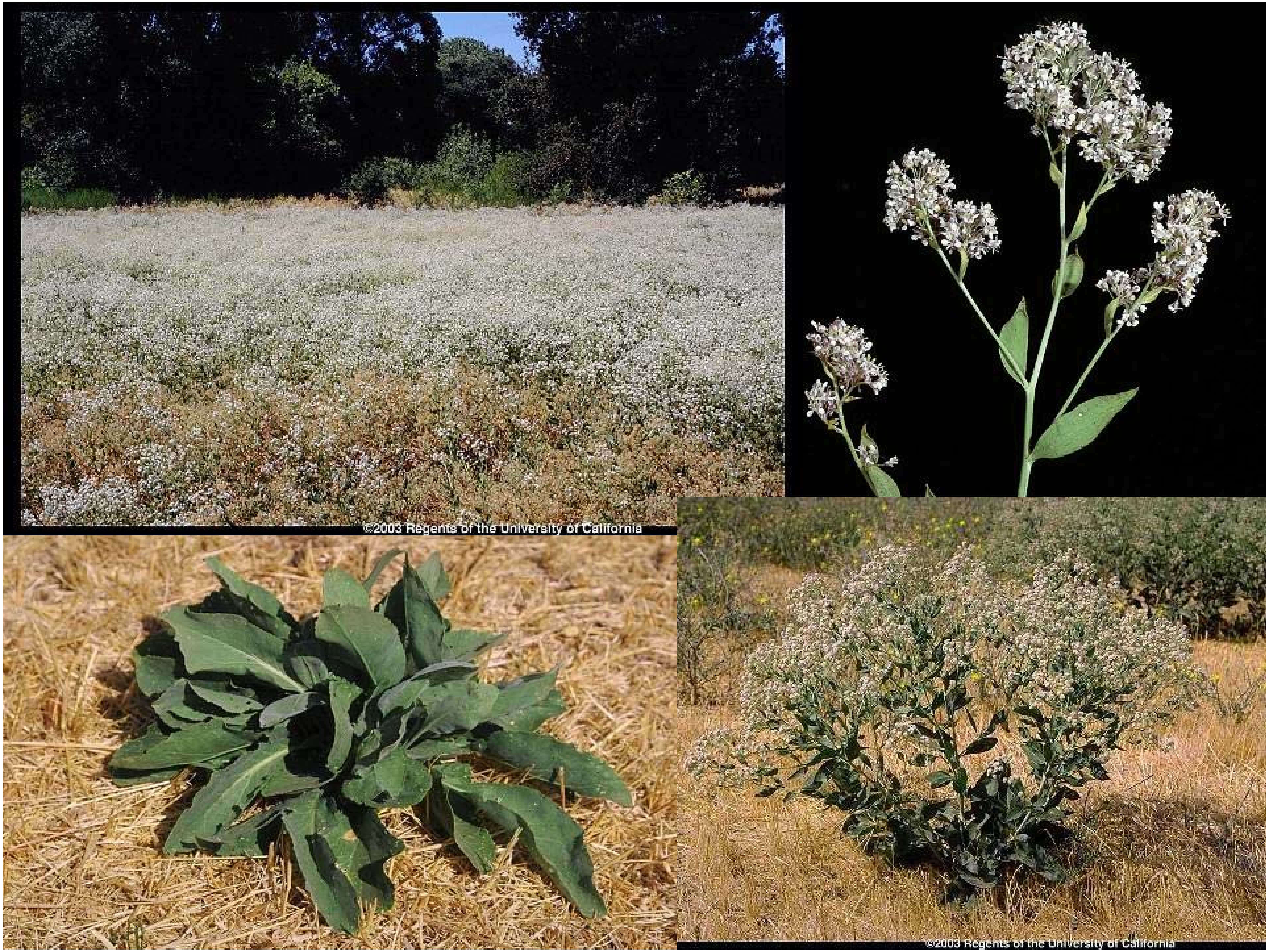
Yellow Starthistle

- *Centaurea solstitialis*
- Winter annual-spread by seed
- Approx. 13 M acres infested in California
- Develops taproot to 6 feet or more allowing it to access deep moisture in summer.
- Should be mowed at 5% bloom- if mowed before- more seed production and longer growth period will occur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Perennial Pepperweed

- *Lepidium latifolium*
- Perennial with extensive lateral root system
- Crown and lower stems woody
- In California usually starts in area that may have occasional standing water- not necessary once established.
- Spreads by creeping roots, root fragments and by seed

Field Bindweed

- *Convolvulus arvensis*
- Perennial with vinelike stem
- Spreads by seed, rhizome and creeping roots.
- Roots can penetrate soil to 10 feet or more.
- Seeds can remain dormant for 15-20 years- or more
- Maximum translocation of carbohydrates from shoots to roots occurs from the bud to full flow stage


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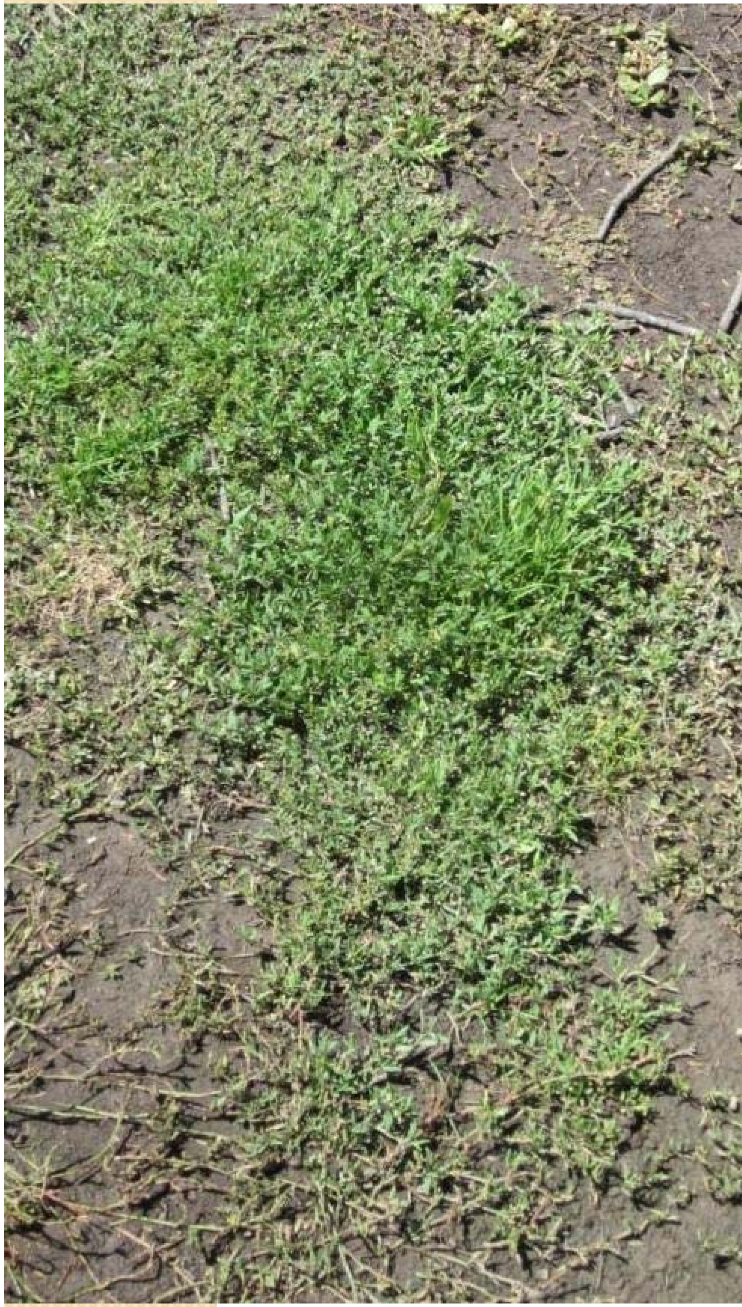
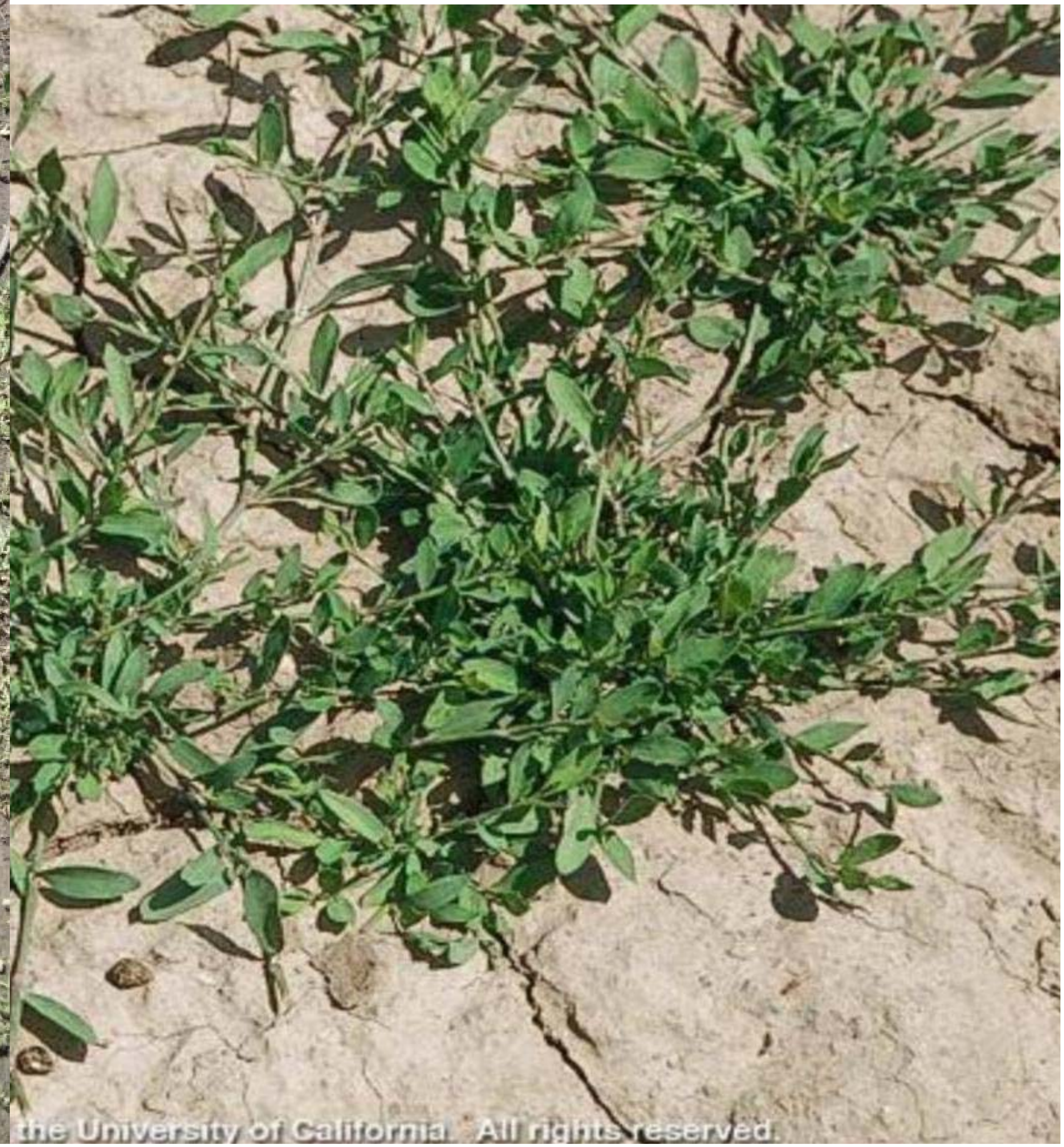
Cheeseweed-Malva-Mallow

Malva parviflora

- Several Malva species- all annual to short lived perennial
- Heart-shaped cotylendons
- If conditions are right cultivated pieces can re-root
- Usually a problem in non-cultivated areas
- Large plants difficult to control with postemegent herbicide applications

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Prostrate knotweed

Polygonum aviculare L.

- Summer annual. Reproduces by seed. Is one of the first summer annuals to germinate in spring. Usually a sign of compacted or problem soil. Knotweed is easily pulled and chemicals usually are not needed.
- Compaction of soil should be corrected. Aeration will help. Soil amendments such as gypsum may help alleviate the problem in clay soils.

Dallisgrass

Paspalum dilatatum Poir.

- Coarse textured perennial producing spreading clumps and short, thick rhizomes.
- Reproduces by seed; once established the clumps expand by short rhizomes. Well adapted to close, frequent mowing. Also a weed in alfalfa fields.
- Once established, control is by digging or chemical treatment.


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White clover

Trifolium repens L.

- Perennial
- Reproduction is by seed and stolon
- Seed coats are very hard, ensuring extended dormancy
- Grows best in areas of low Nitrogen
- Can regrow faster than turf, giving area ‘lumpy’ appearance


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C190-02

Goosegrass

Eleusine indica

- Annual; low rosette, mat forming, stems compressed.
- Appears as silvery, pale green clump.
- Normally found in compacted areas or areas of heavy wear.


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Bermudagrass

Cynodon dactylon

- Perennial. Reproduces by stolon or rhizome, less by seed.
- Drought-tolerant; goes dormant when temperature drops in fall.
- Spreads especially well under close mowing.

Managing Weeds Under Drought Conditions

Things to Consider:

- Which weeds will survive?
- How do drought conditions effect control?

