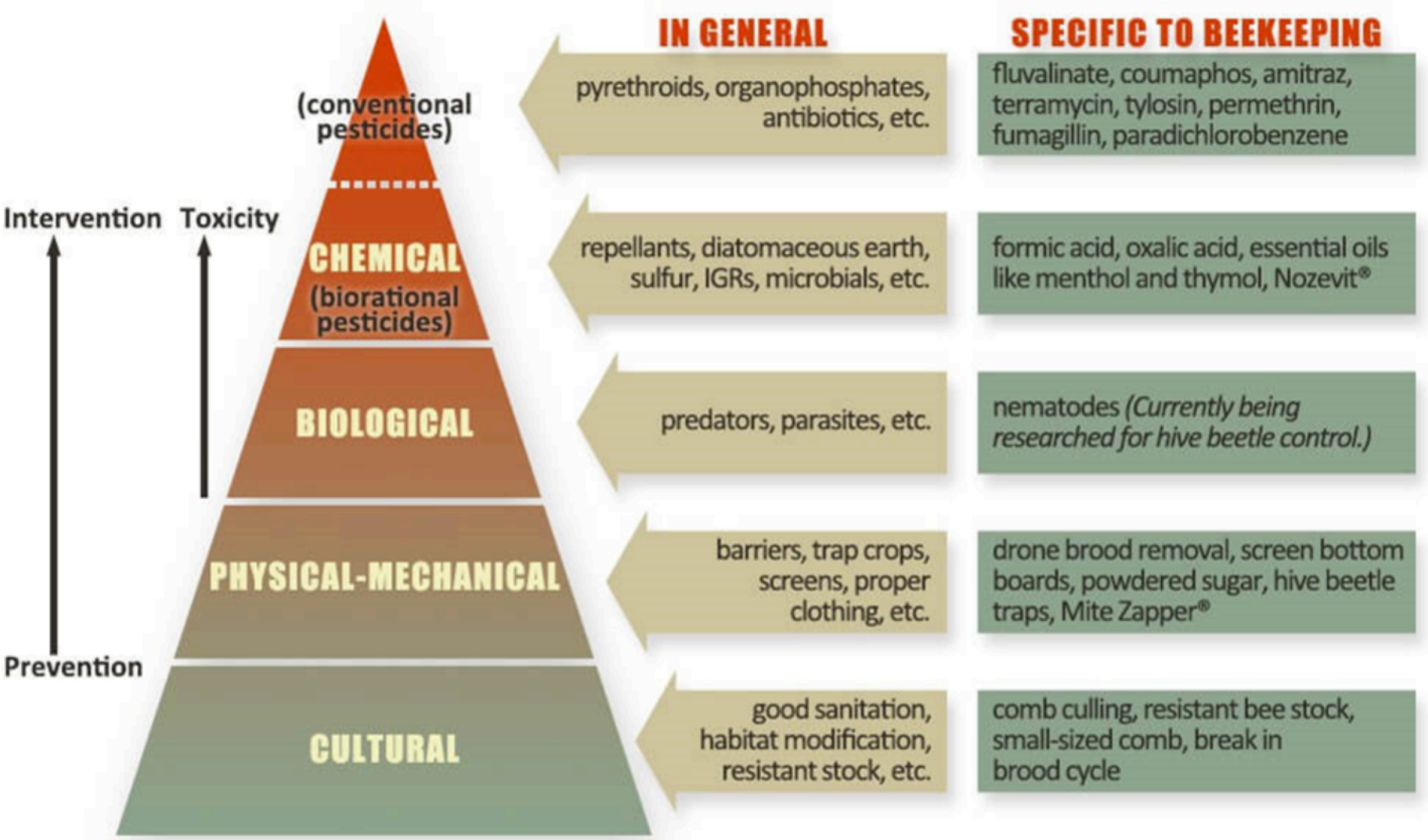
The IPM Pyramid of Tactics

Frank Niccoli

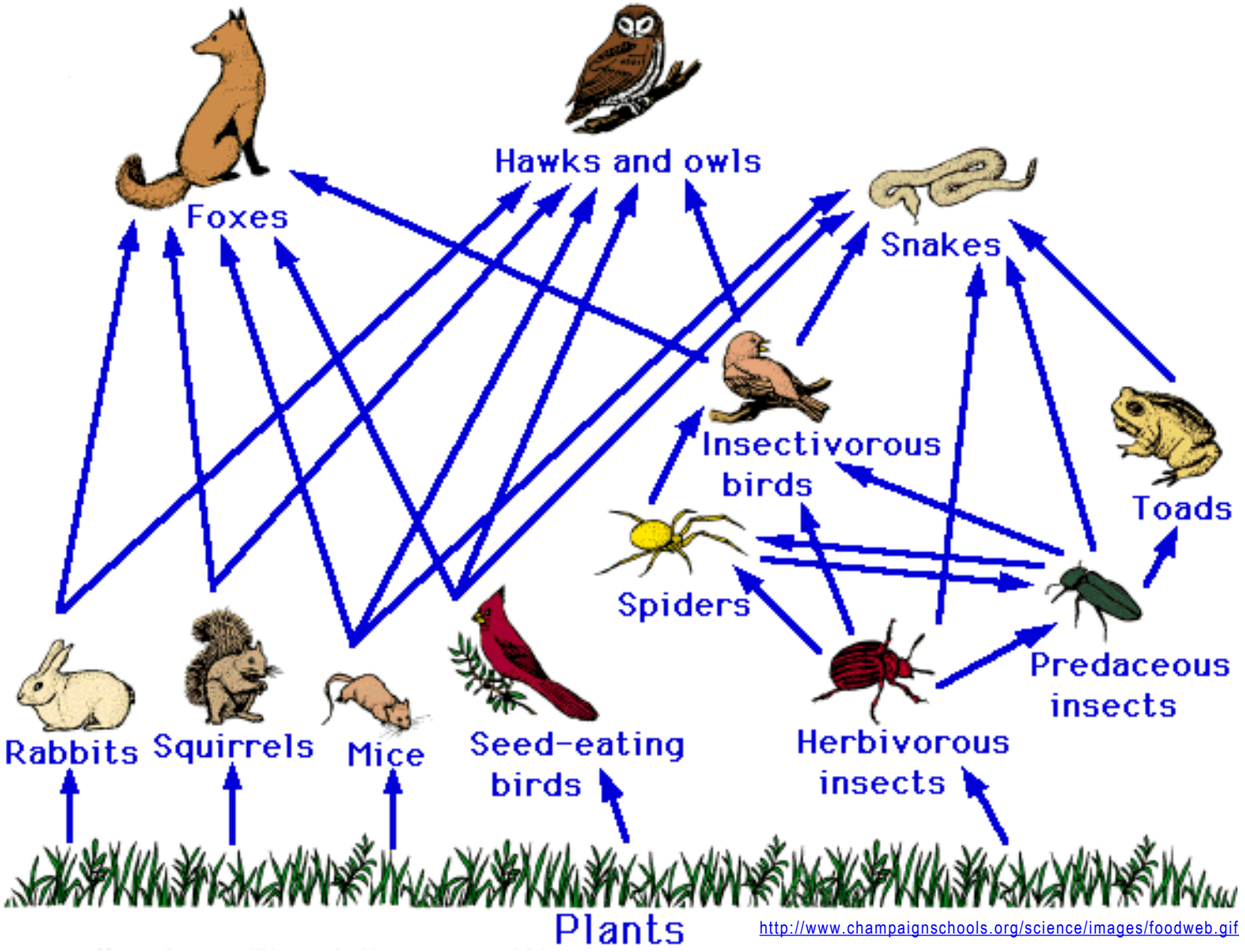


Pyramid of IPM Tactics

What is a pest?

