

Sustainable Gardening

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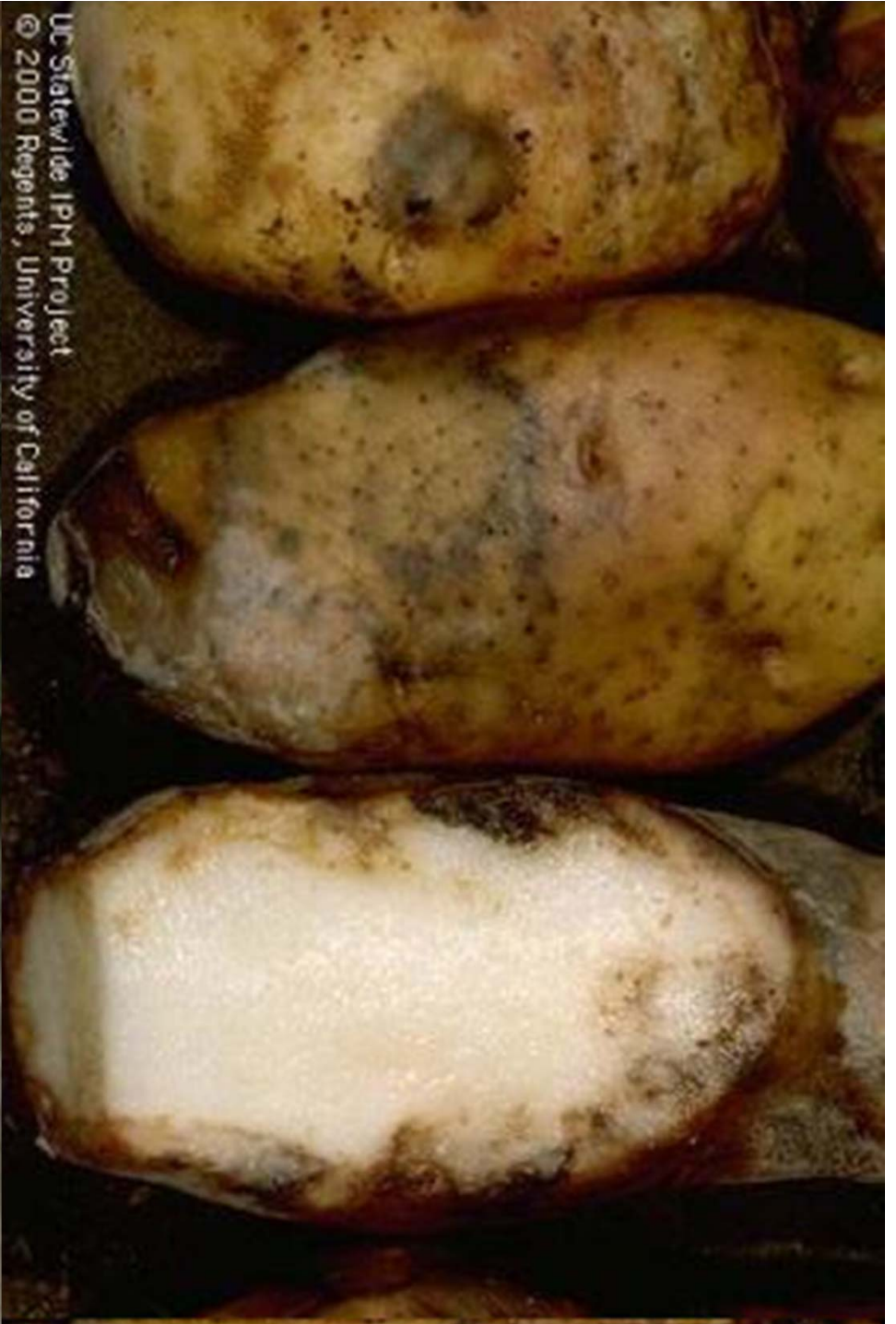
Sustainability: The 3 E's

- Ecological
 - Does it cause lasting damage to the biological systems on which it's based?
- Economic
 - Can it be done profitably?
- Equitable
 - Is the system unjust to others?
- These are heady topics for a garden talk...

2009 east coast tomato and potato failure

- Late blight
 - *Phytophthora infestans*
 - Afflicts
 - Tomatoes
 - Potatoes
 - Others in Solanaceae
- In a well-managed farm:
 - Typically shows up late in the season
 - More of an annoyance than a problem
 - Organics: manageable