Using Herbicides under drought conditions

Factors that effect herbicide activity

- ✓Soil Characteristics
- ✓Degradation
- ✓Moisture level
- ✓Temperature
- ✓Herbicide Characteristics
- ✓Application

Herbicide Action Criteria

- ✓Herbicide must be absorbed
- ✓It must be moved to the site of action
- ✓Must arrive in high enough quantities to be toxic

Preemergence Herbicides

- ✓Usually need rain or irrigation within 3 weeks to work
- ✓Generally will not control weeds that are already up (emerged) germinating seedlings are controlled
- ✓Must be at proper depth to work effectively

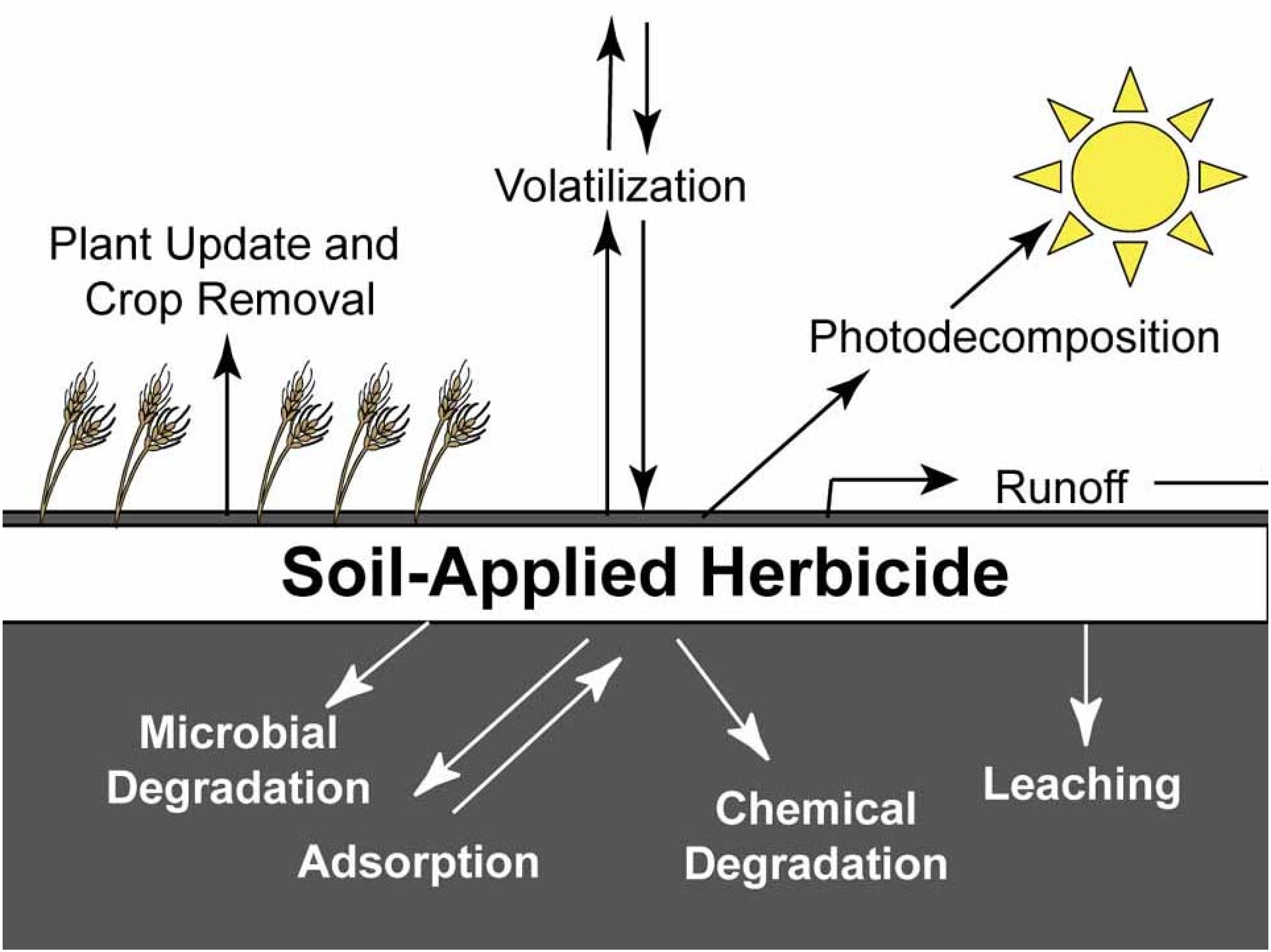
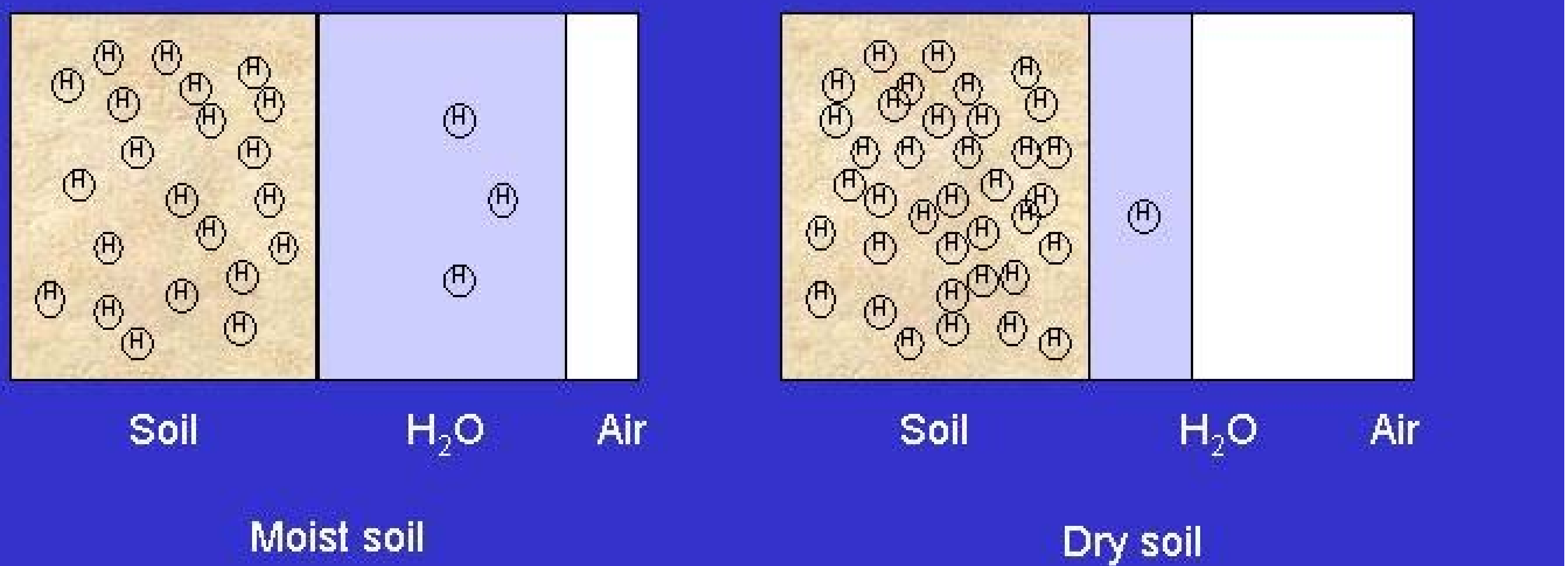

Volatilization
Plant Update and
Crop Removal
Photodecomposition
Runoff
Soil-Applied Herbicide
Microbial
Degradation
Adsorption
Chemical
Degradation
Leaching

Figure 2. Soil moisture effect on herbicide availability.

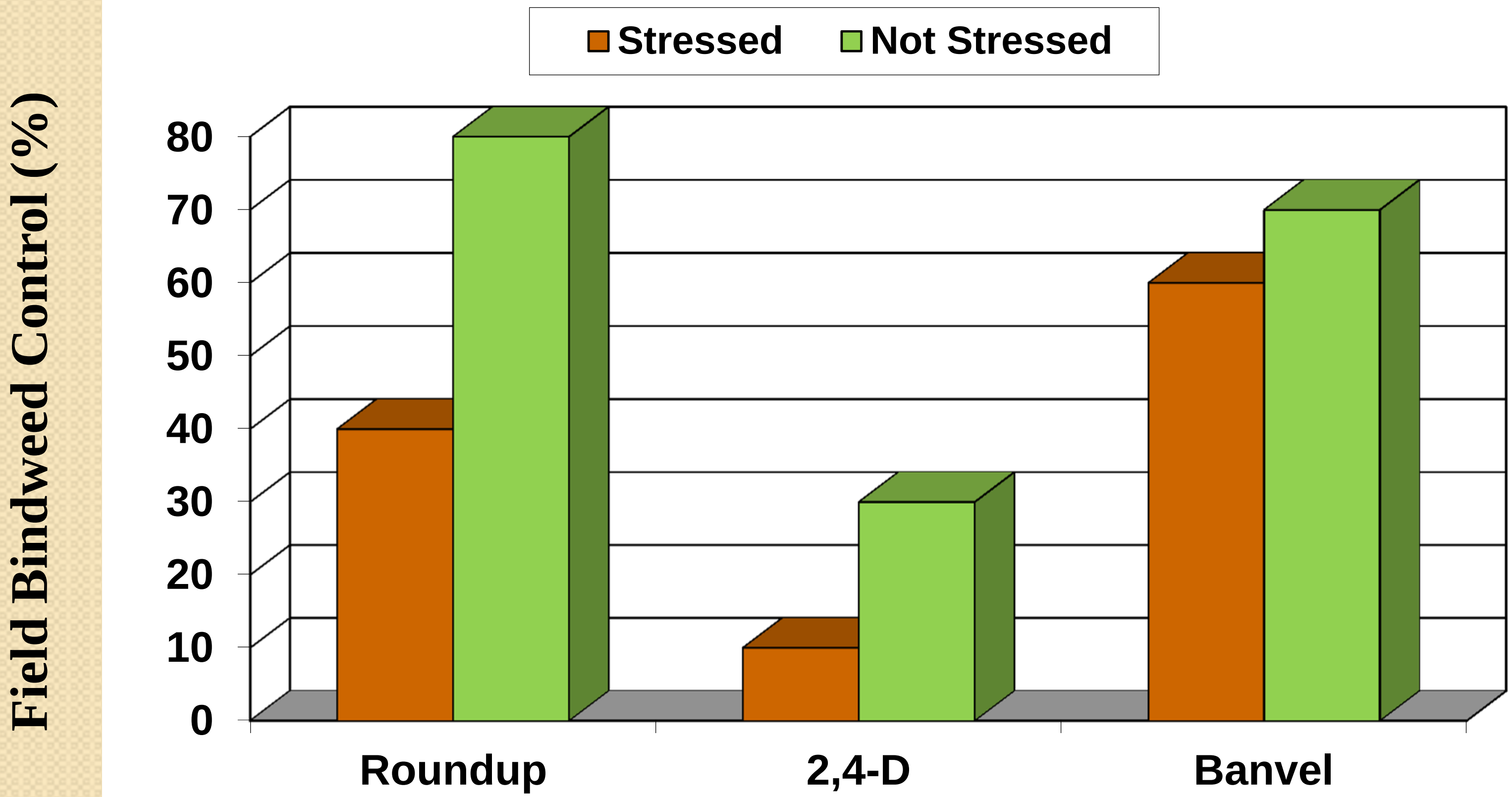


Drought conditions can shift weed control to Postemergent Herbicides due to Preemergent failure and late weed emergence

Postemergence Herbicides

- ✓Must be absorbed into the weed
- ✓Easiest to control seedlings
- ✓Weeds must be actively growing
- ✓Some rain free period after application