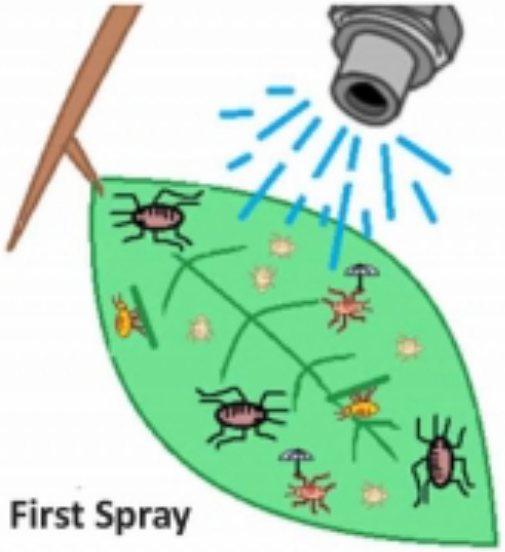
- An organism which has characteristics that are regarded by humans as injurious or unwanted
  - Eats a desired plant
  - Causes disease in a desired plant
  - Carries disease to a desired plant
- May be:
  - A vertebrate (deer; rabbit)
  - An insect/mollusk (snail)
  - A bacterium, virus or fungus
- A pest in one setting may be beneficial in another; like a weed, a pest may be an organism 'in the wrong place'