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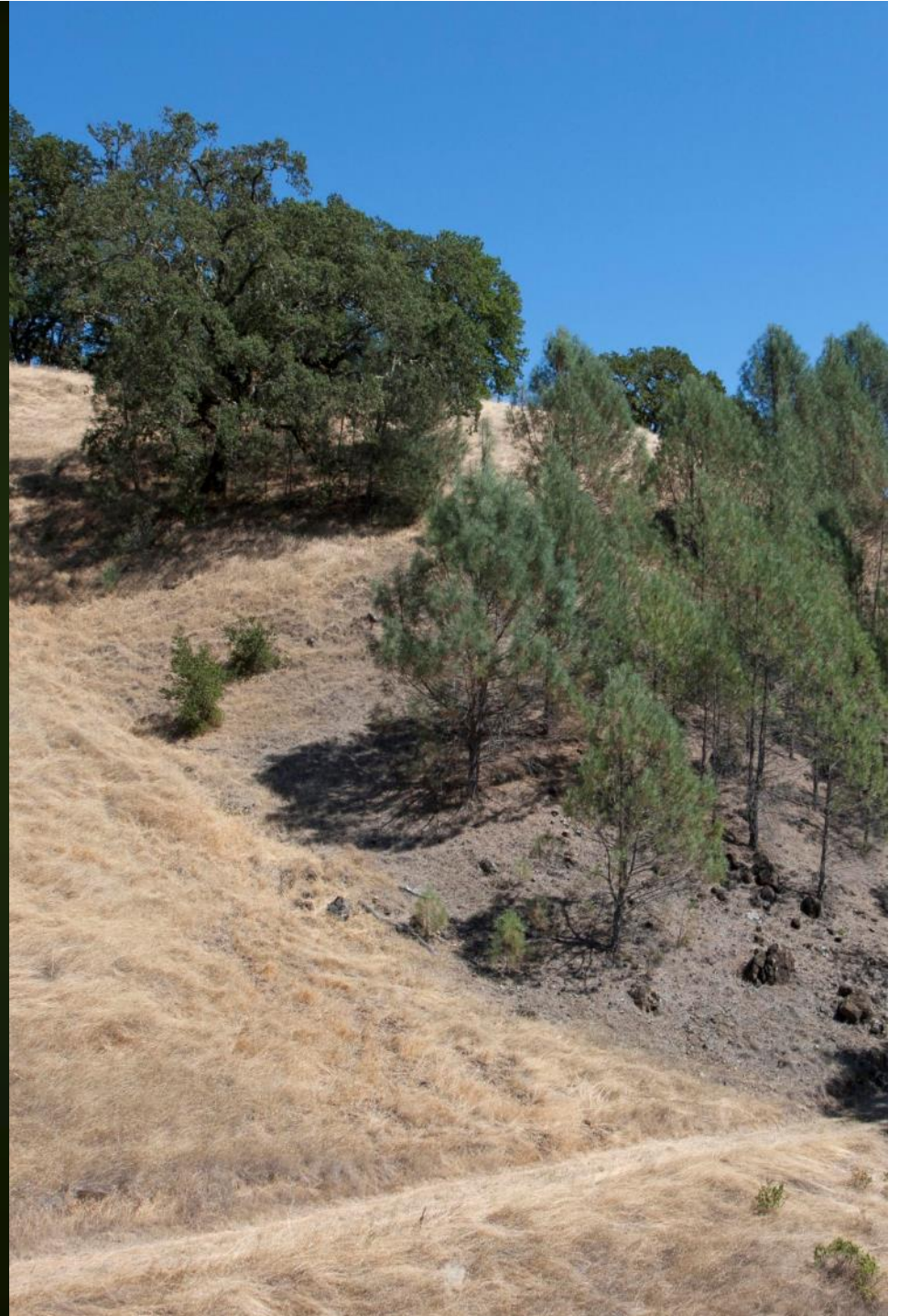


When it's not so well managed ...

- Poor quality control at one (?) big nursery
 - Thousands of infected tomato starts
 - Small gardens > farms
 - 36 million gardens 2008
 - >43 million as of Aug 2009
 - Not a lot of education
 - Pathogen can travel 40 mi
 - Early start to late blight
 - Impact on tomato and potato crops:
 - Conventional: barely manageable
 - Organic: crop loss

So what?

- Water
 - Quantity
 - Quality
- Soil
 - Quantity
 - Quality
- Air
 - Quality
- All connected



Water Quantity: A limited resource

Landscape Water:

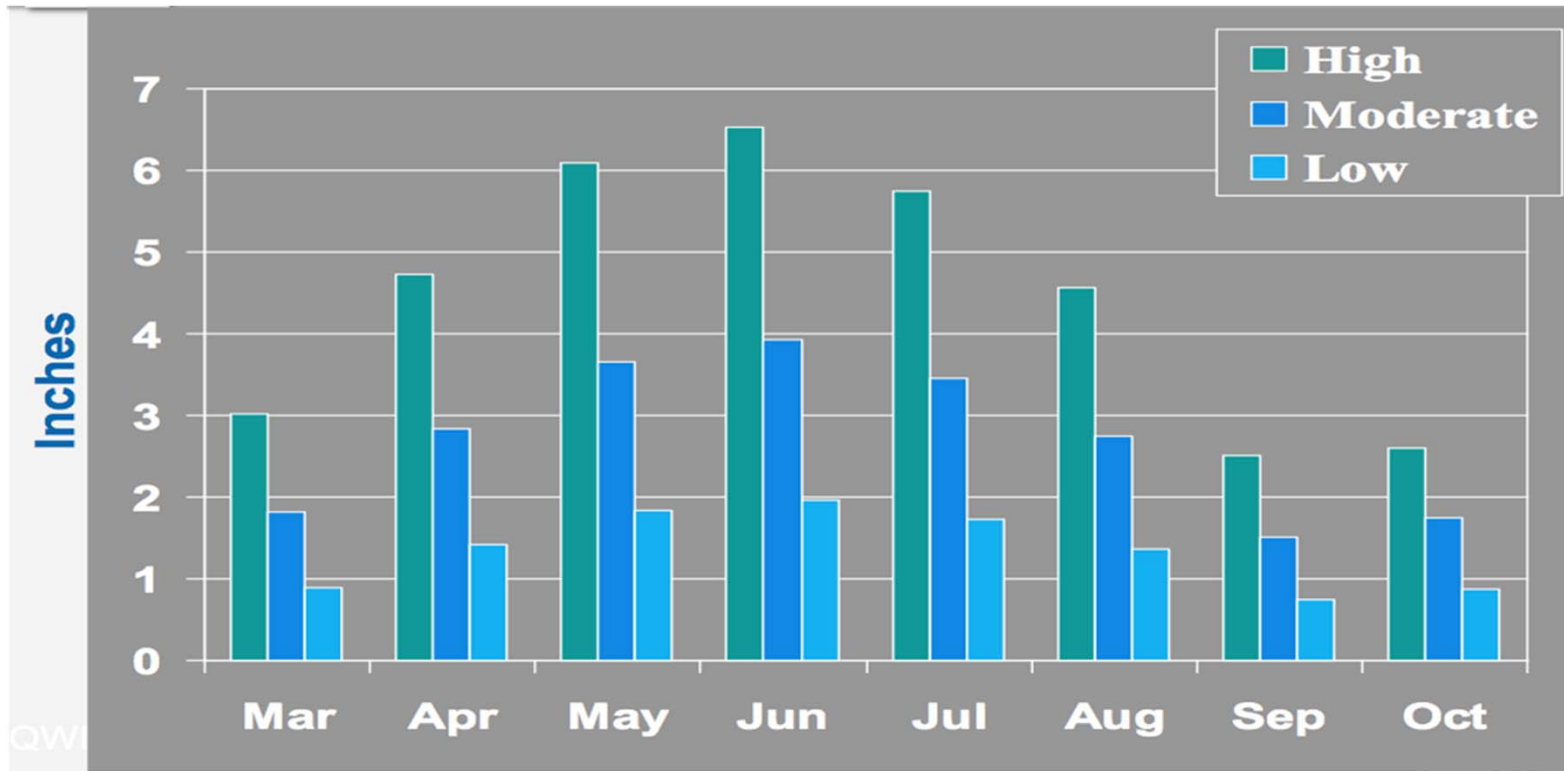
- 50-70% home use
- So Co population to increase 54% by 2050*
- Water use to outpace supply by 2020 **
- Conservation here to stay!
- Water ~ energy