Field Bindweed Control relative to Plant Stress



Control 1yr after application

Bayer 1987

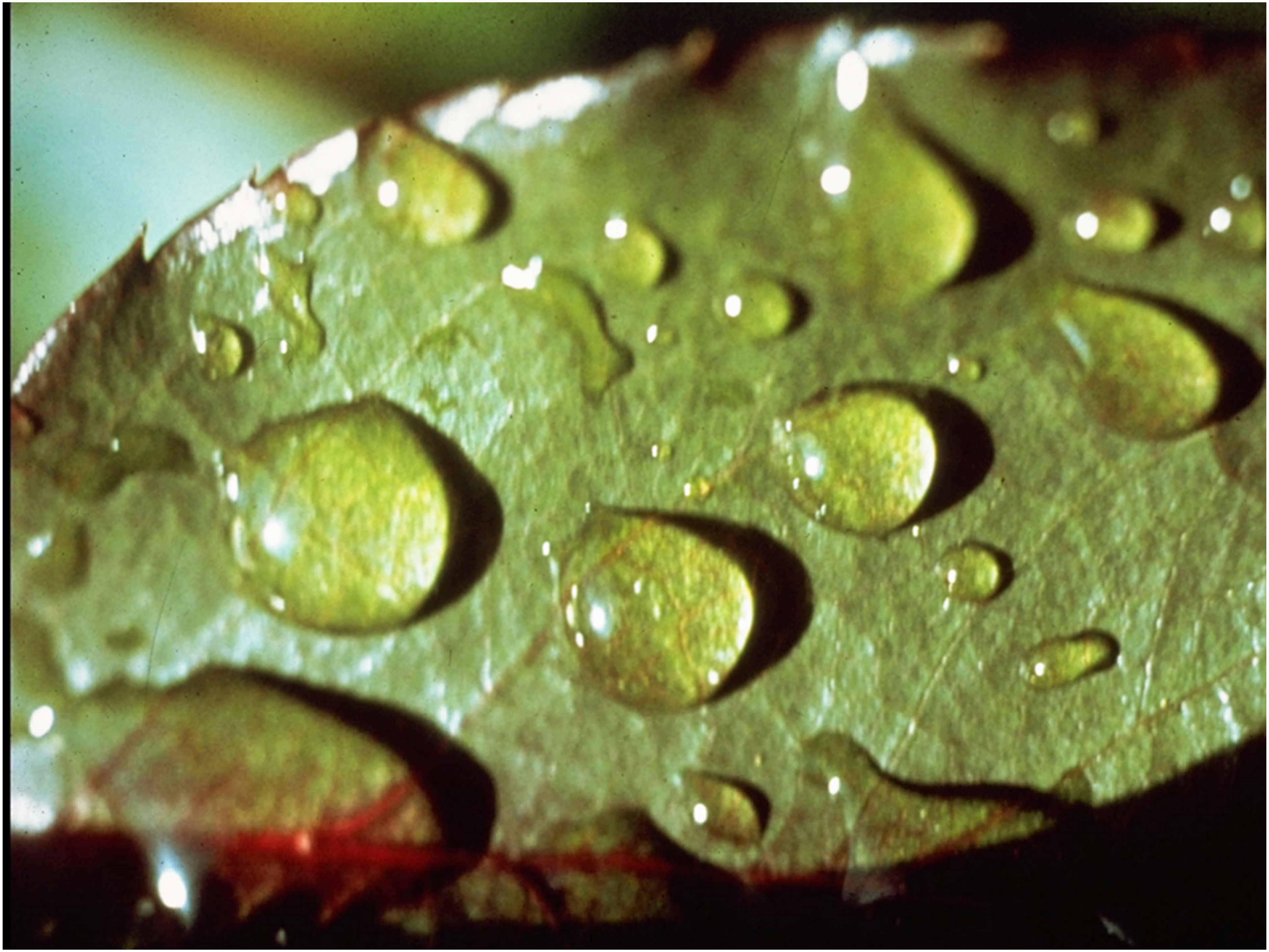
Drought Stress

Plant stress

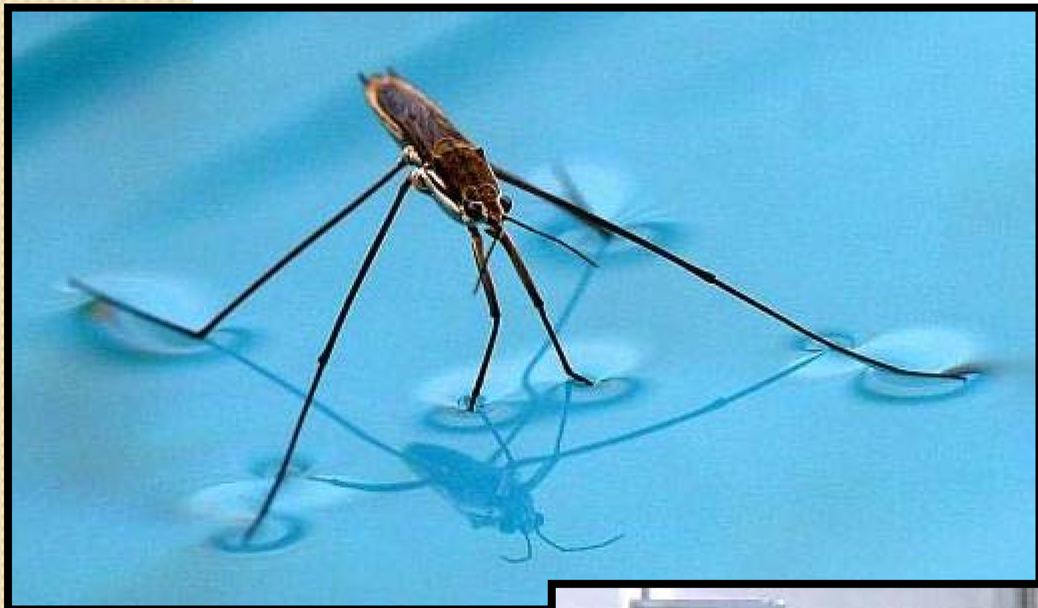
Thickened cuticle

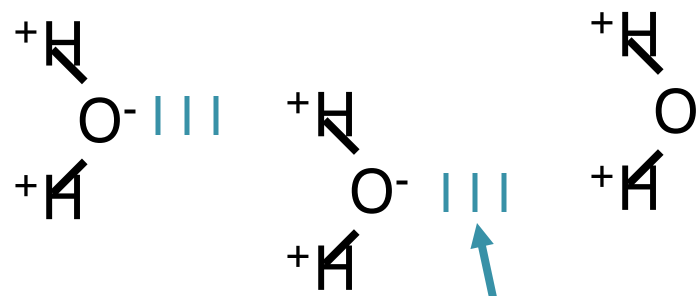
Surfactants

- Surfactants are products that enhance the ability of a herbicide to enter into a leaf or to stay in an aqueous solution
  - Surface Active Agents
- Normally used at 0.25 to 1%, v/v (2 to 8 pt/100 gal)
- Most are nonionic surfactants, although silicon surfactants are also available
- All act on the surface tension of water



Surface Tension of Water

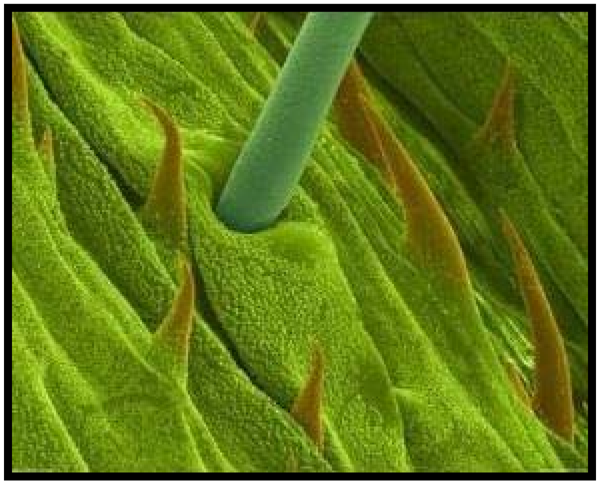




Caused by hydrogen bonding between water molecules

How Do Surfactants Improve Herbicide Uptake?

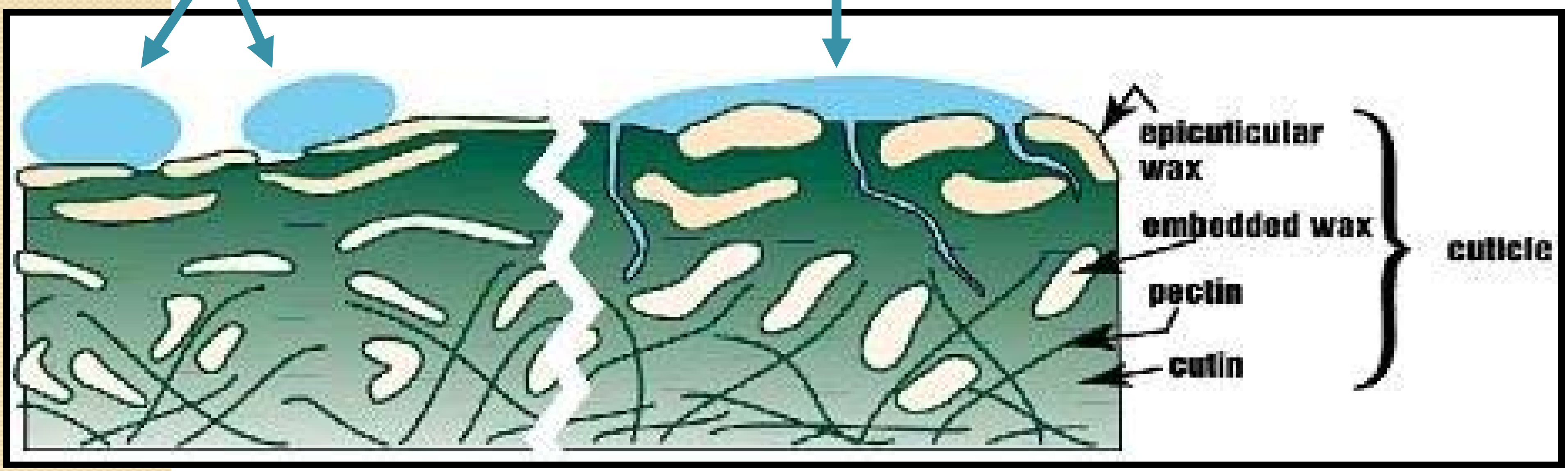
- The leaf surface restricts water loss and hinders uptake of liquids from the environment
  - Hairs (density, length)
  - Cuticle (wax, cutin, pectin)
  - Stomata (holes in the that regulate gas exchange with the atmosphere)



Adding surfactant to the mix can increase herbicide droplet contact with foliage

Without surfactant

With added surfactant



How Do Surfactants Improve Herbicide Uptake?

- Surfactants:
  - Cause greater droplet contact with the leaf surface and aid in movement into stomata
  - Slow evaporation of herbicide droplets
  - May increase rain-fastness of herbicides
  - Assist in passage of hydrophilic herbicides through hydrophobic wax layers

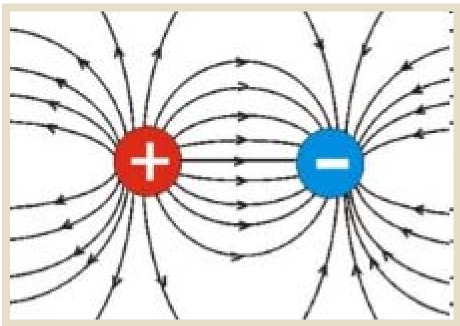
Reduced rainfall can effect water quality-
Ground water will usually have a higher mineral content

Things To Watch Out For

- The threshold level for "hard" water antagonism ranges from 150 ppm for calcium to 300 ppm for sodium
- Compatability problems from addition of liquid fertilizers
- If dry AMS is used, be sure to filter out non-soluble materials to prevent clogging of nozzles
- At low pH, more glyphosate exists as a salt than as the free acid
- Slightly acidic spray solution applied to leaves results in better glyphosate uptake
- So when spraying glyphosate, it's best to use water with a pH from 4 to 6
- If water exceeds pH 7, consider using a buffer

Glyphosate and Hard Water

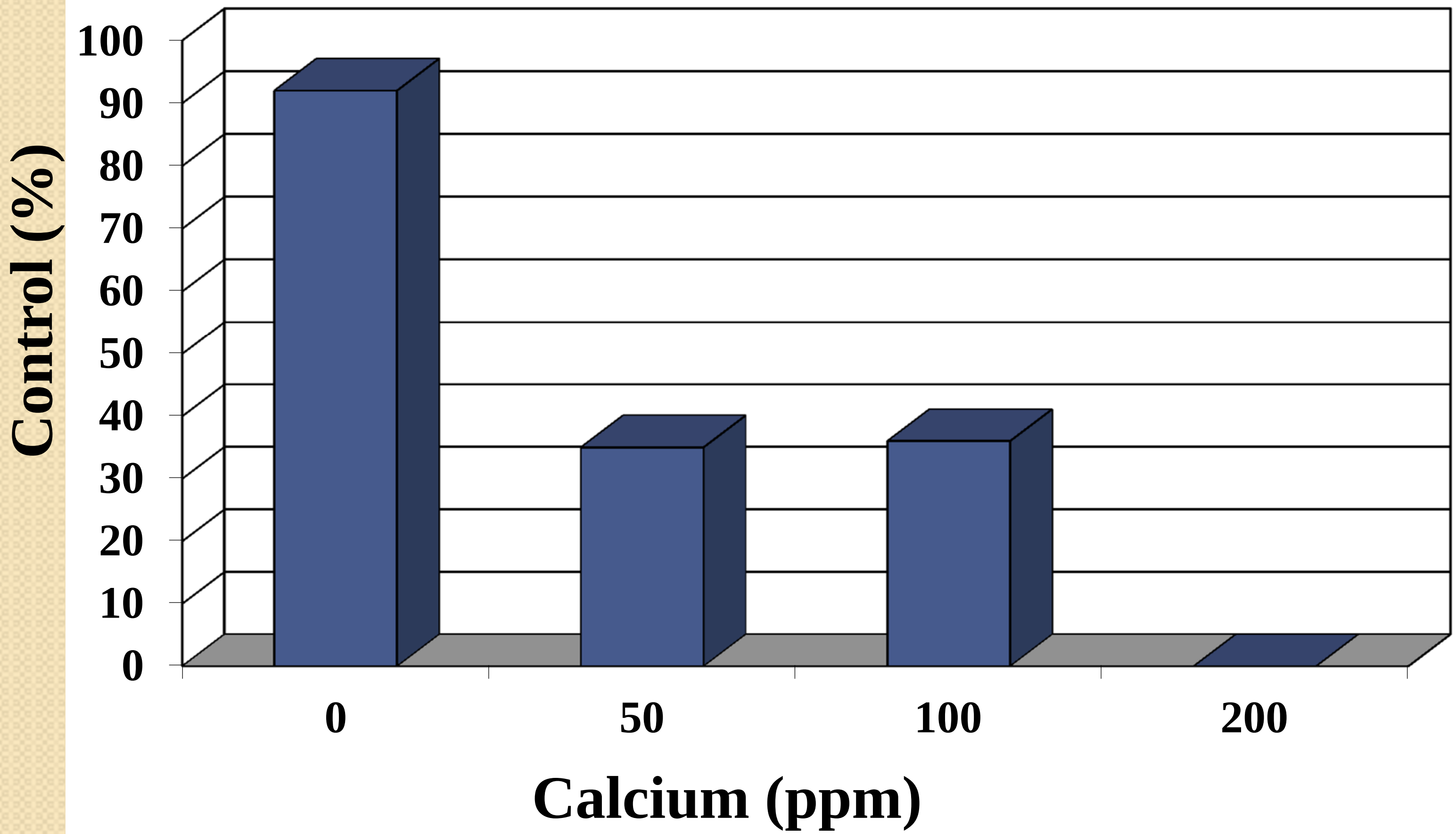
- Glyphosate salts are antagonized by other salts in hard water such as calcium, sodium, magnesium, and iron
  - These elements form cations (positively charged ions) that react with negatively charged glyphosate salts
- Both ammonium (NH_3^{1+}) and sulfate (SO_4^{2-}) active
  - Glyphosate is more readily absorbed into foliage when combined with ammonium than when combined with Ca^{2+}, Na^{1+}, Mg^{2+}, or Fe^{2+} ions
  - Free sulfate binds with Ca^{2+}, Na^{1+}, Mg^{2+}, or Fe^{2+} ions



Physiological Effects of Glyphosate/Fertilizer Mixes

- Adding AMS can increase movement of herbicide through the leaf cuticle, cell wall, or across the plasma membrane of the cells of certain weed species
  - Basipetal movement of ^{14}C-glyphosate is increased when AMS is added due to improved cellular uptake and phloem mobility
- More glyphosate in plant cells establishes a concentration gradient, increasing "phloem loading" and translocation

Torpedograss Control relative to Calcium conc.



Roundup applied @ 1.0 lbs/ac

Shilling and Haller 1985

Wheat fresh weight reduction from Roundup (0.2 lbs/a) at 14 DAT

Ammonium Sulfate	Distilled water	Well water #1	Well water #2
None	79	0	0
2%	84	85	83
By analysis (1.16%)	_	80	79

Nalewaja and Matysiak 1993

Dust and Glyphosate

- Recall that glyphosate binds with soil, so dusty on plant foliage ties up the herbicide and reduces activity

Managing Weeds Under Drought Conditions

Things to Consider:

- Which weeds will survive?
- How do drought conditions effect control?
- How will control methods effect weed species makeup?