Predator/prey relationships in nature



http://www.champaignschools.org/science/images/foodweb.gif

In nature, plants fight back…



First Spray

Second Spray

Legend

Natural Enemy

Metabolic Resistant Insect

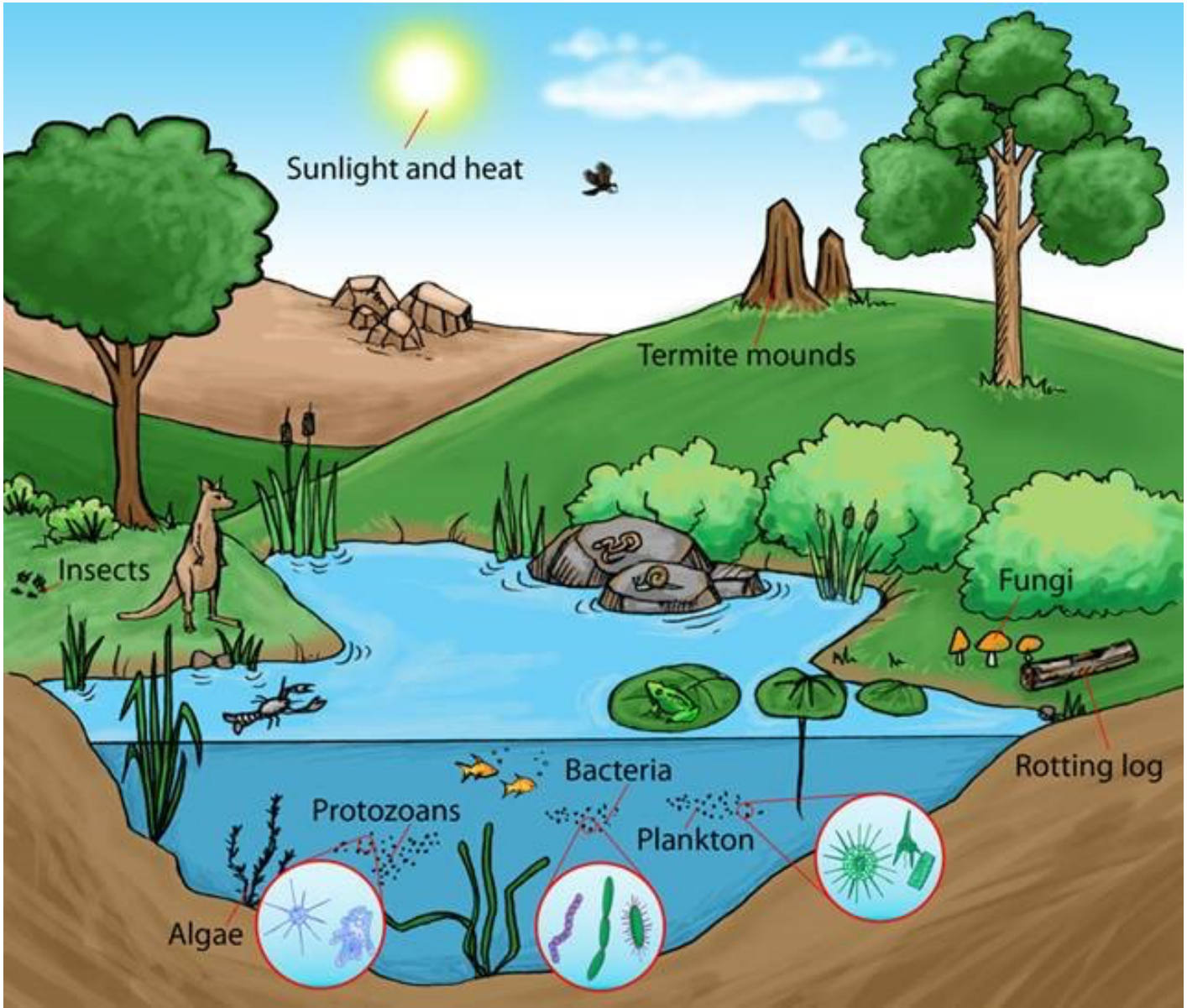
Behavioral Resistant Insect

Pest

Third Spray

Fourth Spray

Plant an Ecosystem

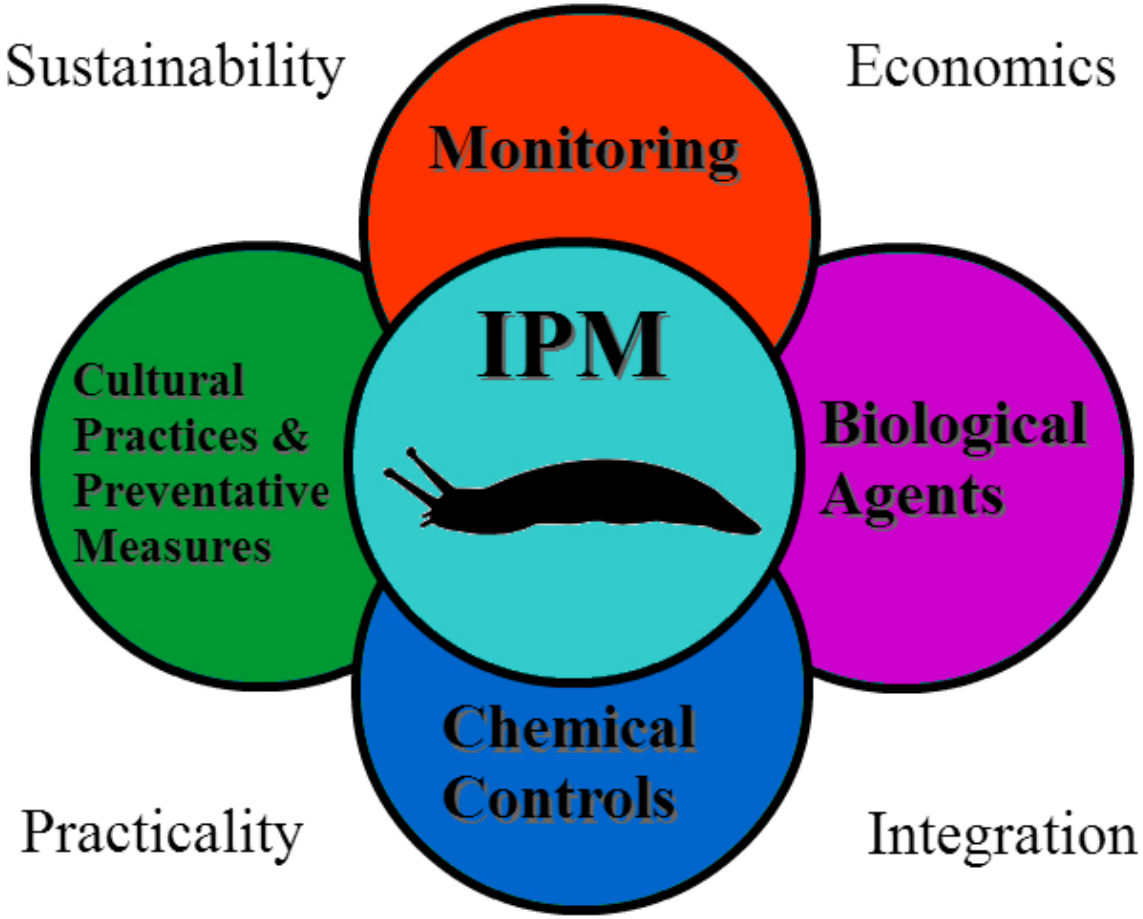


Planting natives reduces pesticide use in the garden

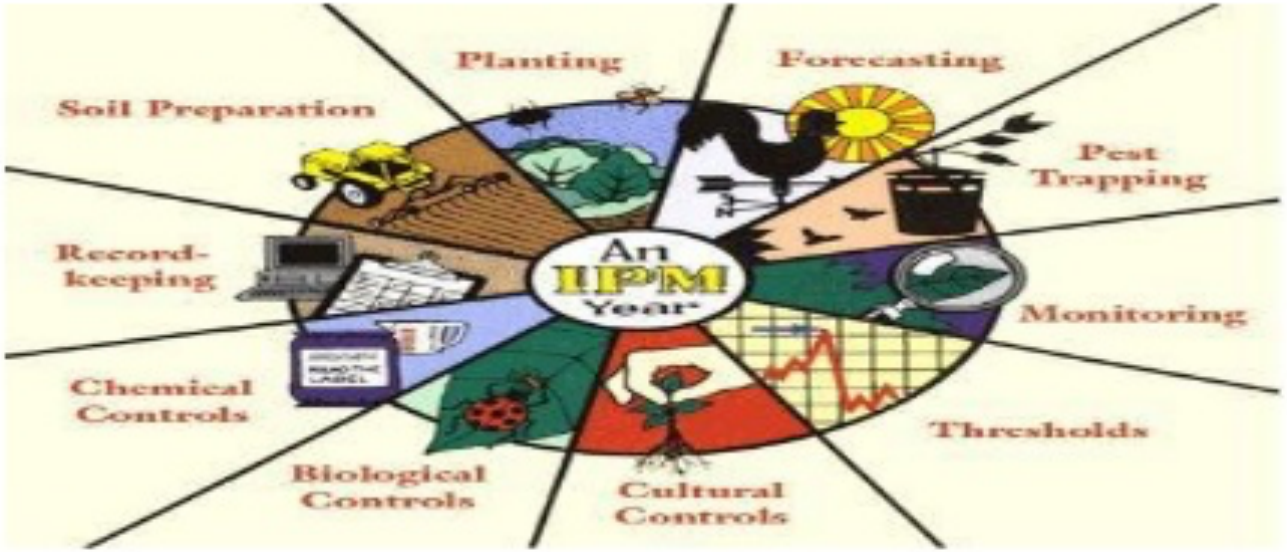
The Strategy

And that's where the concept of Integrated Pest Management (IPM) provides useful guidelines

What is Integrated Pest Management (IPM)



WHAT DOES IT ACTUALLY MEAN ?



INTEGRATED PEST MANAGEMENT

IPM

INTEGRATED

Composed of separate parts united together to form a more complete & compatible unit

PEST

An organism that reduces the availability, quality, or value of some natural resource

MANAGEMENT

Skilled handling

- Use the least invasive – and often most effective - means first:
  - Prevention – cultural practices
  - Mechanical Controls
  - Naturally occurring biological controls (native predators)
- Consider using non-native predators
- Use chemical controls sparingly, as a last resort:
  - Naturally occurring elements
  - Biologics – chemicals made by plants that are toxic to pests/diseases
  - Non-biologic pesticides:
    - Insecticides
    - Fungicides
    - Miticides

What are the Benefits?

Integrated Pest Management (IPM)