* Sonoma County General Plan 2010

** Sonoma County Water Agency 2011

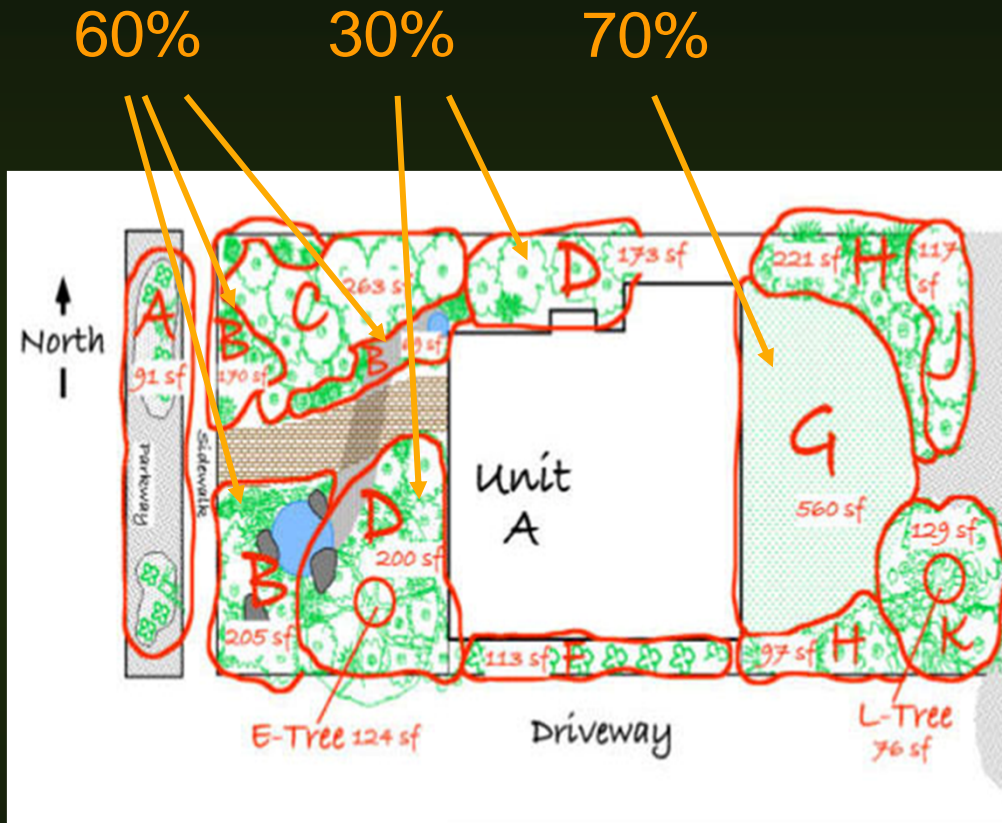


Water Need Through Irrigation Season



Source: Qualified Water Efficient Landscaper Manual

Water where?



- Hydrozone!
- Grouping plants with similar water needs
- Percentages are the proportion of reference Evapo-Transpiration (ET_o)
- WUCOLS as a starting point:
 - <http://ucanr.edu/sites/WUCOLS/>

Water Quality: The easy stuff

- Tap water
 - Under-appreciated?
 - Vs. bottled water
 - Used for irrigation
 - Hidden costs
- Well water
 - The wild west
 - Test it!
 - Dropping groundwater
 - Increasing costs
 - Ideal for irrigation?
 - Salt issues?
 - Potability?
 - Increased regulation