Herbicide Resistance

- Herbicide resistance: the inherited ability of a plant to survive and reproduce following exposure to a dose of herbicide normally lethal to the wild type
  - "We used to be able to control this weed with this treatment but it doesn't work as well anymore…"

Herbicide Tolerance

- Herbicide tolerance: the inherent ability of a species to survive and reproduce after herbicide treatment; implies no selection or genetic manipulation to make the plant tolerant
  - "We've never gotten dependable control of this weed with this herbicide…"

Weeds that Naturally Tolerate Glyphosate in the Western United States

Burning nettle

Creeping buttercup

Panicle willowweed

Morningglory

Yellow nutsedge

common lambsquarters

purslane

Black nightshade

Filaree

Cheeseweed

Glyphosate-resistant Weed Distribution in California and Oregon

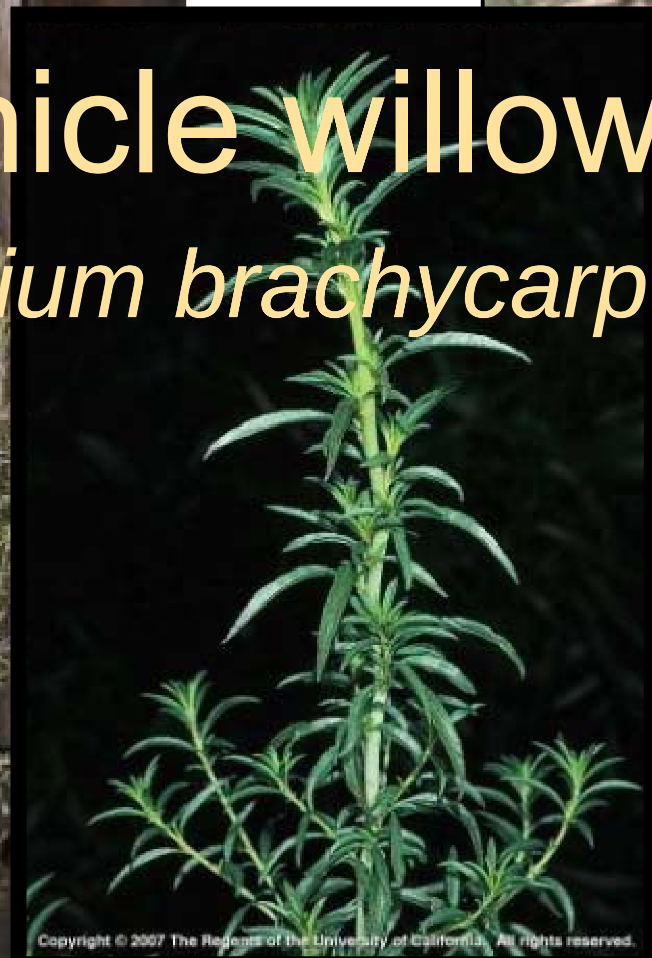


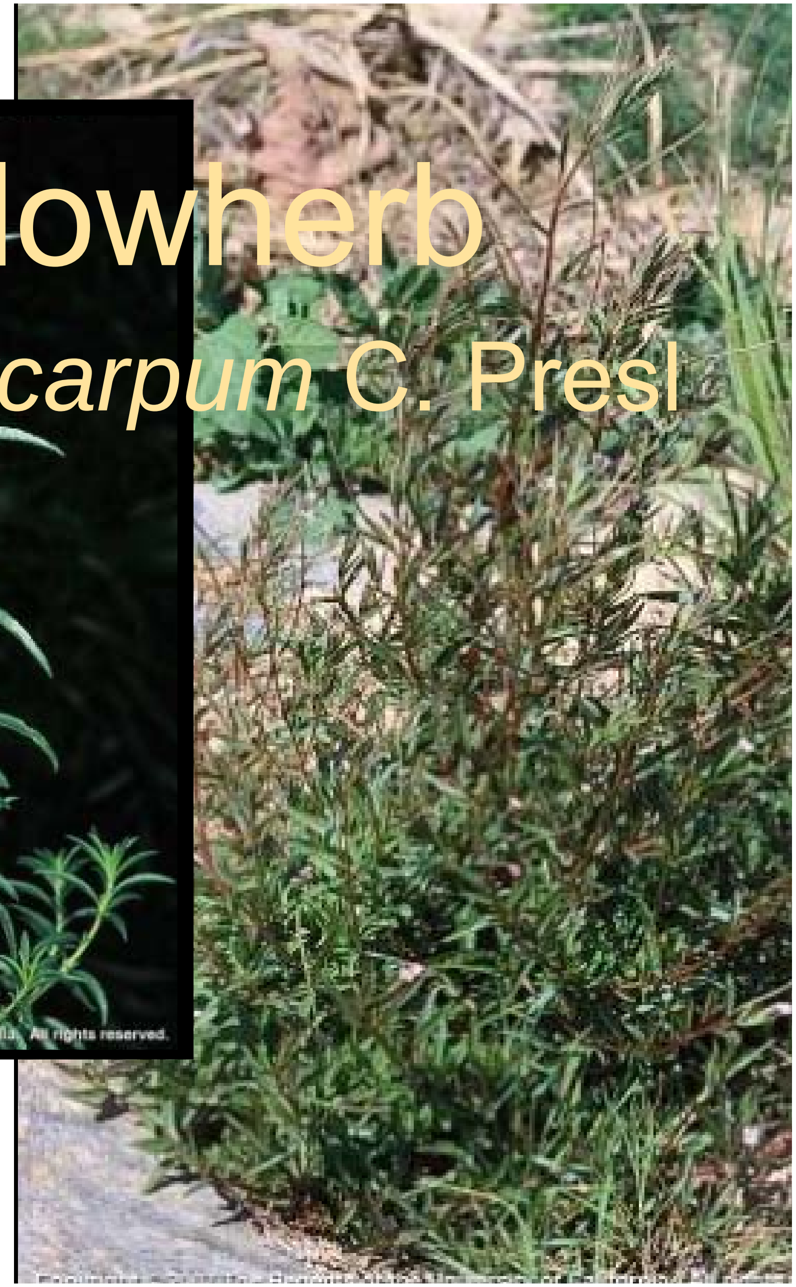


Common name	Rigid ryegrass	Italian ryegrass	Horseweed	Hairy fleabane	Junglerice
State	California	Oregon	California	California	California
Location	Orchards	Orchards	Roadsides	Roadsides, vineyards	Corn, orchards, roadsides
Year first confirmed	1998	2004	2005	2007	2008

Panicle willowherb

Epilobium brachycarpum C. Presl






February 28


November 28

Rigid and Italian Ryegrass
(*Lolium rigidum* and *L. multiflorum*)

- Often co-exist (swarm)
- Annual grass
- Obligate outcrossers
- Throughout CA but more common weed in northern Central Valley
- 2 to 15-fold resistance
- Usually target site mutation

Horseweed *(Conyza canadensis)*

- AKA mare's tail
- Annual weed
- Prolific seed producer
- Wind-blown seed
- Early colonizer
- Doesn't tolerate disturbance
- 6-fold resistance (whole plant)
- 4-8 fold resistance (in vivo)
- Mechanism not known. Suspected translocation mutation

Large Horseweed treated with glyphosate


Is this the root of
the problem?

Final Points

- Be able to ID weeds and understand their biology
- Weather conditions will 'shift' weed populations
- Weed management imposes selection pressure

  Tolerance, resistance, shifting populations
- Understand herbicide mode of action and rotate herbicides and other management tactics to reduce selection pressure
- Monitor fields and control escapes to manage small problems rather than large ones!

Questions?

University of California
Agriculture and Natural Resources

New (2012) restrictions on pyrethroid insecticide applications protect urban surface waters

Andrew Sutherland
Bay Area Urban IPM Advisor
UCCE and UC IPM

UC IPM

University of California
Agriculture and Natural Resources

Statewide Integrated Pest Management Program

Making a Difference for California

What's an Urban IPM Advisor?!

- Andrew Sutherland: Bay Area Urban IPM Advisor
  - Alameda, Contra Costa, San Francisco, San Mateo, Santa Clara counties
  - Professional / commercial landscape IPM
  - Structural / industrial IPM
  - Urban agricultural IPM
- amsutherland@ucanr.edu
- http://ucanr.edu/sites/urbanIPM/

UC IPM

What is Cooperative Extension?

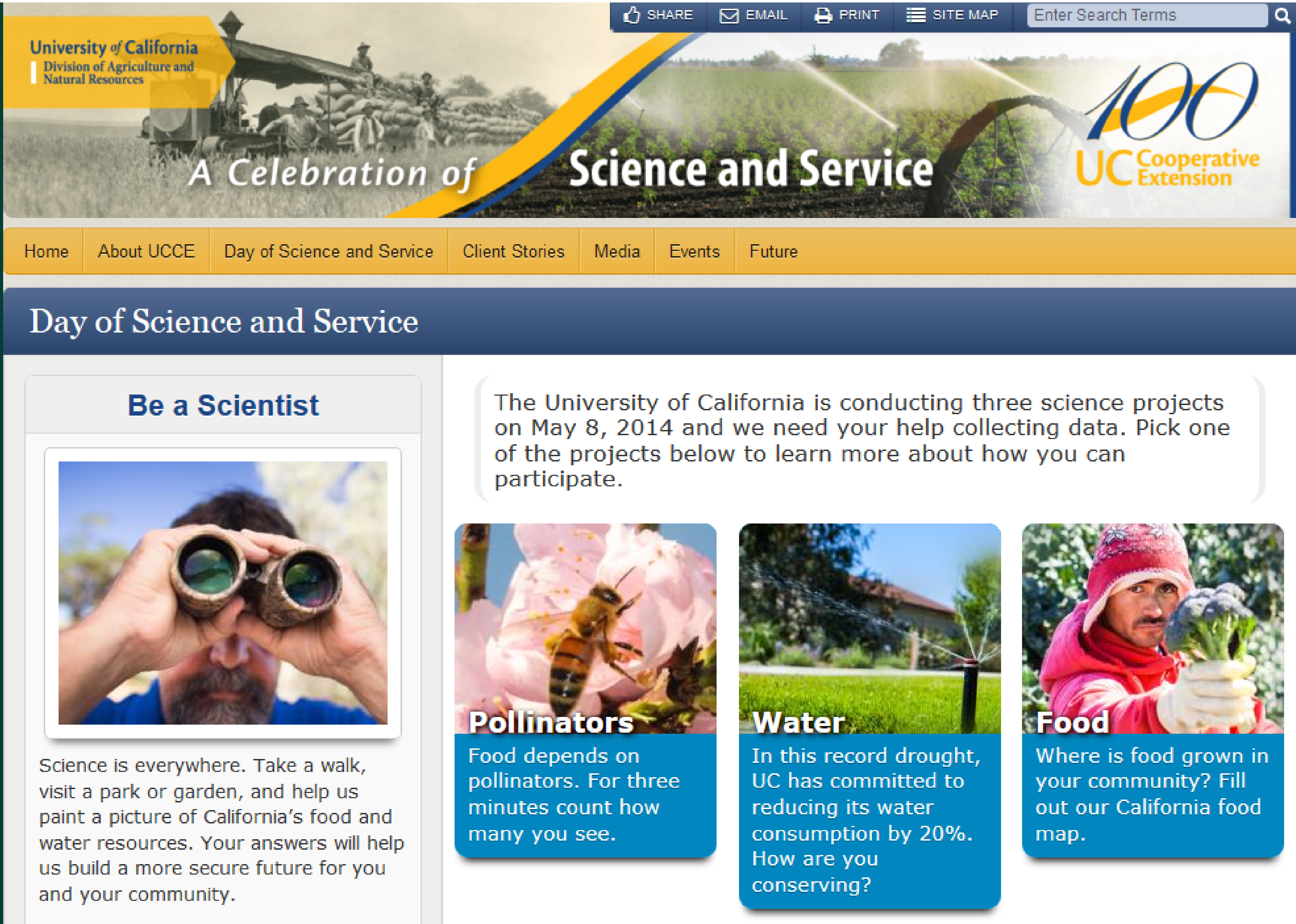
- Morrill Act 1862, Smith-Lever Act 1914: land-grant colleges CE continuum
  - Federal mandates: focus on applied disciplines and extend information to interested public
  - Needs shifting from agricultural to health, natural resources, urban community

University of California Cooperative Extension Alameda County:

100 Years & Counting!

We are: Problem-solvers, catalysts, collaborators, stewards and educators.