IPM is based on six basic components

Set Action Thresholds

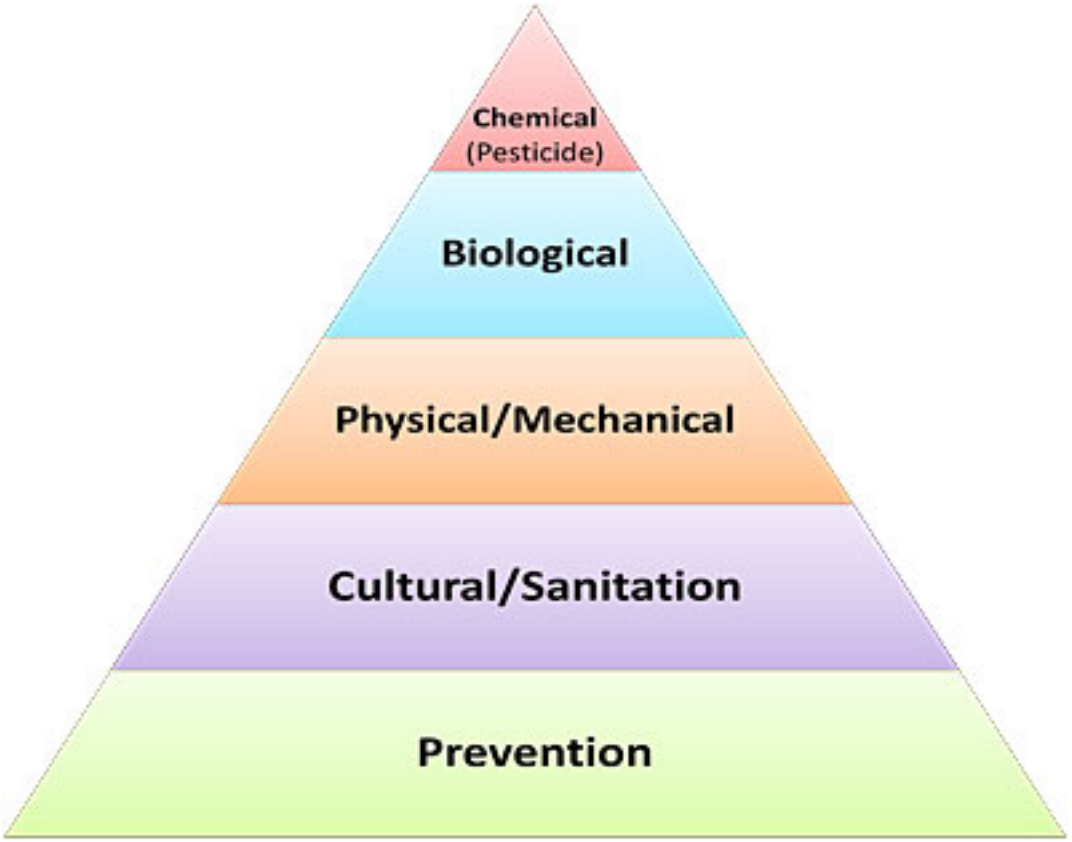
Monitor and Identify Pests

Preventive Cultural Practices

Mechanical Methods

Biological Controls

Chemical Controls

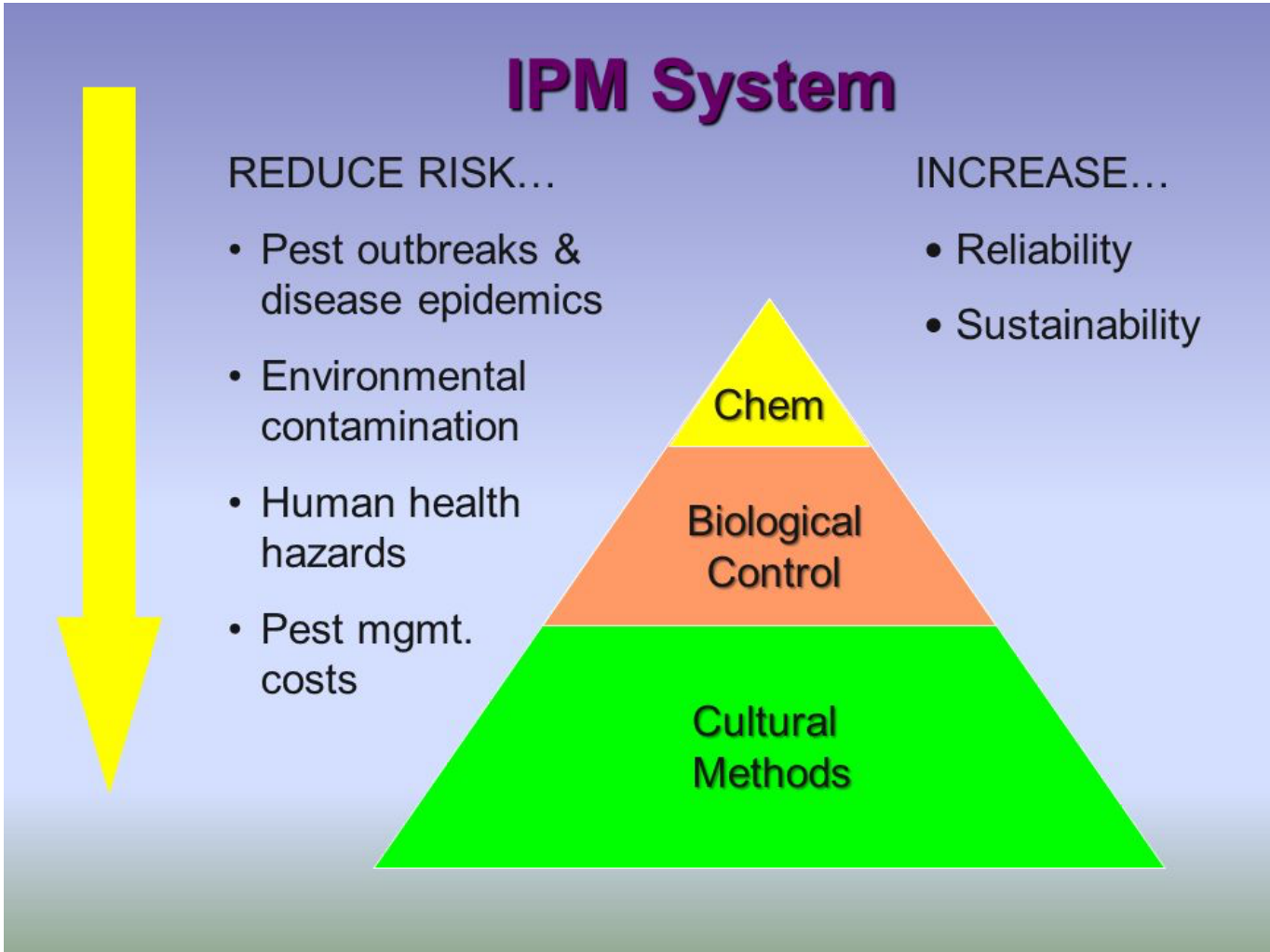


IPM is based on six basic components

Set Action Thresholds

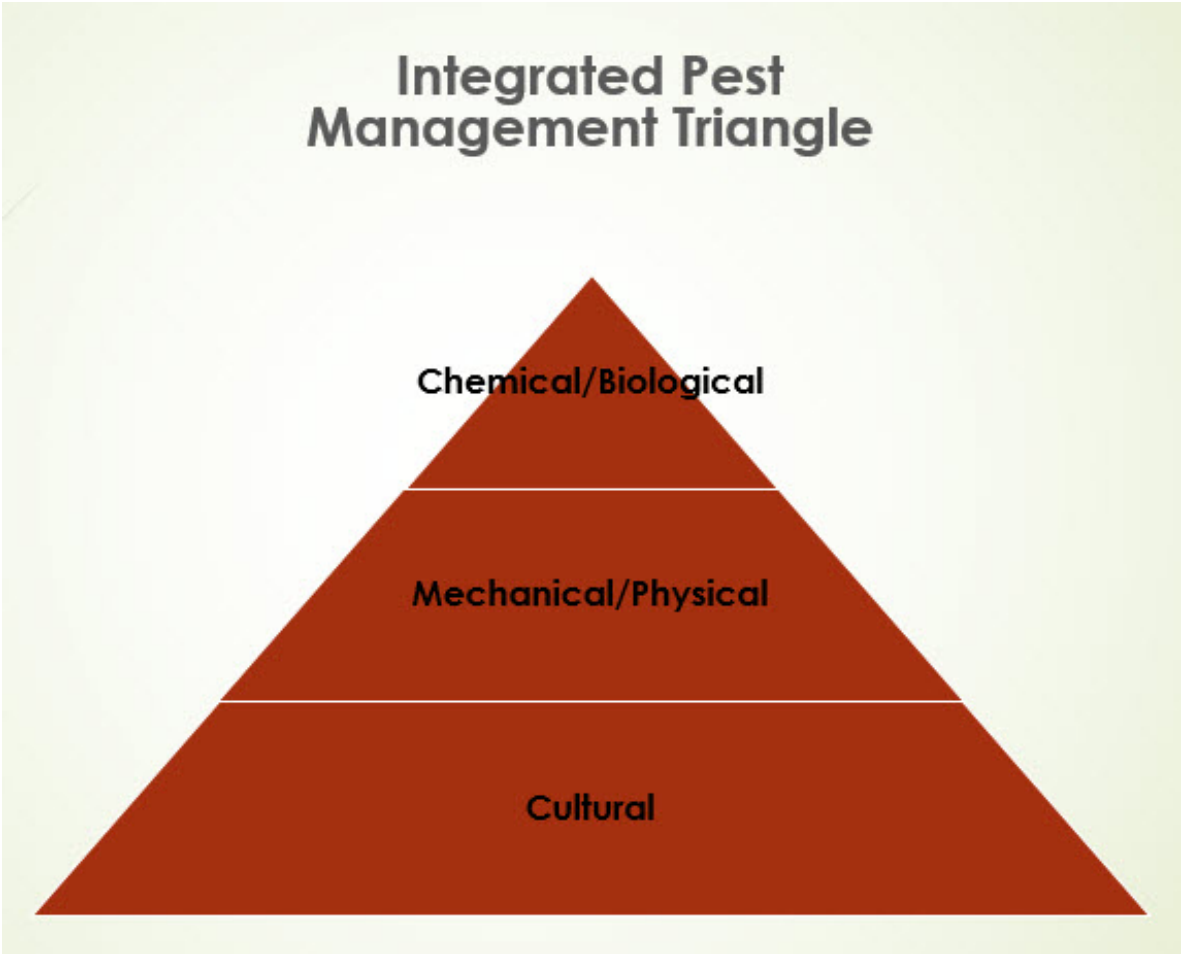
IPM is based on six basic components

Preventive Cultural Practices



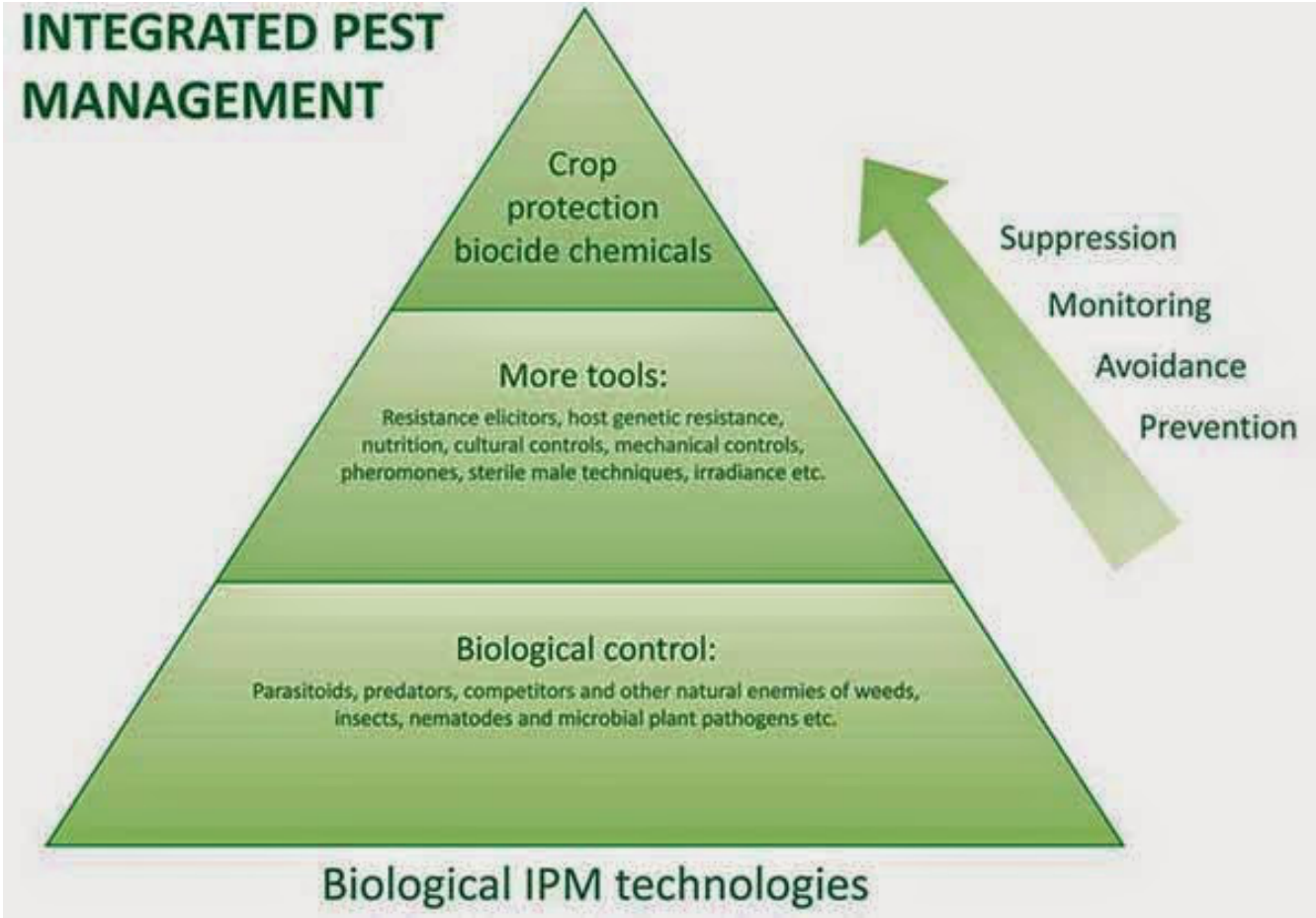
IPM is based on six basic components