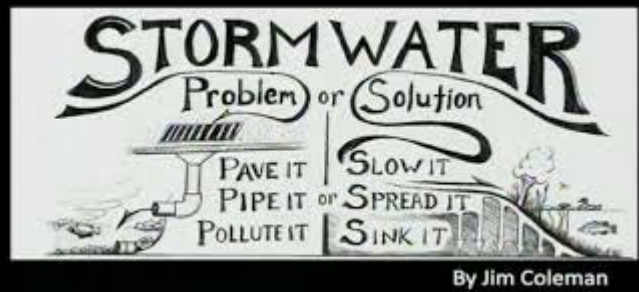
Image: info.forwater.com

Water Quality: The harder stuff

- Recycled water
 - (Grey water)
 - Salt issues?
 - Non-potable (?)
- Harvested water
 - Over-regulated?
 - Non-potable (?)
 - Low salt
 - Cost per gallon?
- Issues
 - Erosion
 - Other contaminants



Protect Water Quality



- Mulch (no real definition)
- Minimize pesticide & herbicide use by using IPM practices
- Avoid over fertilization by soil testing to understand your garden's specific needs
 - Determine needs and fertilize organically when you can!
- *Keep water on your property (slow it, spread it, sink it!)*
 - Integrate water catchment & reuse strategies



Avoid Over-fertilization

- Test soil – nutrient analysis
- Naturally derived fertilizers for slow release, e.g.:
 - Blood meal
 - Bone meal
 - Fish meal





Soil Quantity: Erosion

- Natural topsoil formation
 - 1 inch ~ 1000 years
 - Serpentine: longer
- Topsoil loss
 - Often unintentional
 - Sometimes unavoidable
- Topsoil building
 - Mulch
 - Compost
 - Cover cropping
 - Time & water

We Can Do It!



1943 THE U.S. GOVERNMENT

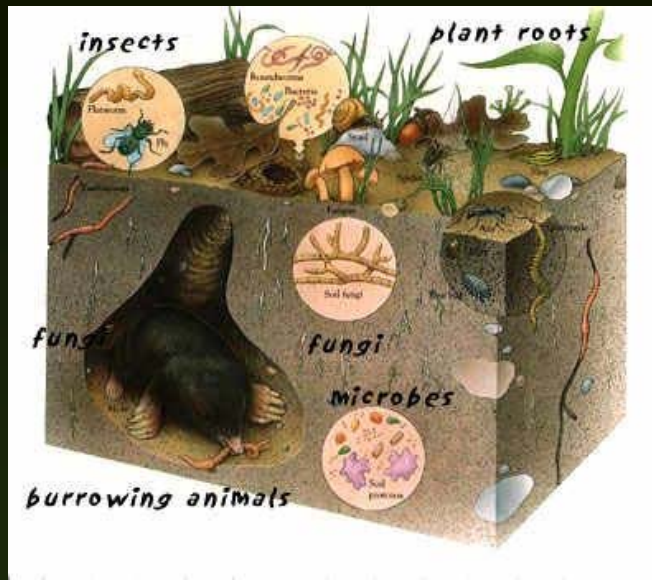


WAR PRODUCTION COORDINATING COMMITTEE

ALL FORGET

Soil Quality: Carbon

- Highly variable
 - Serpentine:
 - California's state soil!
 - High Mg:Ca ratio
 - Clays get a bad rap
 - Much of the problem may be inherited from previous owners
 - "Abiotic"
- We can rebuild it
 - Parent material
 - Soil testing
 - Your own carbon sequestration project (air)



Nurture the Soil



- Know your soil type, pH, and its nutrient strengths and weaknesses
- Minimize erosion w/plants & mulch
- Consider alternatives to tilling
- Avoid soil compaction
- Compost on site (?)
- Utilize cover crops where appropriate



Low Input Gardening

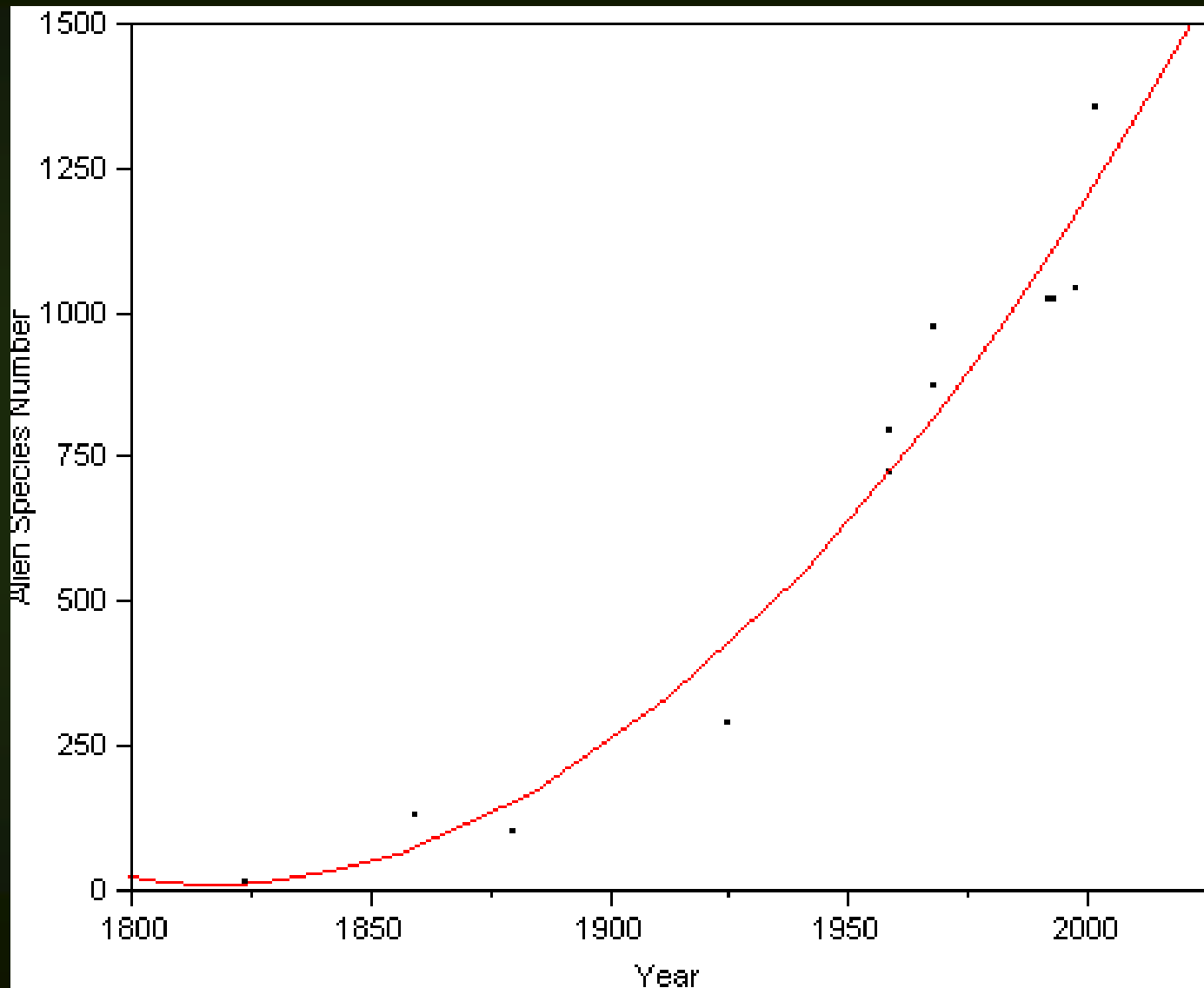
- What might a garden look like if you didn't add ANYTHING?
- Or maybe ...
- Or maybe someone would be kind enough to landscape it for us