Since 1914, University of California Cooperative Extension scientists and academics, along with campus and community partners, have been helping make California the nation's leading agricultural state.



http://100.ucanr.edu/Day_of_Science_and_Service/

Outline of presentation

- Analysis of problem
  - Urban pesticide users
  - Problems with urban pesticide use
  - The problem with pyrethroids
  - Effects of drought on urban surface water
- Overview of new (2012) CDPR restrictions
  - a.i.s affected, prohibitions, exemptions
- Alternative management strategies
  - IPM and baits
  - The problem with fipronil

Central tenets of IPM

- Education
- Prevention
- Monitoring
- Treatment Thresholds
- Multiple Tactics
- Integration
- Evaluation




UC IPM

Major users of pesticides in urban areas

- General (residential) public
  - Homeowners / tenants
  - Property owners / managers
- Pest management professionals (PMPs)
- Government agencies
- Agriculture
  - Non-crop systems: ornamental nurseries
  - Urban ag systems

UC IPM

tdc
environmental

Pesticides in Urban Runoff, Wastewater, and Surface Water

Annual Urban Pesticide Use Data Report 2010

Prepared for the
San Francisco Estuary Partnership

June 28, 2010

UC IPM

Table 2. Overview of Pesticide Use Reporting in California

Examples of Pesticide Applications that Do Require Reporting	Examples of Pesticide Applications that Do Not Require Reporting
All applications by professional applicators *All applications to agricultural crops* Structural pest control (other than by a residential pesticide user), such as: • Termite, ant, and cockroach treatments • Building fumigation Landscape maintenance (other than by a residential pesticide user), such as: • Lawns • Gardens • Golf courses • Parks • Cemeteries Road, rail, and utility rights of way, for purposes such as: • Weed control • Algae control Mosquito control applications by mosquito abatement agencies Food product fumigation	*All applications by non-professionals* (assuming application by non-professionals is legal) Incorporation of pesticides into consumer products, such as: • Wood preservatives • Biocides in soaps, cleaning products, or impregnated into solid materials (e.g., cutting boards, toys, clothing) • Biocides incorporated in products to prevent the product's degradation (e.g., in sponges and liquid products) • Insecticide-treated clothing • Biocides in paints • Biocide-generating equipment (e.g., clothes washing machines that generate silver ions) Swimming pool, spa, and fountain treatments, such as: • Algaecides • Biocides (e.g., chlorine) Cooling water system treatment with biocides Use of biocides, such as: • Bleach use • Hospital and medical facility and equipment disinfection • Drinking water and wastewater disinfection Pet flea treatments Marine antifouling paint application

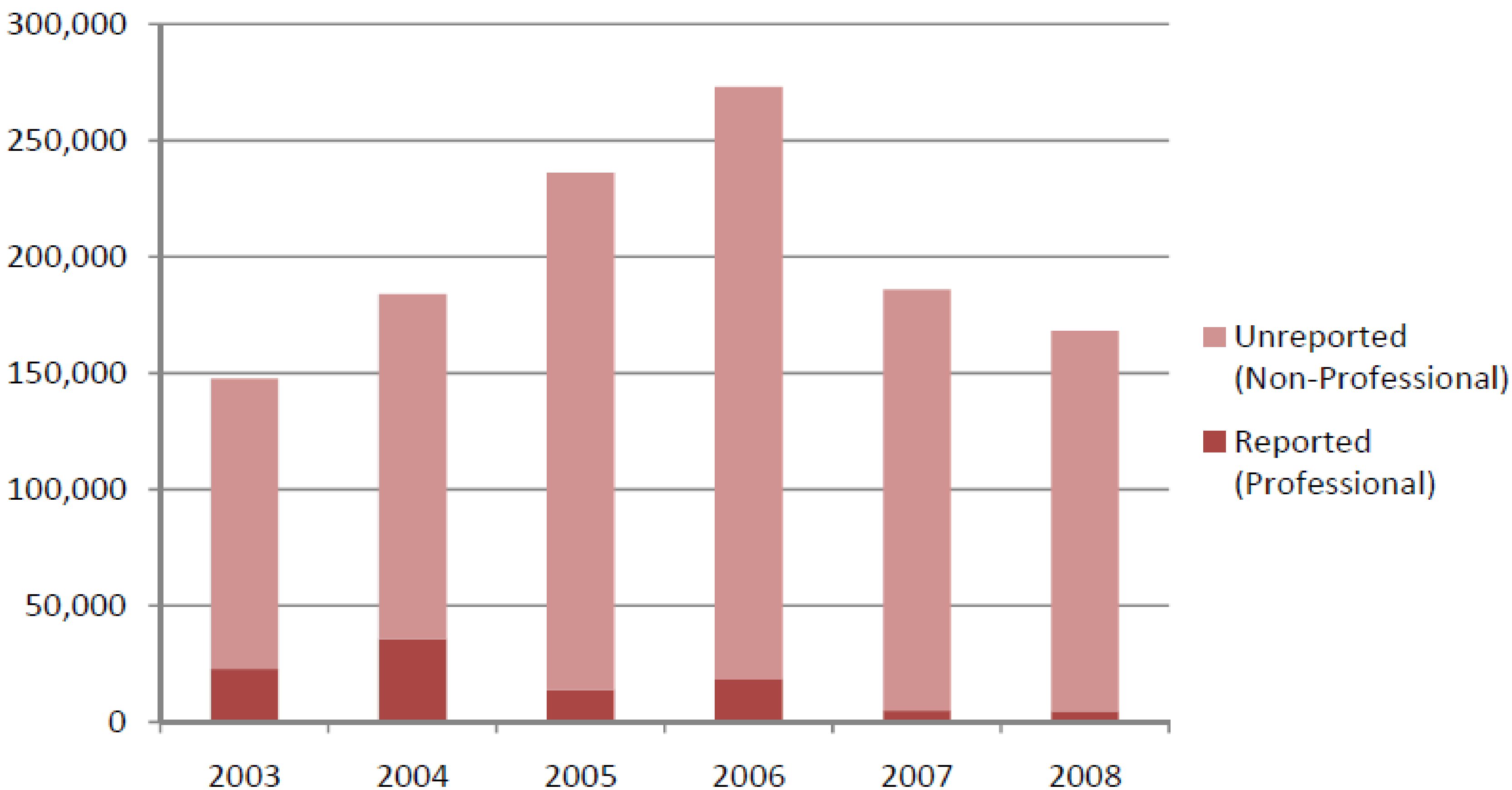
Source: TDC Environmental, based on review of California pesticide use reporting data, California pesticide products, and pesticide use reporting requirements in California law.

Urban Use ≈ Reported Urban Use + Statewide Over-the-Counter (OTC) Sales

Statewide OTC Sales ≈ Statewide Sales – Statewide Reported Use

Total urban carbaryl use was estimated on the basis of sales and reported use data using the method described in Section 2. Figure 18 summarizes estimated carbaryl urban use. Most estimated urban carbaryl use is unreported.

Figure 18. California Estimated Carbaryl Urban Use 2003-2008 (Pounds of Pesticide Active Ingredient)



Source: DPR pesticide sales data (DPR 2007a, 2007b, 2007c, 2008a, 2008b, 2010), DPR pesticide use reports (DPR 2005, 2006a, 2006b, 2007d, 2008c, 2009), and mathematical calculations (see Section 2).

So What?
(Why Urban IPM?)

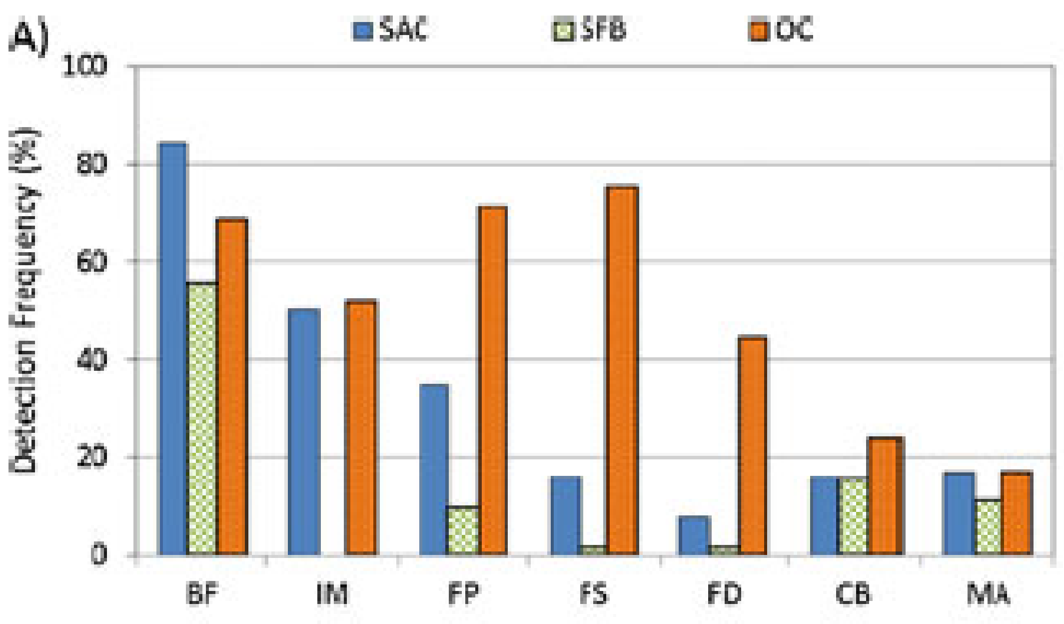
- Urban surface water contamination (w / pesticides) levels 2 – 3 X higher than surface water in production ag areas
  - Diazinon and chlorpyrifos (Bailey et al 2000)
  - Pyrethroids (Weston et al 2005; Amweg et al 2006)
  - Fipronil (Lin et al 2009)
  - Herbicides and insecticides: East Bay creeks: 2,4-D, triclopyr, diuron, MCPA, bifenthrin, fipronil, imidacloprid, carbaryl, malathion (Ensminger et al, 2012)

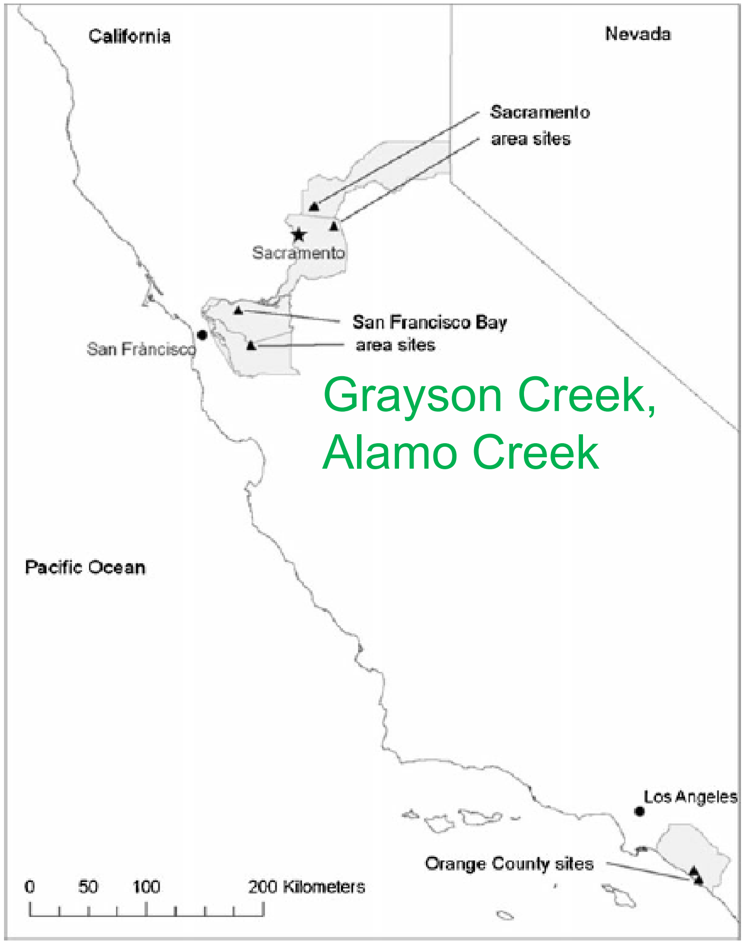
UC IPM

Environ Monit Assess
DOI 10.1007/s10661-012-2821-8

Pesticide occurrence and aquatic benchmark exceedances in urban surface waters and sediments in three urban areas of California, USA, 2008–2011

Michael P. Ensminger · Robert Budd ·
Kevin C. Kelley · Kean S. Goh

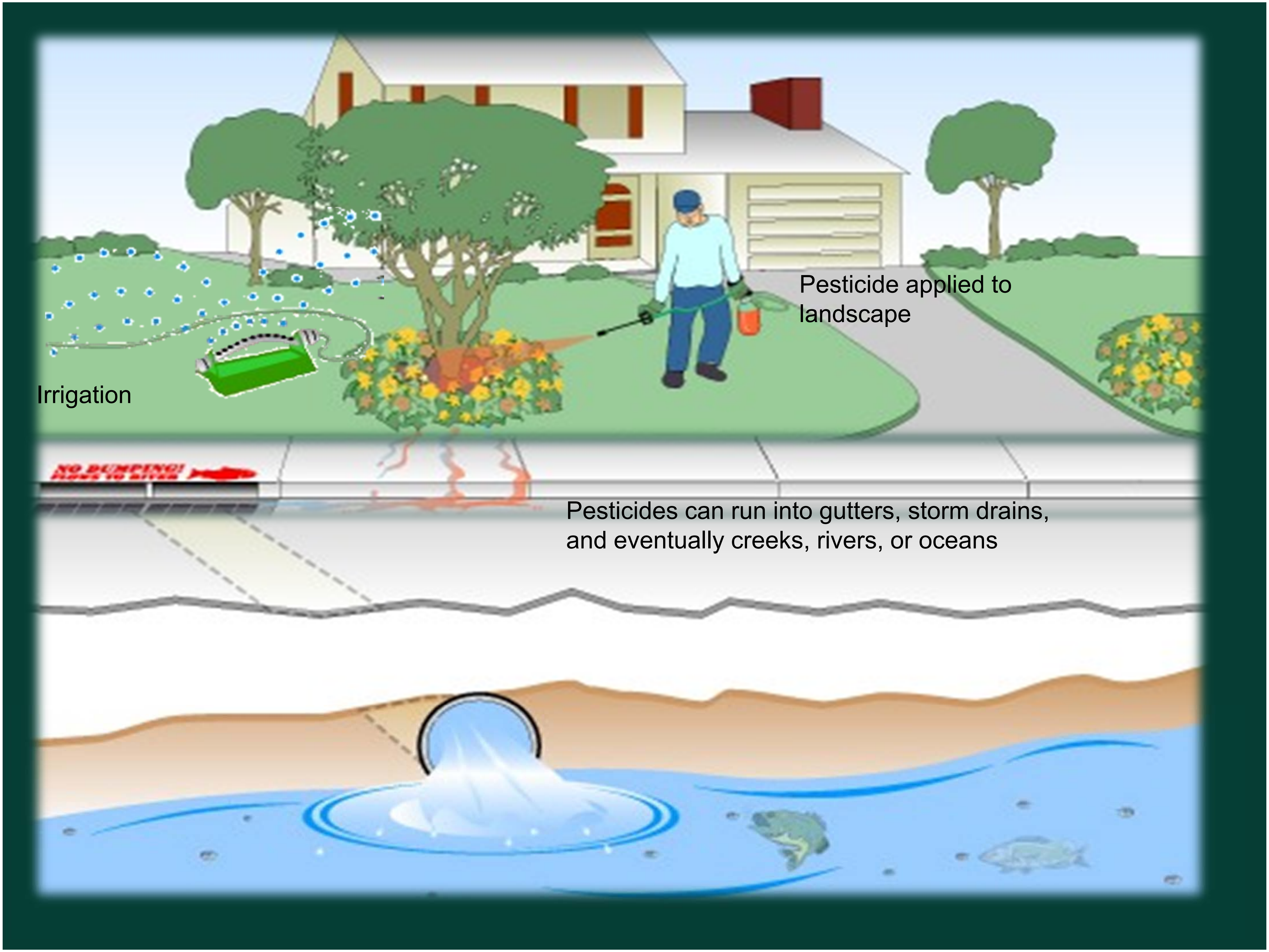




Grayson Creek,
Alamo Creek

Problems with pesticide use in urban areas

- Surface water, soil, groundwater contamination
- Human health concerns
- Disruption of ecosystem
- Economic costs
- Public perception