Physical or Mechanical Methods



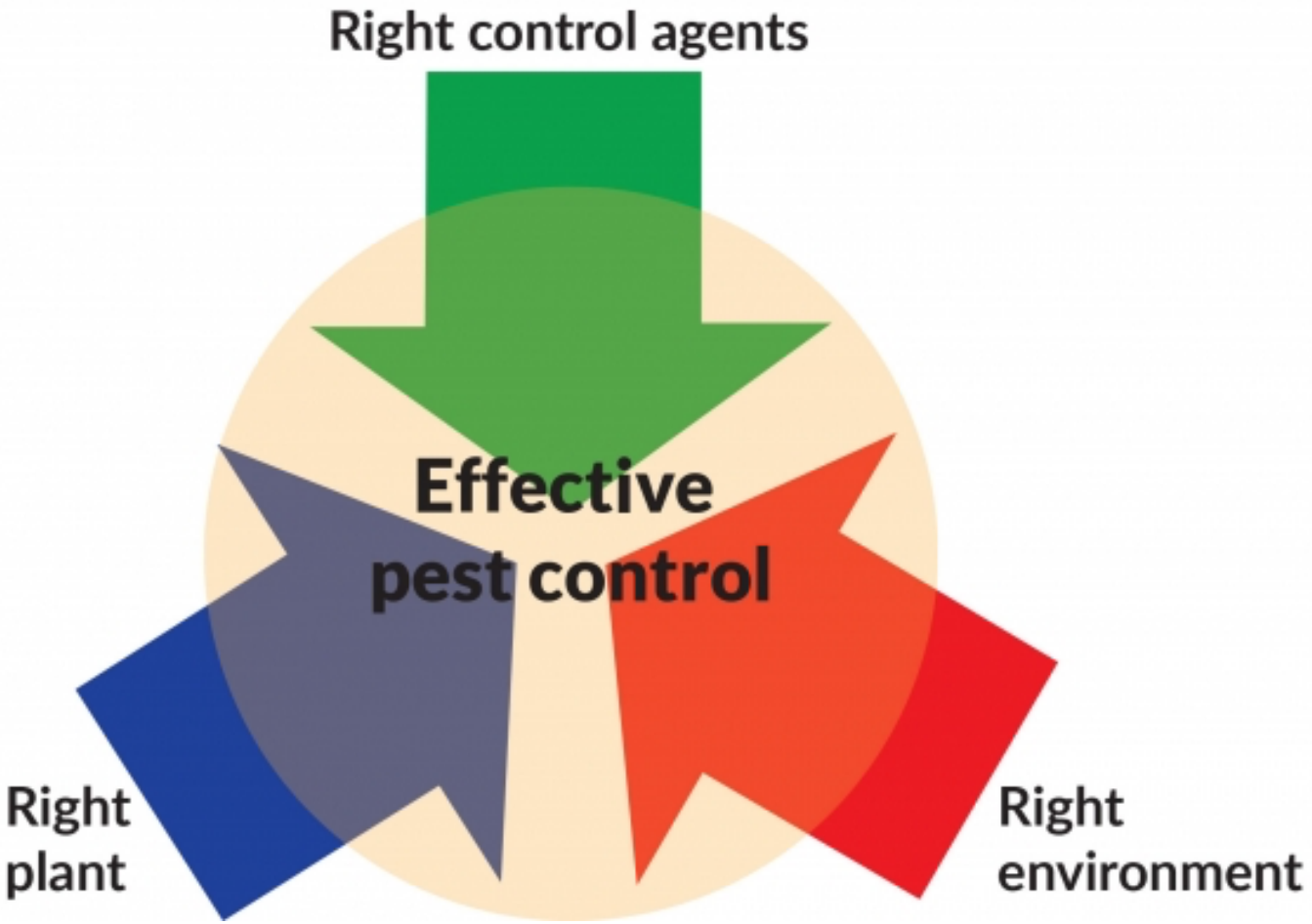
IPM is based on six basic components

Biological Controls



IPM is based on six basic components

Chemical Controls

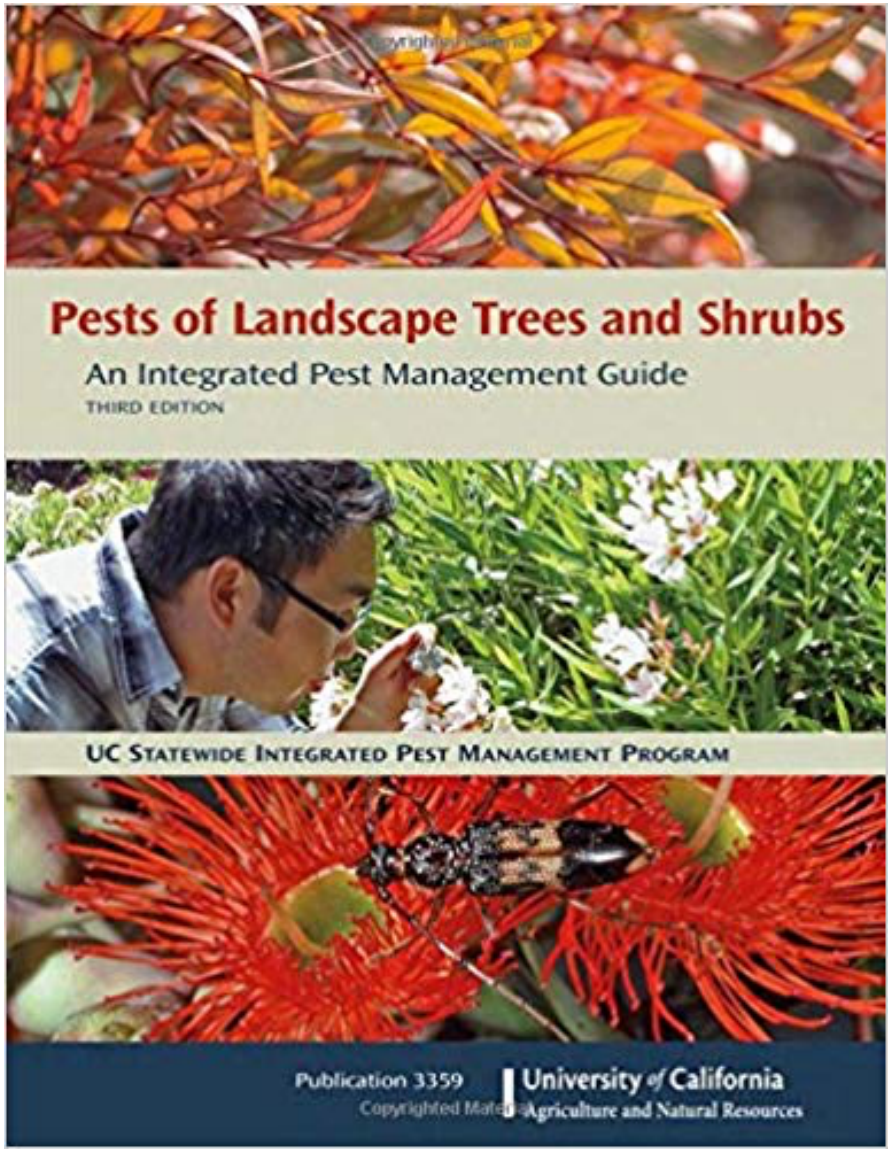


An IPM System is a Moving Target

- Requires observation & knowledge – specific for your garden
- Will vary somewhat with:
  - Yearly weather conditions
  - Maturity of plants
  - New plants
- Will be modified based on your previous experiences
- Suggestion: keep a garden notebook/journal