Photo: Lonely Planet Images



We've been bringing an awful lot of stuff into California

Invasion Rate is Increasing



Source: Daniel Gluesenkamp, CalFlora

$R^2 = 0.95, p < 0.0001$

Later data points: Fred Hrusa







Citrus leafminer

- Only attacks young leaves
- Winding tunnels with clear “film”
- Inconspicuous larvae
- Parasites are here
- More info:

<http://www.ipm.ucdavis.edu/PMG/r107303211.html>



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Polyphagous shot hole borer

- As far north as Ventura
- Kills many tree species
 - Coast live & black oak
 - Sycamore
 - Boxelder and maple
 - Cottonwood & willows
 - White alder
 - Wisteria and ...
- Don't move firewood
- Report suspected finds
- More info:
 - http://ucanr.edu/sites/socaloakpests/Polyphagous_Shot_Hole_Borer/

Asian Citrus Psyllid (ACP)

- Head down pose
- Curlycue wax filaments
- Carries Huanglongbing (HLB) disease
- HLB kills citrus
- ACP found recently in Pacifica / S. S.F.
- Report immediately
- More info:

<http://www.ipm.ucdavis.edu/PMG/C/D-CI-CAND-FF.001.html>





Solve your pest problems with UC's best science

Announcements

- o [UC IPM Web site begins makeover](#)
- o [New! Vineyard Pest Identification and Monitoring Cards](#)

What's New

- o [Green Bulletin November 2011 issue](#)
- o [New Year-Round IPM Programs: Asparagus, Corn, Cucurbits, Peppers](#)
- o [Revised Pest Notes: House Mouse, Rats, Lawn Diseases, Bee and Wasp Stings](#)
- o [More...](#)

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Home, Garden, Turf & Landscape Pests



Agricultural Pests



Natural Environment Pests



Exotic & Invasive Pests



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Home, garden, turf, & landscape pests

University of California's official guidelines for managing pests with environmentally sound methods. ([More...](#))

Search home & landscape:

Pests of homes and structures

- [Household](#): pests of homes, structures, people and pets
 - Pests that sting, bite, or injure
 - Wood-destroying, food, fabric, and nuisance pests
 - Vertebrate pests birds, mammals, and reptiles.

Pests in gardens and landscapes

Choose a plant to find the most likely source of your pest problem

- [Flowers](#)
- [Fruit trees, nuts, berries, and grapevines](#)
- [Lawns and turf](#), including comprehensive lawn guide
- [Trees and shrubs](#), including roses and other ornamentals
- [Vegetables and melons](#)