Pesticide applied to landscape
Irrigation
NO DUMPING!
Pesticides can run into gutters, storm drains, and eventually creeks, rivers, or oceans


Firestone


Scoop

Problems with pyrethroids

- Most widely-used urban insecticides
- Market proliferation following regulations on organophosphates, carbamates
- Persistent (2nd gen resists photodegradation)
- Highly toxic to aquatic arthropods

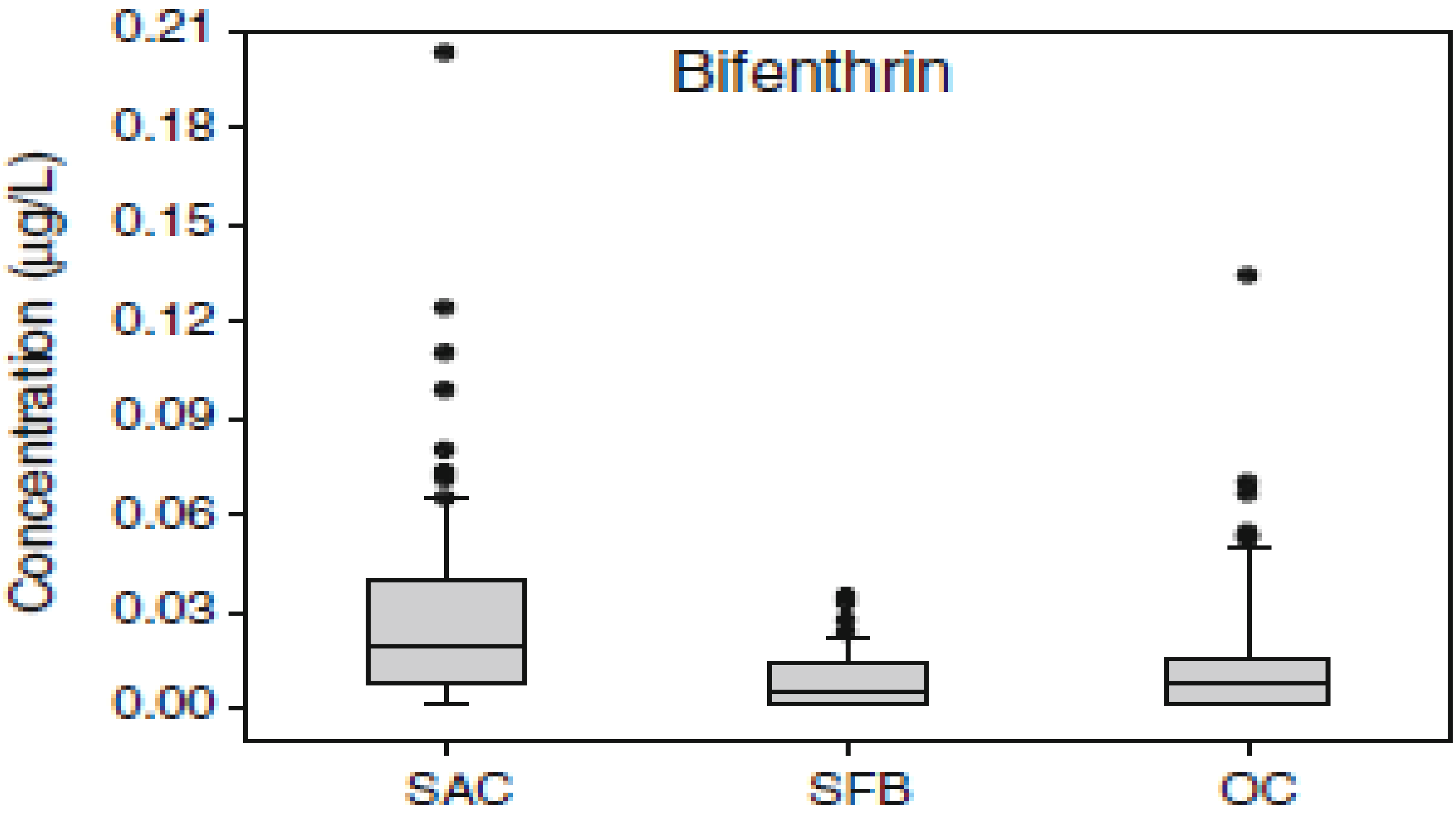
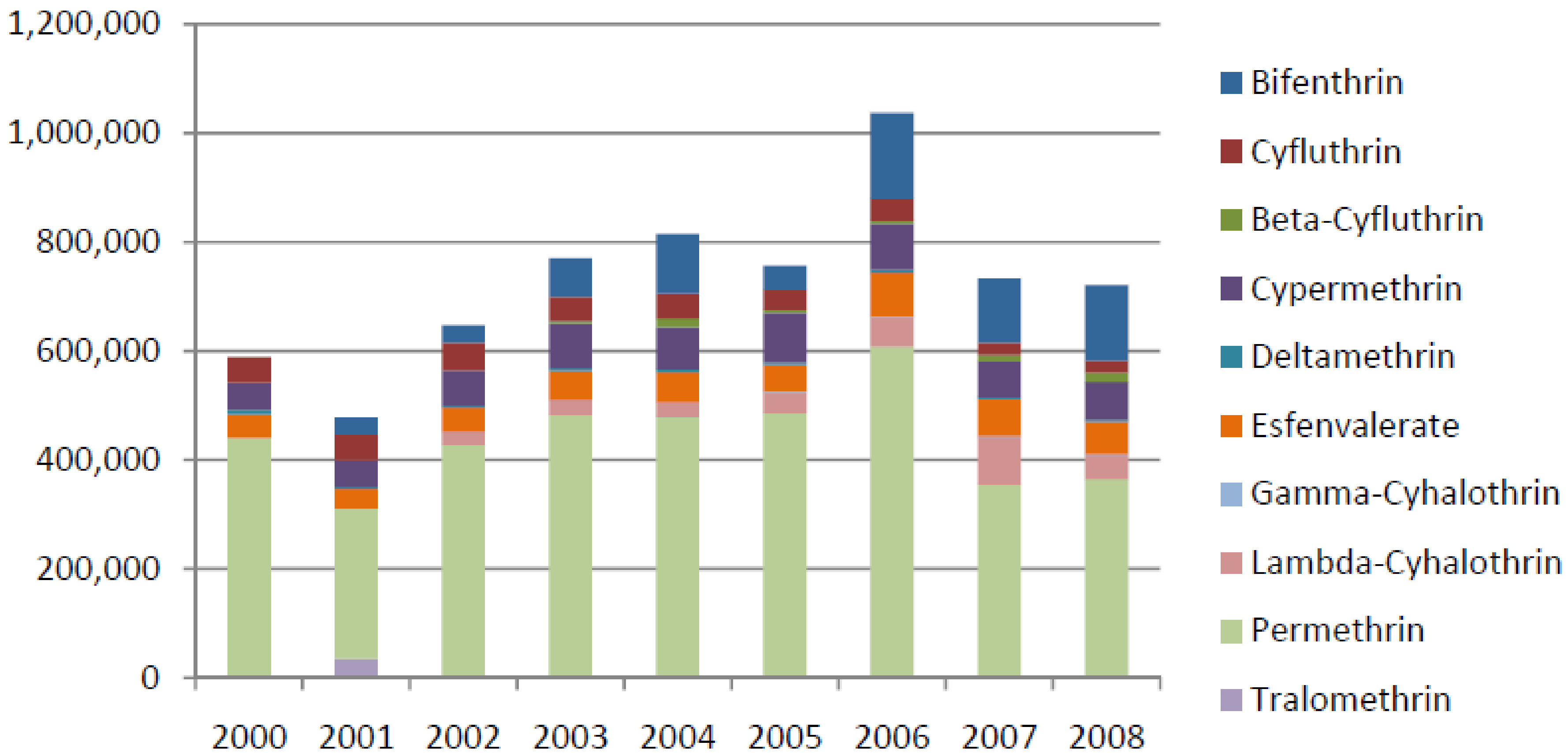


Table 2 Frequency of detected pesticides greater than the minimum aquatic benchmark (BM) listed by the U.S. EPA within three areas of California (units, μL^{-1})

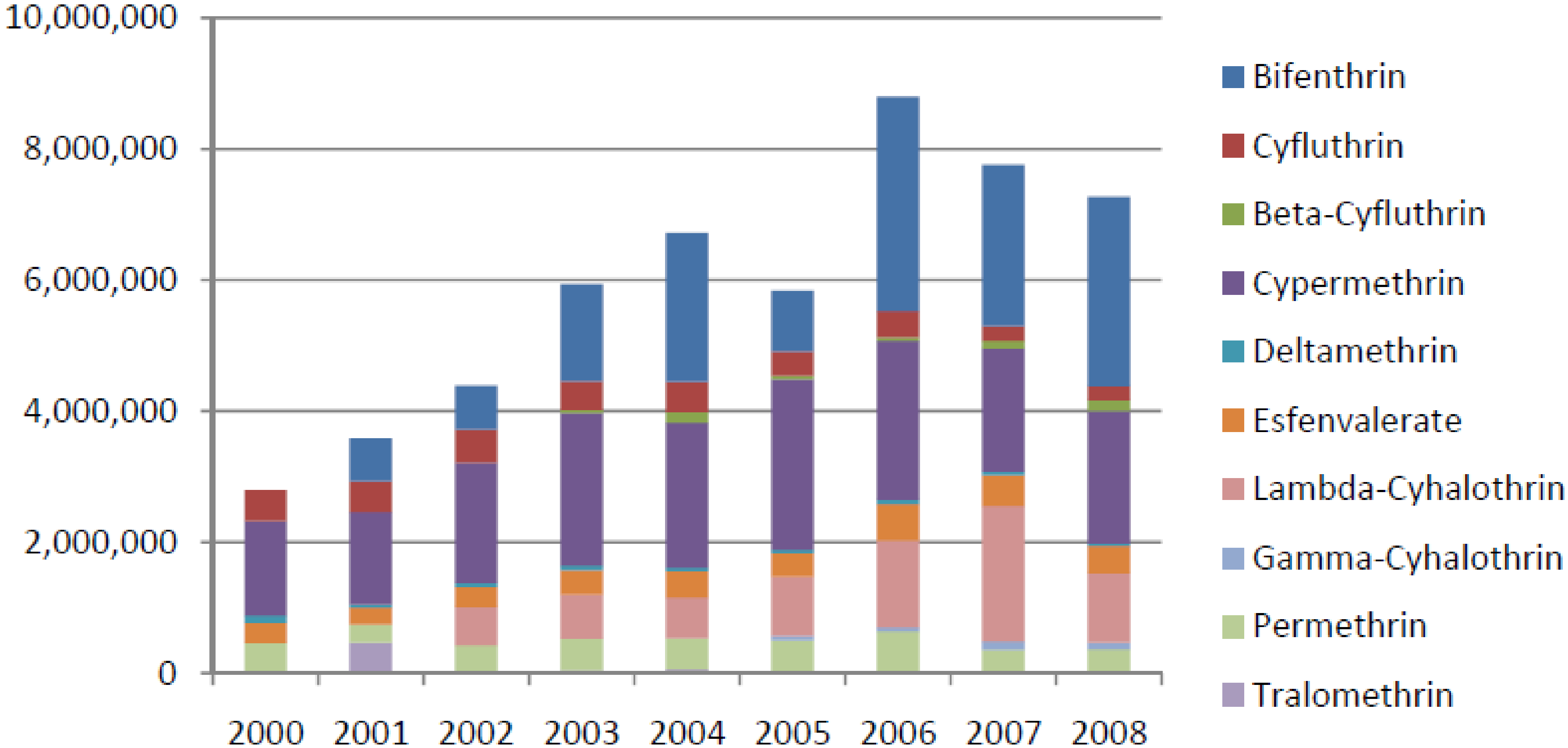
Analyte	RL[a]	Min BM[b]	Area	N	#>RL	Max Result	#>BM (%)
Bifenthrin	0.002, 0.005	0.0013	SAC	82	69	0.20	69 (84)
			SFB	43	24	0.04	24 (56)
			OC	79	54	0.13	54 (68)

Figure 1. California Urban High-Use Pyrethroids Sales 2000-2008 (Pounds of Pesticide Active Ingredient)



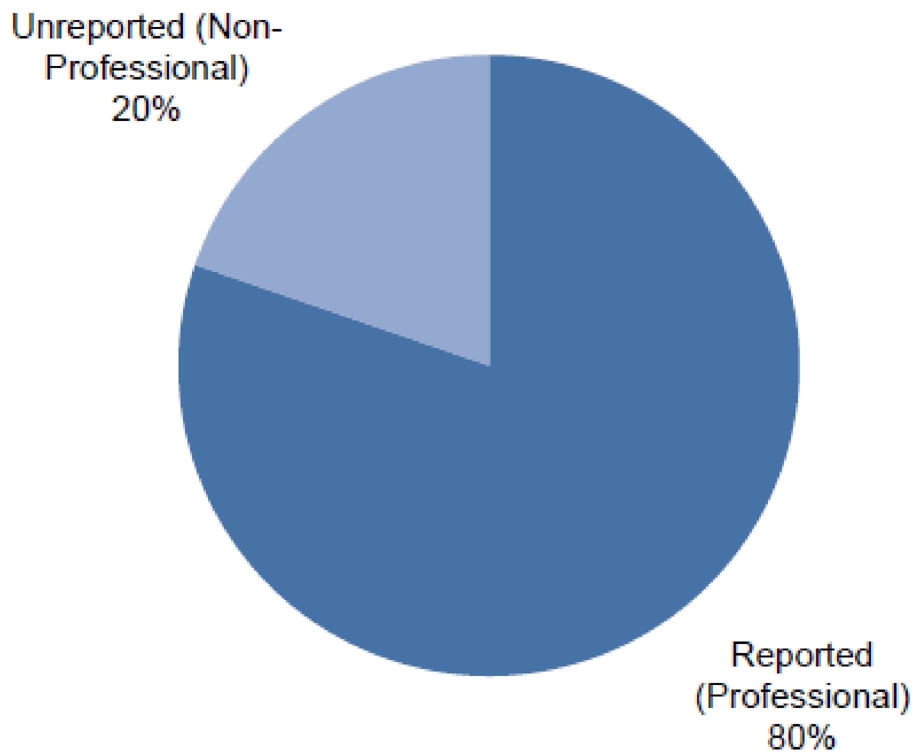
Source: DPR pesticide sales data (DPR 2002a, 2002b, 2003, 2007a, 2007b, 2007c, 2008a, 2008b, 2010). DPR's data include both agricultural and urban product sales.