Resources

Resources

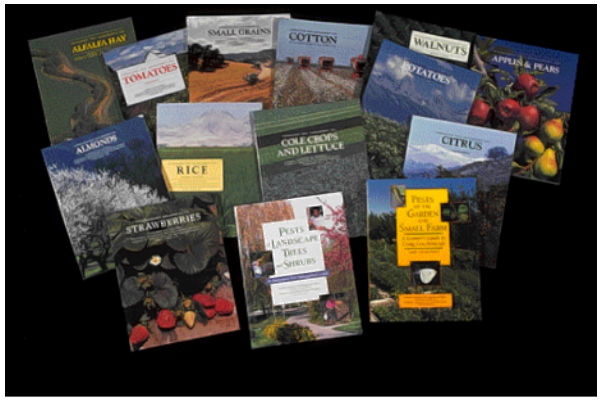

Pests of Landscape Trees and Shrubs
An Integrated Pest Management Guide
THIRD EDITION
UC Statewide Integrated Pest Management Program
Publication 3359
University of California
Agriculture and Natural Resources

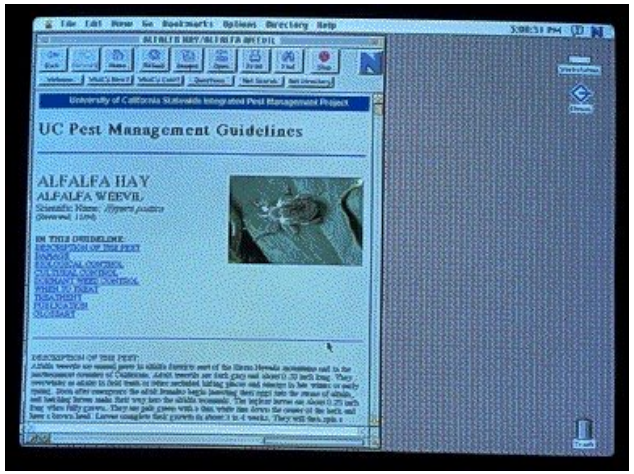
Resources

Resources


Master Gardener
University of California
Cooperative Extension

University of California Statewide IPM Project (UCIPM)





- Goals of the IPM Project are to:
  - reduce the pesticide load in the environment,
  - increase the predictability and thereby the effectiveness of pest control techniques,
  - develop pest control programs that are economically, environmentally and socially acceptable,
  - marshal agencies and disciplines into integrated pest management program, and
  - increase the utilization of natural pest controls.
- Educational component:
  - Print & on-line resources
  - UC IPM Pesticide Education Program

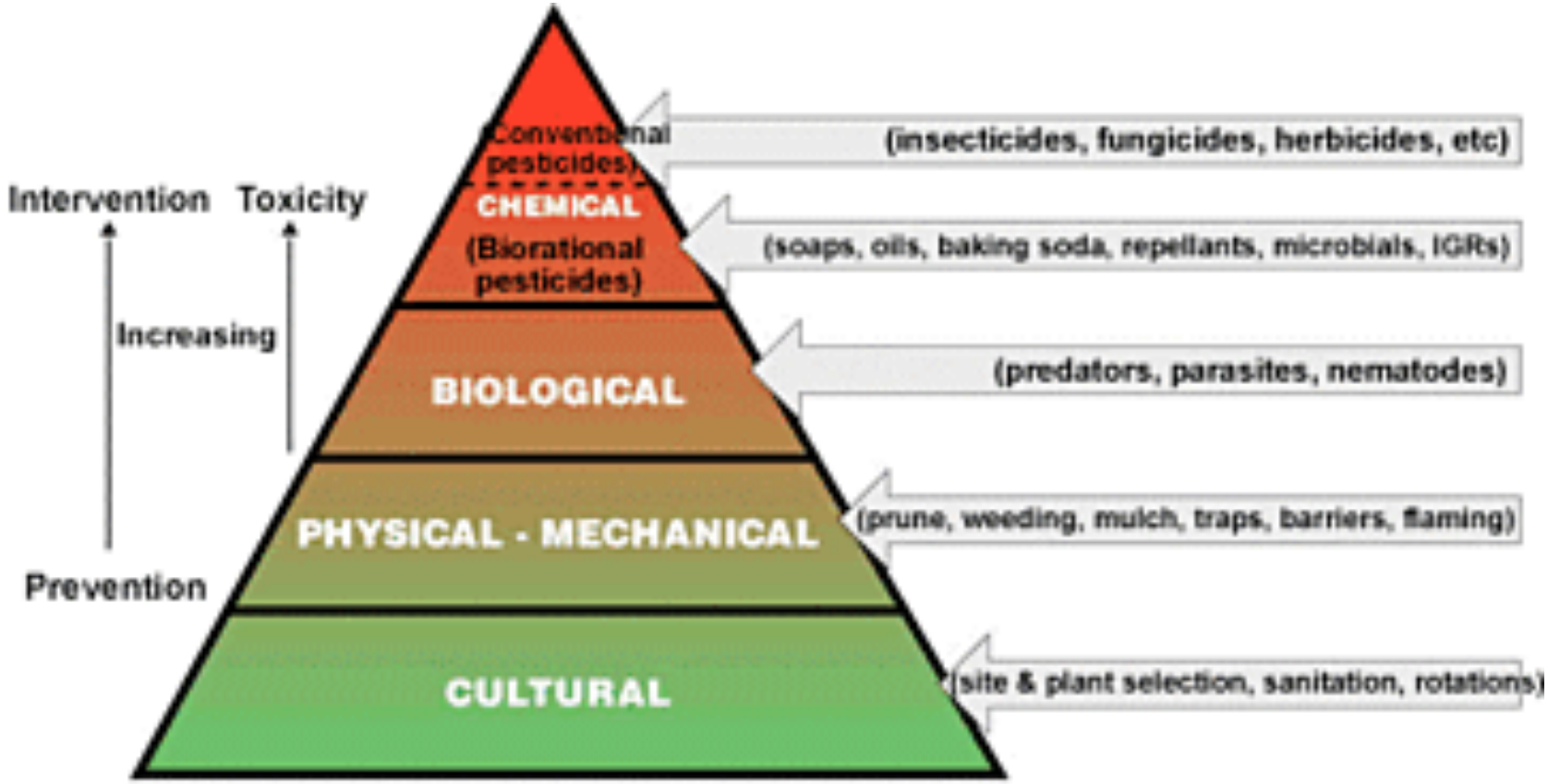
Set Pest Level Thresholds

- Find out what pests/ diseases occur in your garden – observation
- Learn more about the pests, their effects
  - What are their life-stages
  - What seasons/conditions are they associated with
  - What plant species are susceptible
- Learn how to determine when action should be taken