Some common pests and methods

- Birds, mammals, and reptiles: vertebrate pests



Metrosideros	<i>Metrosideros</i> spp.	Myrtaceae (Myrtle family)
Mexican blue palm	<i>Brahea armata</i>	Arecaceae (Palm family)
Mexican fan palm	<i>Washingtonia robusta</i>	Arecaceae (Palm family)
Mexican orange	<i>Choisya ternata</i>	Rutaceae (Rue family)
Mimosa	<i>Albizia</i> spp.	Fabaceae (Pea family)
Mock orange	<i>Choisya ternata</i>	Rutaceae (Rue family)
Monkey flower	<i>Diplacus</i> spp.	Scrophulariaceae (Figwort family)
Monkey flower	<i>Mimulus</i> spp.	Scrophulariaceae (Figwort family)
Monkey puzzle tree	<i>Araucaria</i> spp.	Araucariaceae (Araucaria family)
Mountain ash	<i>Sorbus</i> spp.	Rosaceae (Rose family)
Mountain mahogany	<i>Cercocarpus</i> spp.	Rosaceae (Rose family)
Mugwort	<i>Artemisia</i> spp.	Asteraceae (Sunflower family)
Mulberry	<i>Morus</i> spp.	Moraceae (Mulberry family)
Myoporum	<i>Myoporum</i> spp.	Myoporaceae (Myoporum family)
Myrtle	<i>Melaleuca</i> spp.	Myrtaceae (Myrtle family)
Nandina	<i>Nandina domestica</i>	Berberidaceae (Barberry family)
Natal plum	<i>Carissa grandiflora</i>	Apocynaceae (Dogbane family)
Natal plum	<i>Carissa macrocarpa</i>	Apocynaceae (Dogbane family)
New Zealand Christmas tree	<i>Metrosideros</i> spp.	Myrtaceae (Myrtle family)
Norfolk island pine	<i>Araucaria</i> spp.	Araucariaceae (Araucaria family)
Oak	<i>Quercus</i> spp.	Fagaceae (Beech family)
Oleander	<i>Nerium oleander</i>	Apocynaceae (Dogbane family)
Olive	<i>Olea europaea</i>	Oleaceae (Olive family)
Orchid tree	<i>Bauhinia</i> spp.	Fabaceae (Pea family)
Oregon grape	<i>Mahonia</i> spp.	Berberidaceae (Barberry family)
Oregon myrtle	<i>Umbellularia californica</i>	Lauraceae (Laurel family)
Ornamental pear	<i>Pyrus</i> spp.	Rosaceae (Rose family)
Palm	Many species	Arecaceae (Palm family)
Palmetto palm	<i>Sabal palmetto</i>	Arecaceae (Palm family)
Palo verde	<i>Cercidium</i> spp.	Fabaceae (Pea family)
Paperbark	<i>Melaleuca</i> spp.	Myrtaceae (Myrtle family)
Pepper tree	<i>Schinus molle</i>	Anacardiaceae (Sumac family)
Pepperwood	<i>Umbellularia californica</i>	Lauraceae (Laurel family)
Persimmon	<i>Diospyros</i> spp.	Ebenaceae (Ebony family)
Photinia	<i>Photinia</i> spp.	Rosaceae (Rose family)
Pindo palm	<i>Butia capitata</i>	Arecaceae (Palm family)
Pine	<i>Pinus</i> spp.	Pinaceae (Pine family)
Pittosporum	<i>Pittosporum</i> spp.	Pittosporaceae (Pittosporum family)
Podocarpus	<i>Podocarpus</i> spp.	Podocarpaceae (Podocarpus family)
Pongamia	<i>Pongamia pinnata</i>	Fabaceae (Pea family)

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Oak—*Quercus* spp. Family Fagaceae (Beech family)

Plant identification

Oaks are deciduous or evergreen trees with acorns.

Optimum conditions for growth

Oaks grow in various climatic zones and do well in full sun.



Leaves of valley oak

© 1995 Br. Alfred Brousseau, Saint Mary's College of California



Fall color of pin oak

Pests and disorders of *Quercus* spp.

Invertebrates

- [Acorn moth](#)
- [Aphids](#)
- [Armored scales](#)
 - Obscure scale
- [Bark beetles](#)
 - Ambrosia beetles
 - Oak bark beetles
- [Carpenterworm](#)
- [Clearwing moth borers](#)
 - Sycamore borer
- [Filbertworm, filbert weevil, and acorn moth](#)
- [Flatheaded borers](#)
 - Flatheaded apple tree borer
 - Goldspotted oak borer (5 MB, PDF)
 - Oak twig girdler
 - Pacific flatheaded borer
- [Foliage-feeding caterpillars](#)
 - California oakworm
 - Fruit tree leafroller
 - Tent caterpillars
 - Tussock moths
- [Foliage miners](#)
 - Leafminers
 - Oak ribbed casemaker
 - Shield bearers
 - Skeletonizers
- [Fuller rose beetle and Live oak weevil](#)
- [Gall and blister mites](#)
 - Live oak erineum mite
- [Gall makers](#)
 - California gallfly
 - Cynipid gall wasps
 - Ichneumonid wasps
 - Jumping oak gall wasp
 - Twohorned oak gall wasp
- [Glassy-winged sharpshooter](#)
- [Mealybugs](#)

Invertebrates (cont.)

- [Roundheaded borers](#)
 - Roundheaded oak twig borer
- [Soft scales](#)
 - Kermes scales, black-punctured kermes
 - Oak lecanium scale
- [Spider mites](#)
 - Sycamore spider mite
- [Treehoppers](#)
 - Oak treehopper
- [Whiteflies](#)
 - Crown whitefly
 - Gelatinous whitefly
 - Stanford whitefly
- [Woolly aphids](#)
 - Woolly oak aphid

Diseases

- [Anthracnose](#)
- [Armillaria root rot](#)
- [Canker diseases](#)
 - Hypoxylon canker
 - Nectria canker
- [Drippy oak acorns](#)
- [Foamy canker](#)
- [Oak branch dieback](#)
- [Oak leaf blister](#)
- [Oak twig blight](#)
- [Powdery mildew/Witches' broom](#)
- [Root and crown rots](#)
- [Rusts](#)
- [Sudden oak death](#)
- [Wetwood](#)
- [Wood decay](#)

Environmental disorders

- [Leaf burn](#)
- [Leaf scorch](#)
- [Mineral deficiencies](#)

How to Manage Pests

Pests in Gardens and Landscapes

Powdery Mildew on Ornamentals

Revised 4/09



In this Guideline:

- [Identification and damage](#)
- [Life cycle](#)
- [Management](#)
- [About Pest Notes](#)
- [Publication](#)
- [Glossary](#)

Powdery mildew is a common disease on many types of plants and is prevalent under the diverse conditions that cause disease on different plants. These fungi tend to infect either plants in the same family or only one

IDENTIFICATION AND DAMAGE

You can recognize this disease by the white, powdery mycelial and spore growth that forms on [leaf surfaces](#) may infect new or old foliage. This disease can be serious on woody species such as rose, crape myrtle, [flowers](#), and leaves. New growth may be [dwarfed](#), distorted, and covered with a white, powdery growth. [Healthy leaves](#).