Figure 2. California Urban High-Use Pyrethroids Sales 2000-2008 (Expressed in Terms of Toxicity Using *Permethrin Equivalents*)



Source: DPR pesticide sales data (DPR 2002a, 2002b, 2003, 2007a, 2007b, 2007c, 2008a, 2008b, 2010). Conversion to *permethrin equivalents* based on values in Table 3. DPR's data include both agricultural and urban product sales.

Figure 14. California Bifenthrin Estimated Urban Use, 2007-2008 2-Year Average (Pounds of Active Ingredient)



Source: DPR pesticide sales data (DPR 2008b, 2010), DPR pesticide use reports (DPR 2008c, 2009), and mathematical calculations (see Section 2).

Effects of drought on urban surface water quality

- Evaporation concentrates contaminants
- Irrigation events may increase in volume, frequency
- Dust management efforts may increase other urban runoff events
  - Washing of vehicles in driveways
  - Driveway wash-offs, hose-downs
- Drought stress may predispose some plants to insect attack → pesticide apps.

UC IPM

Information for pest management professionals and pesticide applicators

UC IPM Green Bulletin

University of California
Agriculture and Natural Resources

Vol. 3 • No. 1 • November 2012

New Restrictions on Pyrethroid Insecticide Applications Protect Urban Surface Waters

On July 19, California's Department of Pesticide Regulation (DPR) introduced new regulations for pyrethroid insecticide applications made in outdoor nonagricultural settings (California Code of Regulations, Title 3, Division 6, Sections 6000, 6970, and 6972: http://www.cdpr.ca.gov/docs/legbills/calcode/chapter_.htm). The United States Environmental Protection

toxic to indicator species representing the small arthropods that make up the base of the aquatic food web. The new regulations address applications of 17 different active ingredients (Table 1; see Page 3) during rain, to standing water, to areas in close proximity to surface waters, and to horizontal and vertical impervious surfaces.

CDPR: New Regulations

- Introduced July 2012
- Enforced January 2013
- California Code of Regulations, Title 3, Division 6, Sections 6000, 6970, and 6972
- http://www.cdpr.ca.gov/docs/legbills/calcode/chapter_.htm

Table 1. New Regulations Affecting Applications of Pyrethroid Insecticides.*

Active ingredient	Some common trade names**
beta-cyfluthrin	some Bayer Advanced products
bifenthrin	Talstar, Allectus, Wisdom, Bisect
bioallethrin	various Wasp and Hornet Killer products
cyfluthrin	Tempo, some Bayer Advanced products
cypermethrin	Demon, Cynoff
deltamethrin	Deltagard, some Enforcer products, Ultratec
esfenvalerate	some Ortho Bug-B-Gone products
fenpropathrin	Tame
gamma-cyhalothrin	some Spectracide products, Optimate
lambda-cyhalothrin	Cyonara, Demand, Scimitar
permethrin	some Enforcer products, Permanone, Astro
phenothrin	Ace, Raid House and Garden Bug Killer
prallethrin	Black Flag Wasps Hornets Yellowjackets Scorpions
resmethrin	Orthonex, Prentox, Rosepride Systemic
S-bioallethrin	Ultratec
tau-fluvalinate	Mavrik, some Bayer Advanced products
tetramethrin	Ortho Hornet & Wasp Killer

* Subject to EPA's Nonagricultural Outdoor Labeling Notification of 2009 and DPR's July 19 regulations regarding nonagricultural applications.

** Containing these active ingredients and registered for landscape or structural use in California.

New Regulations: Prohibited Applications

- Any site during precipitation, except to the underside of eaves;
- Any surface with visible standing water (puddles) or within 25 feet of aquatic habitat located downhill from the application site; and
- Sewers, storm drains, curbside gutters, drainage grates, French drains, or dry creek beds at any time.

New Regulations: Restricted / Limited Applications

- Preconstruction termiticides: prohibited when $\leq$ 25 feet from aquatic habitat or when $\leq$ 10 feet from storm drain system
  - *when located downhill from application*
- To impervious surfaces: limited to pin streams, spot treatments
  - driveways, sidewalks, walls, foundations, fencing, doors, windows, etc.
- Perimeter applications to structures
  - *new limitations*

‘Traditional Perimeter Sprays’

- Allowable under new regulations:
  - Vertical surfaces
    - Up to two feet above grade
  - Horizontal surfaces
    - Only if pervious
      - Soil, mulch, gravel, etc

Restricted / Limited Applications *continued*

- Broadcast applications to pervious surfaces; *turf, landscape, mulch, soil, gravel, etc.*
  - Liquid formulations: NOT within two feet of horizontal impervious surfaces
  - Granular applications: Ok next to impervious surfaces but MUST be swept off, back into treatment area

fmcturfwire.com

fmcturfwire.com

Exempt Applications under New Regulations

- Injection: soil or structural materials: bricks, concrete, or wood
- Post-construction rod or trench termiticide application methods
- Applications to below-ground insect nests or nests made of mud or paper combs
- Applications of baits in weather-proof stations or gel baits
- Pesticide applications to receiving waters for which a permit has been issued under the Statewide General National Pollutant Discharge Elimination System (NPDES) for Pesticide Discharges to Waters of the U.S. from Spray Applications, and Vector Control Applications
- Applications to the underside of eaves
- Foggers or aerosol applications

Regulatory Info | Consumer Info | Benefits | Company Sponsors | Resources & News | Alerts

PWG 2 PMP

Essential Pyrethroids Information for Pest Control Professionals

New Label Requirements!

Professional pest control operators are now required to make changes in how they apply pyrethroid pesticides. The changes are the result of new label requirements at the federal level and new regulations being developed in California.

LEARN MORE

Who We Are

The Pyrethroid Working Group (PWG) is an alliance of companies that manufacture pyrethroid insecticides. The industry has come together to address a wide range of issues specific to pyrethroids, a class of effective and widely used active ingredients for general pest and termite control. Click here to learn more about PWG member companies and links to their individual web pages tailored for Pest Management Professionals.

Why did we create this web site?

The Pyrethroid Working Group is dedicated to making available the most accurate, relevant and current information about pyrethroids. This site has been created especially for Pest Management Professionals as a way to keep them abreast of the latest research and regulatory issues involving pyrethroid insecticides.

Visit our YouTube channel for helpful instructional videos!

Or Click here to download the videos!

Subscribe to Alerts

To keep abreast of the evolving pyrethroids regulatory environment, pest management professionals can sign up for instant notifications via email or text messages with more detailed information and deadlines. Because we respect your privacy, your information will only be used to alert you to new information concerning pyrethroids pesticides. It will not be used for marketing or any other purpose.

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applyresponsibly.org

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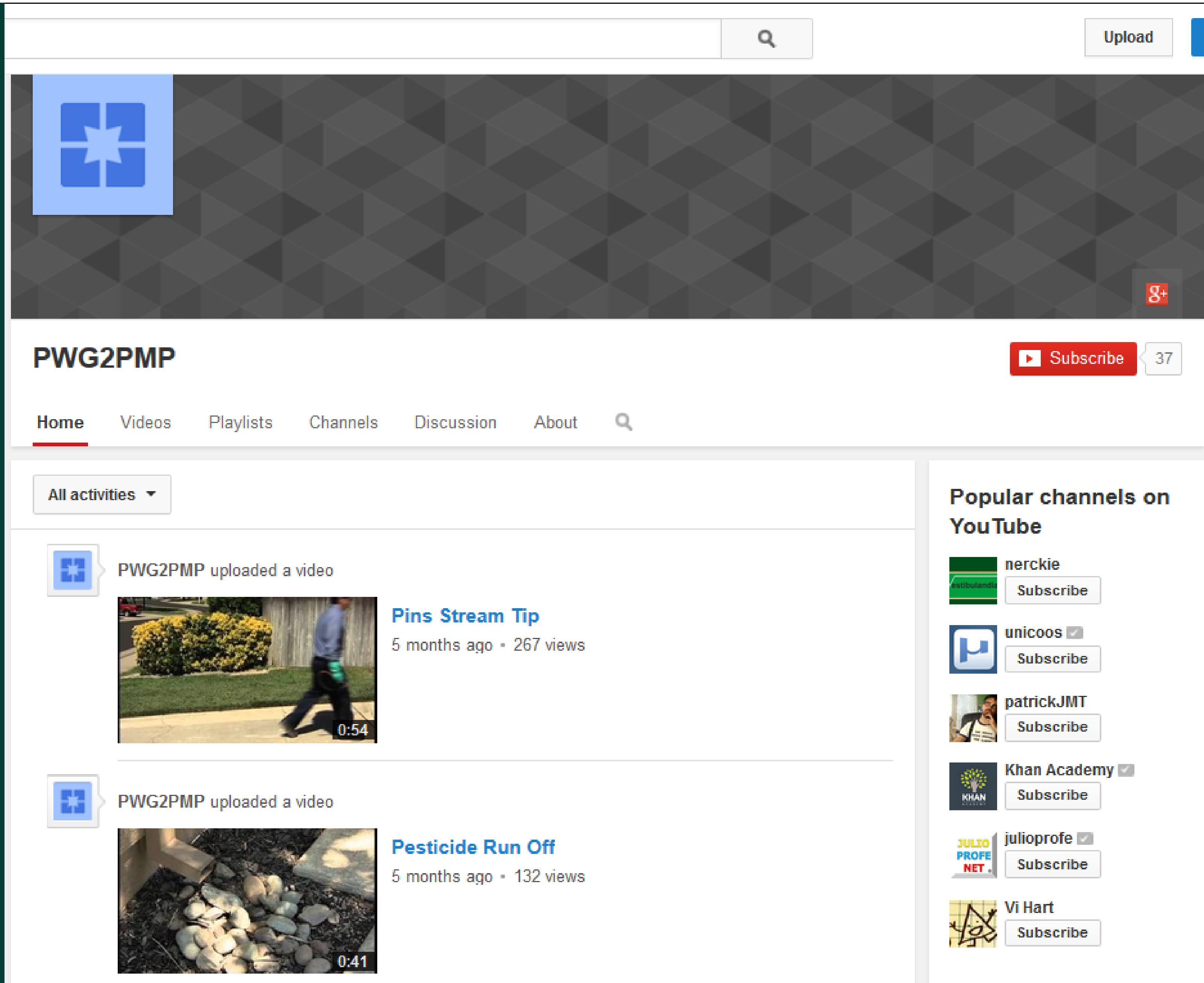
http://pwg2pmp.com/



https://www.youtube.com/user/PWG2PMP?feature=mhee

Alternative Approaches

- IPM Approaches
- Crack-and-crevice or pin-stream only (always allowed)
- Alternative materials???

IPM example: urban ants

- Indoor pest problem
  - Seal cracks, crevices; eliminate leaks
  - Proper sanitation and food storage
  - Liquid / gel bait stations

IPM example: urban ants

- Outdoor pest problem
  - Manage honeydew-producing pests
  - Exclude ants from honeydew
    - Sticky barriers
  - Liquid bait stations
  - Last resort: granular application

Alternative materials

- BEWARE THE PESTICIDE TREADMILL!
- Fipronil
  - Very effective material
  - Professional use only
  - Nonrepellent
  - Slow-acting

Alternative materials

- BEWARE THE PESTICIDE TREADMILL!
- Fipronil
  - Very effective material
  - Professional use only
  - Nonrepellent
  - Slow-acting
  - Very toxic to aquatic invertebrates
  - Increasingly recovered at toxic levels in urban surface waters

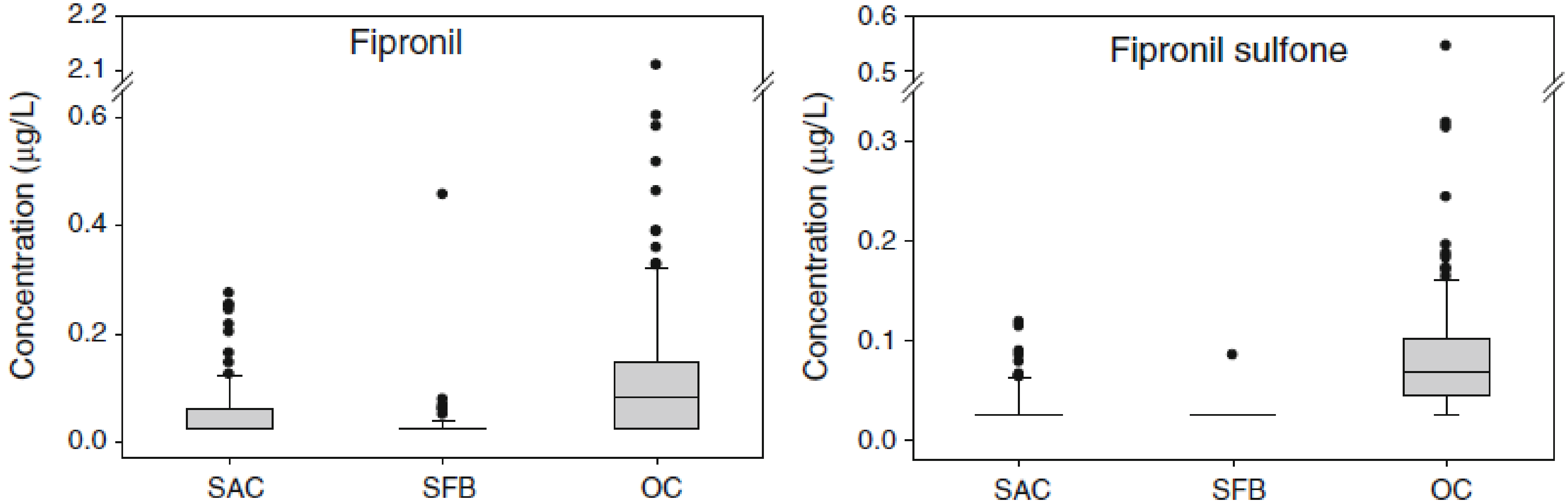


Table 2 Frequency of detected pesticides greater than the minimum aquatic benchmark (BM) listed by the U.S. EPA within three areas of California (units, μL^{-1})

Analyte	RL[a]	Min BM[b]	Area	N	#>RL	Max Result	#>BM (%)
Fipronil	0.05	0.011	SAC	94	32	0.28	32 (34)
			SFB	64	6	0.46	6 (9)
			OC	106	75	2.11	75 (71)
Fipronil sulfone	0.05	0.037	SAC	94	14	0.12	14 (15)
			SFB	64	1	0.09	1 (2)
			OC	106	80	0.55	80 (75)

What's next?