Monitor & Identify Pests

Sticky Trap Monitoring of Insect Pests

Prevention/Cultural Practices



Pyramid of IPM Tactics

Plants

PENNSTATE College of Agricultural Sciences

Selecting the **Right** treatment

Least Hazardous to Human Health

Selecting the **Right** treatment

Least Disruptive of Natural Controls

Selecting the **Right** treatment

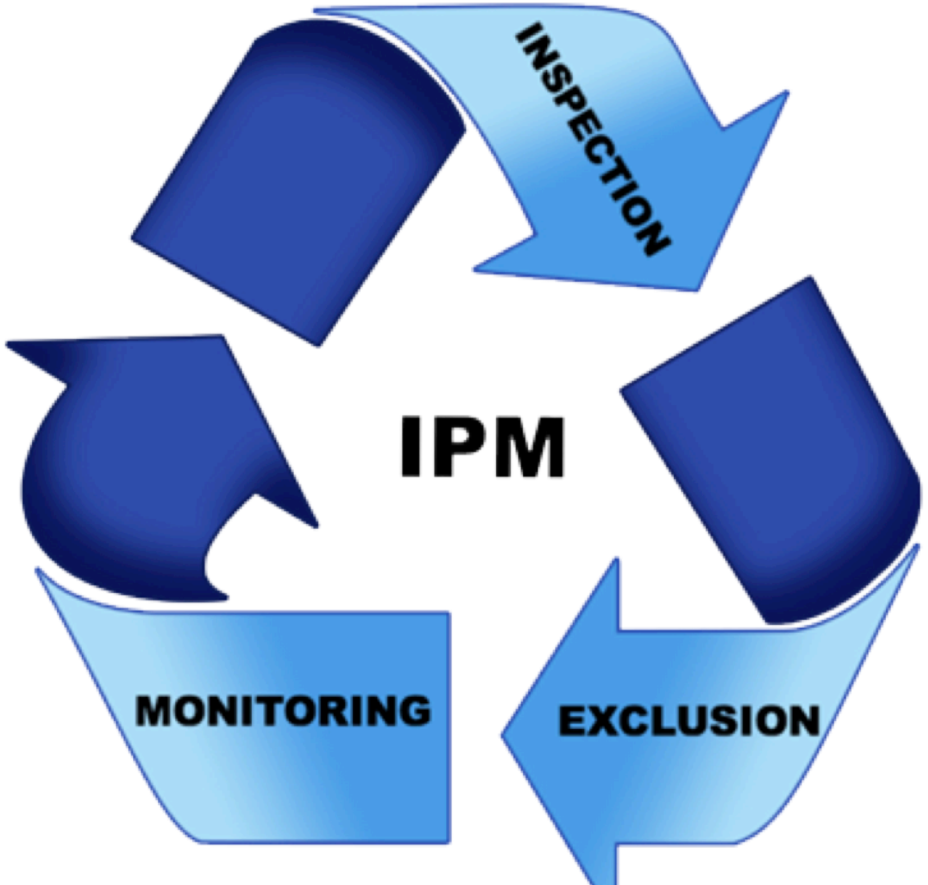
Least Toxic to Non-Target Organisms

Selecting the **Right** treatment

Treatment Closest to a Permanent Solution

Selecting the **Right** treatment

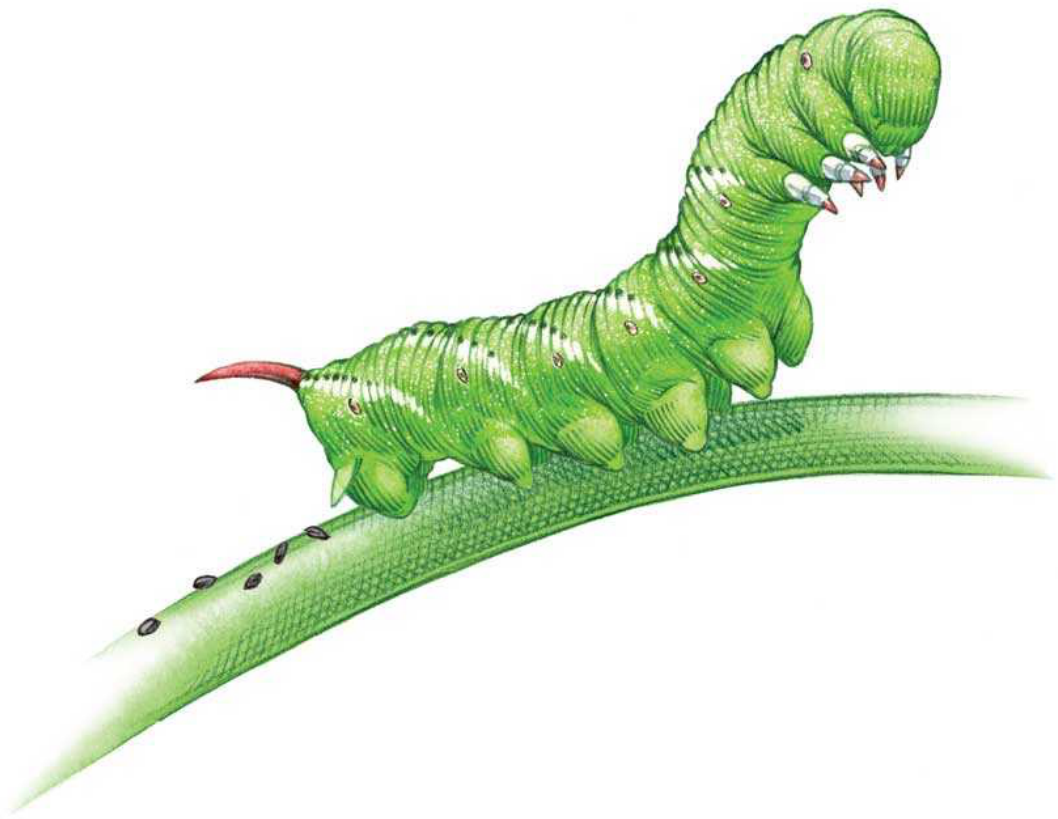
Easiest to Implement Safely and Effectively



Selecting the **Right** treatment

1. Best Site-Appropriate Solution

Seasonal Challenges with Pest Control



Sucking insects

Insects that insert their mouthparts into the carbohydrate rich phloem and suck out the nutrients.

New Foliage Can Attract Suckers

Aphids are Krill

Aphids


copyright © Ernie Cooper 2013
www.macrocritters.wordpress.com

Whiteflies

Monitor Susceptible Plants

Mealybugs

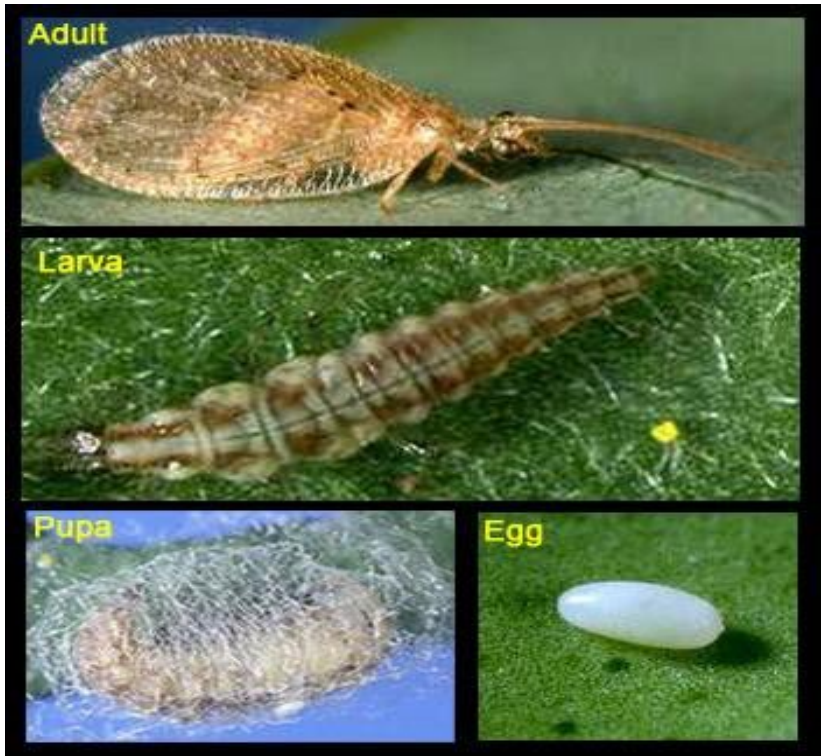
Sooty Mold

True Bugs

Lacewings

Attract these beneficial insects	By planting these species
Bigeyed bug	Native grasses *Polygonum sp.* (Silver Lace Vine)
Hoverflies	*Achillea sp.* (Yarrow) *Asclepias fascicularis* (Narrowleaf Milkweed) *Baccharis sp.* (Coyote brush, Mulefat) *Ceanothus sp.* (California Lilac) *Eriogonum sp.* (Buckwheat) *Prunis ilicifolia* (Hollyleaf Cherry)
Lacewings	*Ceanothus sp.* (California Lilac) *Prunus ilicifolia* (Hollyleaf Cherry)
Lady beetles	*Achillea sp.* (Yarrow) *Asclepias fascicularis* (Narrowleaf Milkweed) *Atriplex sp.* (Quailbush, Saltbush) *Ceanothus sp.* (California Lilac) Native grasses *Rhamnus californica* (Coffeeberry) *Salix sp.* (Willow)

Know the Life Cycles of Beneficial Insects



Attract these beneficial insects	By planting these species
Minute pirate bug	*Achillea sp.* (Yarrow) *Baccharis sp.* (Coyote brush, Mulefat) *Eriogonum sp.* (Buckwheat)
Parasitic & Predatory Wasps	*Achillea sp.* (Yarrow) *Aesclepias fascicularis* (Narrowleaf Milkweed) *Eriogonum sp.* (Buckwheat)
Tachnid flies	*Achillea sp.* (Yarrow) *Eriogonum sp.* (Buckwheat) *Heteromeles arbutifolia* (Toyon) *Rhamnus californica* (Coffeeberry)

Levels of Control

1. Cultural control is a preventative measure using fertilization, plant selection, and sanitation to exclude problematic pests and weeds.
2. Physical control is another preventative strategy. It includes, pest exclusion; creating barriers; modifying conditions such as temperature, light and humidity; trapping; and manually weeding. Foods and beverages should be eaten and stored only in designated areas.
3. Biological control makes use of a pest's natural enemies. This strategy introduces beneficial insects or bacteria to the environment or, if they already exist, provides them with the necessary food and shelter and avoids using broad-spectrum chemicals that will inadvertently kill them.
4. Chemical control is used after all other control strategies are deemed inappropriate or ineffective. Target-specific, low-toxicity pesticides should be applied in a manner that will maximize the effectiveness of pest management and minimize the exposure to humans and other non-target species. Spot treat if possible to reduce exposure.