LIFE CYCLE

All powdery mildew fungi [require living plant tissue to grow](#). On perennial hosts such as roses, powdery mildew forms buds or as spherical fruiting bodies, called [chasmothecia](#), on the bark of branches and stems.

Most powdery mildew fungi grow as [thin layers of mycelium](#) on the surface of the affected plant parts. Spores have a powdery appearance of this fungi and are produced in chains on upper or lower leaf surfaces or on flower parts. This fungal disease that produces visible powdery growth, has spores that grow on [branched stalks](#) and look like a fine powder on leaf surface. Environmental conditions that favor the growth of downy mildew are different from those that favor the growth of powdery mildew, and free moisture.

Wind carries powdery mildew spores to new hosts. Although relative humidity requirements for germination vary, the absence of free water. In fact, water on plant surfaces for extended periods inhibits germination and kills spores. Temperatures of 60° to 80°F and shady conditions generally are the most favorable for powdery mildew development. Powdery mildew is killed by sunlight, and leaf temperatures above 95°F may kill the fungus.

MANAGEMENT

The best method of control is prevention. Avoiding the most susceptible cultivars, placing plants in full sun, and avoiding mildew in many situations. Some ornamentals do require protection with fungicide sprays if mildew conditions are severe on crape myrtle. (See Table 1.) For a list of other common ornamentals susceptible to powdery mildew, see Table 2.

Table 1. Host Plants and Control Measures for Powdery Mildew Species.

Fungus species	Hosts
<i>Gaiovinomyces cichoracearum</i>	begonia, Composite family (chrysanthemum, dahlia, phlox, sunflower, and zinnia)
<i>Erysiphe lagerstroemiae</i>	crape myrtle
<i>Sphaerotheca pannosa</i>	rose

Table 2. Common Ornamentals Susceptible to Powdery Mildew.

Common Name	Susceptible
aster	crape myrtle
azalea (deciduous)	dahlia

Cenicilla

Puntos de un blanco cenizo en las hojas y brotes pueden ser señal de cenicilla. Esta enfermedad afecta muchas plantas y puede ser causada por diferentes tipos de hongos. Para combatir la cenicilla use variedades de plantas resistentes a este hongo y altere el ambiente en que crecen. En algunos casos, ciertas especies de plantas susceptibles a estos hongos requerirán tratamiento con fungicidas.

Los síntomas pueden variar de una especie a otra.

- Use piedra lisa o baldosas, adoquines o concreto permeable para senderos y patios en lugar de superficies impermeables como el concreto y asfalto.
- Las hojas se tornan amarillentas o café y se caen, exponiendo a la planta o fruto a las quemaduras del sol.
- En algunos casos, las hojas o los brotes se tuercen o distorsionan.
- Las frutas y verduras usualmente no se ven afectadas, pero los manzanos, vid y otras frutas con hueso pueden desarrollar unas marcas rojizas en forma de telaraña o áreas suberosas.

La cenicilla es común en condiciones cálidas y secas.

- A diferencia de muchas enfermedades, la cenicilla no necesita de condiciones húmedas para desarrollarse y su crecimiento es inhibido por el agua en la primavera.
- Las temperaturas moderadas (60°F a 80°F) y la sombra favorecen el desarrollo de la enfermedad.

Haga a las plantas menos susceptibles alterando el ambiente en el que crecen.

- Cultive las plantas en sitios soleados.
- Poda el exceso de follaje para permitir el paso del aire.
- No fertilice en exceso con nitrógeno ya que el follaje frondoso y la sombra favorecen a la enfermedad.

Plante variedades resistentes.

Las variedades de plantas muy susceptibles que son resistentes o menos susceptibles, incluyen:

- Las ornamentales: mirto, rosa, platanero, rododendro y zinnia.
- Frutas: manzano, duraznero y frambuesa.
- Verduras: melones, calabazas, pepinos, frijoles y chícharos.



Considere usar métodos sin el uso de materiales químicos.

- Rocíe las plantas infectadas con agua. Para prevenir problemas con otras enfermedades, haga esto a media mañana para que se sequen rápidamente. Agregue un poquito de jabón al agua para puede aumentar la efectividad.
- Durante la temporada en la que no se produce fruto, corte las partes y los brotes que muestren una infección leve. Asegúrese de sacar de su jardín cualquier material infectado para que las esporas no se esparzan a nuevas áreas.

Las variedades susceptibles de algunas plantas pueden requerir el uso de fungicidas.

- Las plantas que requieren de tratamiento con mayor frecuencia son los manzanos, zarzamora, vid, rosales y cucurbitáceas.
- Controle las infecciones leves a moderadas de la cenicilla usando aceite de horticultura o aceites a base de plantas como el de árbol de neem o de jojoba, o fungicidas a base de bicarbonato de sulfuro. No aplique los aceites en donde haya usado bicarbonato de sulfuro o cuando la temperatura rebase los 90°F.
- Prevenga las infecciones usando sulfuros solubles en agua, en especial los que vienen listos para usarse y formulados con agentes tensoactivos parecidos al jabón. Estos productos son ineficaces si se aplican cuando la infección ya ha aparecido. Podría ser necesario repetir la aplicación.
- Existen otros fungicidas para otros tipos de plantas, pero la mayoría se deben aplicar antes de que aparezcan los primeros brotes de la enfermedad.