- Fipronil potentially being considered as candidate for new regulations
- Increasing frequency and improved resolution, sensitivity of monitoring
- Neonicotinoids only recently targeted

What's next?

- Fipronil potentially being considered as candidate for new regulations
- Increasing frequency and improved resolution, sensitivity of monitoring
- Neonicotinoids only recently targeted

Good news: IPM will remain viable approach in most cases

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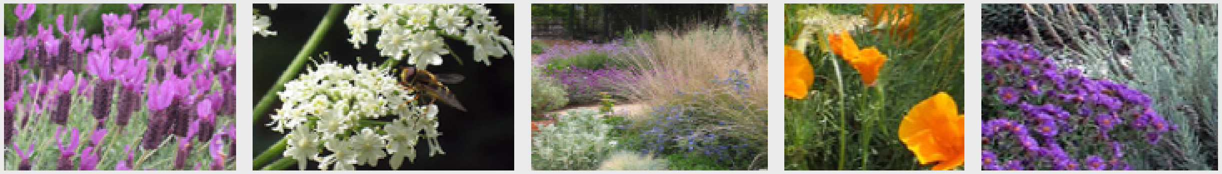

CALIFORNIA CENTER FOR URBAN HORTICULTURE

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Drought Messages for Landscape Managers

This resource for landscape managers includes hyperlinks within the text to more comprehensive references. An extensive list of drought resources and supplementary information for landscape managers and home gardeners can be downloaded here. If you have additional resources to add to this list, please contact us at jjtso@ucdavis.edu.

Reduce irrigation.

Provide only as much water as the landscape requires [1] [2] [3] [4]. Most landscapes are given too much water and can flourish on less. Over-irrigation can actually predispose plants to other problems.

Prioritize the plants that will receive water.

During irrigation restrictions, select those plants that will receive the limited amounts of water available for irrigation. One way to determine this is to think about which plants can tolerate limited water [1] [2] or are more easily replaced. Lower priority plants may be removed from crowded areas to further conserve water.

Upcoming Events

Water Conservation Training for Government Facilities
- INDUSTRY

Mar 12, 2014

Pollinator Gardening Workshop

Registration Closes TODAY at 5:00 PM

Mar 15, 2014

Rose Day 2014
- PUBLIC

Rose Day 2014 is Saturday May 3rd and Sunday May 4th. Agenda will be posted in March.

May 03, 2014

See more events

News

Current Issues in Invasive/Emerging Pests & Diseases Workshop Available for Download

Feb 11, 2014

CCUH is on Twitter!

Jan 29, 2014

More news...

Featured

http://ccuh.ucdavis.edu/industry/drought-messages-for-landscape-managers

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Developing research-based solutions to water-related challenges

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- Drought resources
- Nitrogen Hazard Index
- Rosenberg Forum
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California Drought Resources

In the midst of historic drought, California's academic institutions serve as a tremendous resource both in offering everything from near-term management advice to farmers and ranchers to the innovative work being carried out by researchers on a vast array of issues from drought resistant crops to snow sensors to climate change.

These pages are being continuously updated as we work to bring the resources of the state's universities and colleges to a broad range of communities.

- Drought-related events
- Drought information and resources
- Drought experts list
- Media coverage featuring our experts
- Story highlights

Follow us on Twitter @ucanrwater for drought-related news and updates.

"As California faces its worst drought in decades, water supply and quality for agricultural, urban, and

http://ciwr.ucanr.edu/California_Drought_Expertise/

UCCE / UC IPM resources for commercial landscape IPM

- UC IPM Pest Notes
  - http://www.ipm.ucdavis.edu/PMG/menu.house.html
- UC IPM Green Bulletin
  - http://www.ipm.ucdavis.edu/greenbulletin/
- UC ANR Urban Ants website
  - http://ucanr.edu/sites/UrbanAnts/
- Andrew's Urban IPM website
  - http://ucanr.edu/sites/urbanIPM/Commercial_Landscape_IPM/

FREE

Pest Notes

for Home and Landscape from the University of California

Birds, Mammals, and Reptiles

Bats

Birds on Tree Fruits and Vines

Cliff Swallows

Coyote

Deer

Deer Mouse

Ground Squirrel

House Mouse

Lizards

Moles

Opossum

Pocket Gophers

Rabbits

Raccoons

Rats

Rattlesnakes

Carpenter Bees

Carpenterworm

Carpet Beetles

Citrus Leafminer

Clearwing Moths

Clothes Moths

Cockroaches

Codling Moth

Conenose Bugs

Cottony Cushion Scale

Drywood Termites

Earwigs

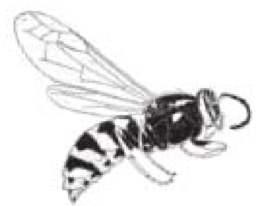
Elm Leaf Beetle

Eucalyptus Longhorned Borers

Eucalyptus Redgum Lerp Psyllid

Eucalyptus Tortoise Beetles

False Chinch Bug



Millipedes and Centipedes

Mosquitoes

Nematodes

Oak Pit Scales

Olive Fruit Fly

Pantry Pests

Psyllids

Red Imported Fire Ant

Redhumped Caterpillar

Removing Honey Bee Swarms and Established Hives

Roses: Insect and Mite Pests and Beneficials

Scales

Scorpions

Sequoia Pitch Moth

Silverfish and Firebrats

http://www.ipm.ucdavis.edu/PDF/PESTNOTES/index.html

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How to Manage Pests

Pests in Gardens and Landscapes

Pocket Gophers

Download PDF | Quick Tip | Nota Breve

Revised 9/09

Adult pocket gopher, *Thomomys* species

Pocket gophers, often called gophers, *Thomomys* species, are burrowing rodents that get their name from the fur-lined, external cheek pouches, or pockets, they use for carrying food and nesting materials. Pocket gophers are well equipped for a digging, tunneling lifestyle with their powerfully built forequarters; large-clawed front paws; fine, short fur that doesn't cake in wet soils; small eyes and ears; and highly sensitive facial whiskers that assist with moving about in the dark. A gopher's lips also are unusually adapted for their lifestyle; they can close them behind their four large incisor teeth to keep dirt out of their mouths when using their teeth for digging.

IDENTIFICATION

Five species of pocket gophers are found in California, with Botta's pocket gopher, *T. bottae*, being most widespread. Depending on the species, they are 6 to 10 inches long. For the most part, gophers remain underground in their burrow system, although you'll sometimes see them feeding at the edge of an open burrow, pushing dirt out of a burrow, or moving to a new area.

Top view of a pocket gopher mound.

Mounds of fresh soil are the best sign of a gopher's presence. Gophers form mounds as they dig tunnels and push the loose dirt to the surface. Typically mounds are crescent or horseshoe shaped when viewed from above. The hole, which is off to one side of the mound, usually is plugged. Mole mounds are sometimes mistaken for gopher mounds. Mole mounds, however, are more circular and have a plug in the middle that might not be distinct; in profile they are volcano-shaped. Unlike gophers, moles commonly burrow just beneath the surface, leaving a raised ridge to mark their path.

One gopher can create several mounds in a day. In nonirrigated areas, mound building is most pronounced during spring or fall when the soil is moist and easy to dig. In irrigated areas such as lawns, flower beds, and gardens, digging conditions usually are optimal year round, and mounds can appear at any time. In snowy

UNIVERSITY OF CALIFORNIA AGRICULTURE & NATURAL RESOURCES

UC IPM Online

Statewide Integrated Pest Management Program

How to Manage Pests

Key to Identifying Common Household Ants

This key includes the ant species that are most likely to be a nuisance around California homes and structures. Many other ant species occur in California, but most are not home invaders. References | Acknowledgment

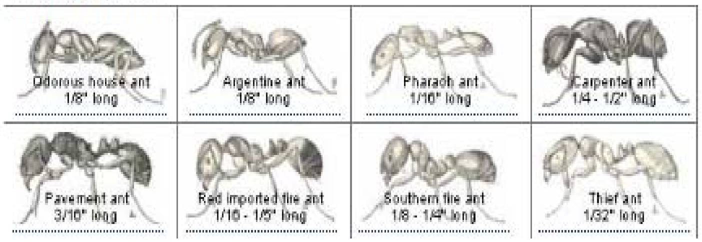
☐ **Begin key**

- Click through the key until you get to a summary screen of the ant that the key identified

Supplementary information

- An introduction to ants
- Quick tips for identifying ants
- PDF version to print (PDF)

Already know your species? Click on an illustration below to go directly to a summary screen



Related information

- Ants Pest Note

PDF: To display a PDF document, you may need to use a PDF reader.

Information for pest management professionals and pesticide applicators

UC IPM

Green Bulletin

University of California
Agriculture and Natural Resources

Vol. 3 • No. 4 • August 2013

Neonicotinoid Insecticide Use Under Increasing Scrutiny

Tight new regulations being imposed by European Union authorities and a widely publicized mass die-off of native pollinators in Oregon (see page 3) have recently brought neonicotinoids to the public's attention. Neonicotinoid insecticides are increasingly being scrutinized by regulators and the public alike throughout the world.

First developed in the late 1980s, neonicotinoids represented the first new class of insecticides in over 50 years. They are nervous-system toxins widely used in agricultural, horticultural, veterinary, and structural settings for broad-spectrum management of pest insects. Desirable qualities such as reduced toxicity to humans and pets (as compared to some organophosphates and carbamates) and systemic activity in plants led to rapid and widespread use. Imidacloprid, the first neonicotinoid developed, is now the most widely-used insecticide in the world. (See Table 1 for other active ingredients and common product names.)

From the beginning, it was recognized that foliar applications of neonicotinoids were quite broad in activity and would have negative impacts on beneficial insects. However, the high water-solubility and environmental persistence of neonicotinoids meant that applications

S.H. DREISTADT, UCIPM

University of California
UrbanAnts

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- What conditions lead to ant infestations?
- Learn More About Urban Ant Pests in and Around Your Home
- Resources for Professionals
- Urban Ant Links for Professionals
- Publications
- Links

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Information for Consumers

Our Goals

Who we are

Workshop: **Impact of New Regulations on Ant IPM**

November 1, 2012

San José, CA

Topics (Click on title for a PDF of the presentation)

PRESENTATIONS FROM 2012 CONFERENCE

IPM Strategies for Controlling Pest Ants

UC Riverside, March 21, 2012
Click HERE for links to PDFs of the

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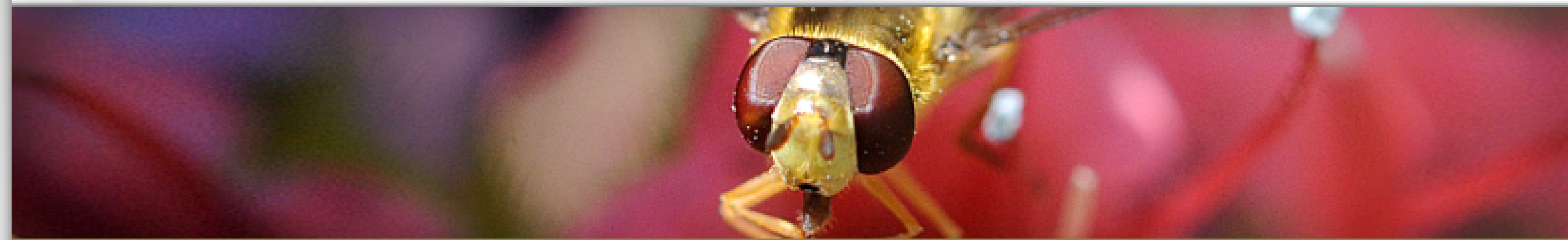

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- Structural / Industrial IPM
- Research Activities
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Commercial Landscape IPM

This page serves as a resource for professional landscape managers seeking information regarding IPM. Regular content updates will inform municipal employees, landscape contractors and supervisors, maintenance gardeners and CDPR licensees (Category B, Subcategory Q) of IPM-related educational programs, ongoing research and current events / topics.

UC IPM Resources for Landscape Professionals

UC Urban Ants: Resources for Professionals

Great resource for child care clients!

IPM Curriculum for Early Care and Education

Professional Landscape Managers Calendar

San Bruno CAPCA ED Seminar
Date: February 21, 2013

CAPCA ED is the premier provider of continuing education (CE) training for California PCAs, QALs, QACs, Private Applicators, Arborists, and other Licensed & Certificate Holders. Andrew will deliver an educational presentation entitled 'What does IPM look like in urban settings?'

Thanks!...Questions?

- Andrew Sutherland
- Bay Area Urban IPM Advisor
- amsutherland@ucanr.edu
- http://ucanr.edu/sites/urbanIPM/
- 510-777-2481 office
- 510-499-2930 cell
- 1131 Harbor Bay Parkway; Alameda

Thanks!

- UC IPM: http://www.ipm.ucdavis.edu/
- Presentation on-line at:
  - http://ucanr.edu/MarinIPM