Para mayores detalles en inglés, vea [Pest Notes: Powdery Mildew on Fruits and Berries](#), [Powdery Mildew on Ornamentals](#), and [Powdery Mildew on Vegetables](#) a www.ipm.ucdavis.edu, o visite las oficinas de Extensión Cooperativa.



Reduzca al mínimo el uso de pesticidas que contaminan nuestros canales. Utilice alternativas sin químicos o productos pesticidas menos tóxicos siempre que sea posible. Lea las etiquetas de los productos cuidadosamente y siga las instrucciones sobre el uso, almacenamiento y desecho correcto.

Pida mayores informes sobre control de plagas a la oficina local de Extensión Cooperativa de la Universidad de California que se encuentra en las páginas del gobierno del condado en el directorio telefónico o visite la página en la Red del Programa Integrado de Control de Plagas de la UC, www.ipm.ucdavis.edu.



¡Lo que usted usa en sus paisajes afecta nuestros ríos y océanos!

UC IPM

- Environmental themes mentioned in management section
- Many other treatment options too
- Cultural and design options a good starting point
 - Especially if you can cure more than one problem

All powdery mildew fungi require living plant tissue to grow. On perennial hosts such as roses, powdery mildew survives from one season to the next as vegetative strands in buds or as spherical fruiting bodies, called chasmothecia, on the bark of branches and stems.

Most powdery mildew fungi grow as thin layers of mycelium on the surface of the affected plant parts. Spores, which you can see with a hand lens, are part of the white, powdery appearance of this fungi and are produced in chains on upper or lower leaf surfaces or on flowers, fruits, or herbaceous stems. In contrast, downy mildew, another fungal disease that produces visible powdery growth, has spores that grow on branched stalks and look like tiny trees. Also, downy mildew spores occur mostly on the lower leaf surface. Environmental conditions that favor the growth of downy mildew are different from those that favor powdery mildew and include low temperatures of 50° to 70°F, a relative humidity of 90% or higher, and free moisture.

Wind carries powdery mildew spores to new hosts. Although relative humidity requirements for germination vary, all powdery mildew species can germinate and infect in the absence of free water. In fact, water on plant surfaces for extended periods inhibits germination and kills the spores of most powdery mildew fungi. Moderate temperatures of 60° to 80°F and shady conditions generally are the most favorable for powdery mildew development. Powdery mildew spores and mycelium are sensitive to extreme heat and sunlight, and leaf temperatures above 95°F may kill the fungus.

MANAGEMENT

The best method of control is prevention. Avoiding the most susceptible cultivars, placing plants in full sun, and following good cultural practices will adequately control powdery mildew in many situations. Some ornamentals do require protection with fungicide sprays if mildew conditions are more favorable, especially susceptible varieties of rose and crape myrtle. (See Table 1.) For a list of other common ornamentals susceptible to powdery mildew, see Table 2.

Table 1. Host Plants and Control Measures for Powdery Mildew Species.

Fungus species	Hosts	Control
<i>Gouyonomyces siphocacearum</i>	begonia, Composite family (chrysanthemum, dahlia, phlox, sunflower, and zinnia)	water
<i>Erysiphe lagerstroemiae</i>	crape myrtle	resist
<i>Sphaerotheca pannosa</i>	rose	resist neob

Table 2. Common Ornamentals Susceptible to Powdery Mildew.

Susceptible Plant		Control
aster	crape myrtle	oe
azalea (deciduous)	dahlia	pe
begonia (tuberous)	delphinium	ph
calendula	eucalyptus	re
California poppy	forget-me-not	ro



Photo: UCCE Sonoma Christine Casey?

Know and help the good guys

- Pollinators
 - <https://anrcatalog.ucanr.edu/pdf/8518.pdf>
- Predators
- Parasitoids
- Building better neighborhoods
 - Food (& water?)
 - Shelter
 - Natives
 - <http://www.xerces.org/farming-with-native-beneficial-insects/>



The Four Basic Wildlife Needs: Food, Water, Cover and Space



Cal IPC

- Don't plant invasives
- California Invasive Plant Council
 - Don't plant a pest
 - <http://www.cal-ipc.org/>



Other pests not to plant ...

- Soil pathogens
- Phytophthora species, .e.g:
 - *P. tentaculata*
 - *P. cactorum*
 - *P. cinnamomi*
- Consider planting from seed





What about vegetables?

- Fruits and veggies aren't drought tolerant
 - No water, no sugar, no biomass
- The water must be spent somewhere
- Edibles gardening *is* sustainable ...
 - as long as it's done right
 - (see previous slides)
 - and as long as you eat it

Right plant, right place

- The basic tenet to all good landscaping
- The right landscape plant shouldn't need much
- Veggies in this climate will want water



Shade and Energy Conservation

- 40 % of unwanted heat in your house comes in through windows
- Use deciduous trees to the south & southwest to block sunlight before it enters the windows in the summer
- In winter the trees drop their leaves and allow the sun to warm your home





In the end, it's all connected

- Your small garden counts
 - One patch in a quilt
 - For better or worse
- The fewer inputs, the better, including:
 - Water
 - Fertilizers
 - Pesticides
 - And possibly even plant material
 - ... but any wisdom carried to extreme becomes foolishness
 - ...

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- QWEL Program: <http://www.qwel.net/>
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- Cal IPC: <http://www.cal-ipc.org/>
- Native bunchgrass photo: <http://nativeson.com/>
- Drinking well water photo: <http://info.forwater.com>

Thanks!

- Presentation will be on-line at:
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