Smother the Mother!

Smother the Mother!

Natives

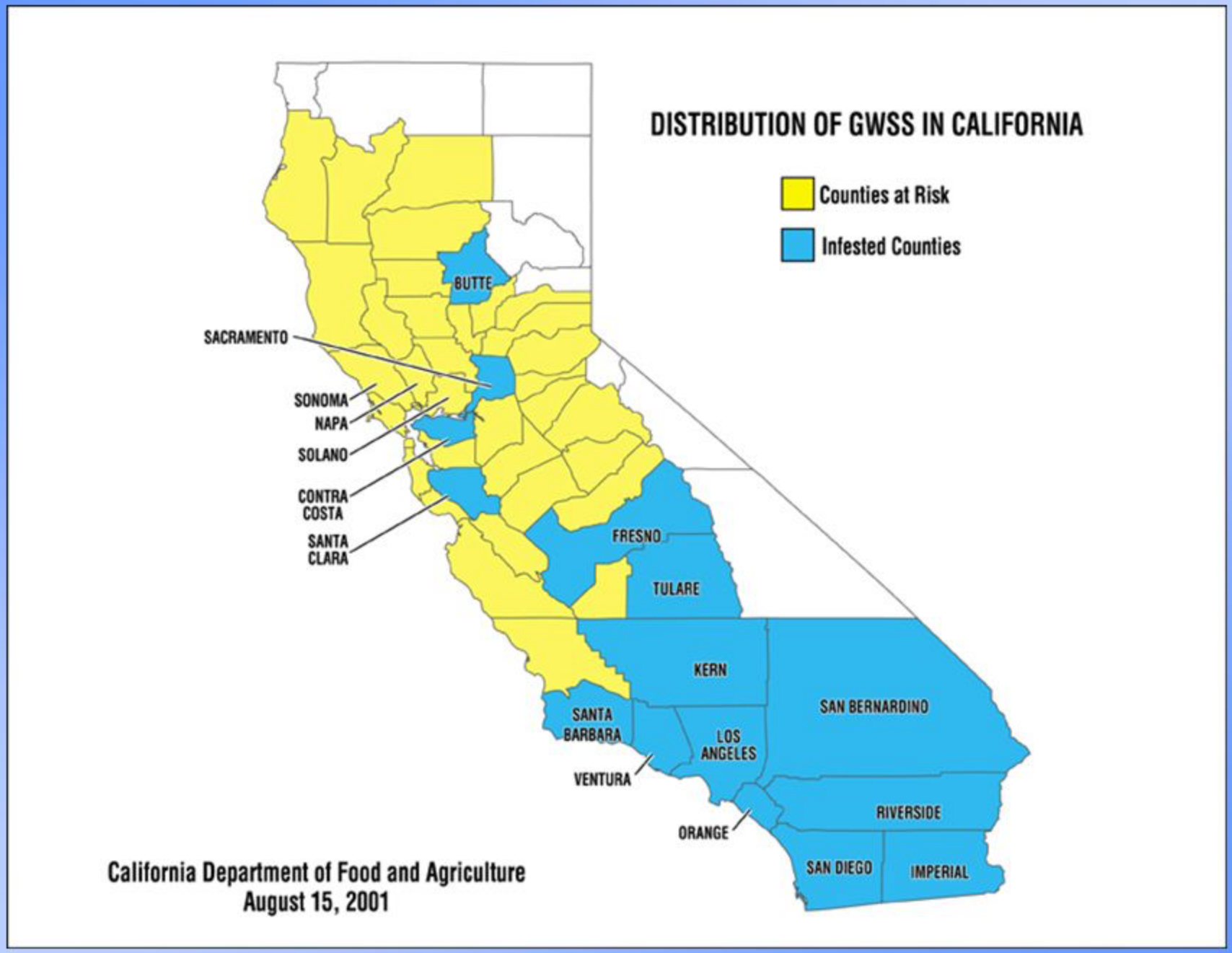
Pests of Rose Family

Leafhoppers & Sharpshooters

Leafhoppers & Sharpshooters

Glassy-winged Sharpshooter

reportable pest


DISTRIBUTION OF GWSS IN CALIFORNIA
Counties at Risk
Infested Counties
BUTTE
SACRAMENTO
SONOMA
NAPA
SOLANO
CONTRA COSTA
SANTA CLARA
FRESNO
TULARE
KERN
SAN BERNARDINO
SANTA BARBARA
LOS ANGELES
VENTURA
RIVERSIDE
ORANGE
SAN DIEGO
IMPERIAL
California Department of Food and Agriculture
August 15, 2001

Pierce's Disease: Native Plants are the Alternate Hosts

Thrips

Thrips

Gall & Blister Mites

Spider Mites

Spider Mites

Chewing Insects

Sucking or a Chewing Pest?

Botanical pesticides: natural but not harmless for control of chewing insects

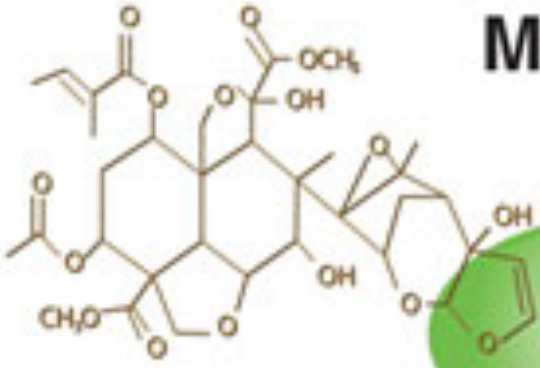
- **Pyrethrum** is extracted from the flowers of a chrysanthemum grown in Kenya and Ecuador. It is one of the oldest and safest insecticides available.
  - Mode of action — Pyrethrum (and synthetic pyrethrum) paralyze insect's nervous system.
  - Used for – aphids, scale insects, spider mites, thrips, caterpillars and many other leaf-feeding pests
- **Rotenone** or rotenoids are produced in the roots of two genera of the legume family: *Derris* and *Lonchocarpus* (also called cubé) grown in South America.
  - Mode of action: shuts down cellular metabolism
  - It is both a stomach and contact insecticide; toxic to many species of insects in many different insect orders (caterpillars, beetles, flies, etc.).
  - Mild human toxicity; ? Risk for Parkinson's Disease
- **Eugenol** (Oil of Cloves) and **Cinnamaldehyde** (derived from Ceylon and Chinese cinnamon oils).
  - Mode of action – similar to Pyrethrum
  - Used for: chewing insects like beetles – but general insecticide
- **Nicotine** is extracted by several methods from tobacco
  - Mode of action – nervous system conduction; convulsions, death
  - effective against most all types of insect pests, but is used particularly for aphids and caterpillars--soft bodied insects.

EcoSMART™ plant oil-based pesticides

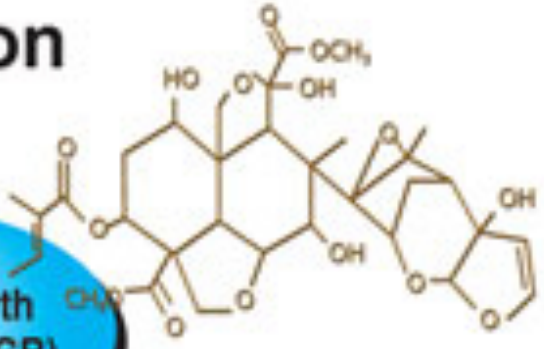
Neem Oil/ Azadiractin

Aza Product	Application (light)	Application (heavy)	Price
AzaMax 16 oz 16 oz / 473 ml / .5 qt 1.2% Aza	.7 oz : 1 gal makes 23 gallons	2 oz : 1 gal makes 8.5 gallons	$74.95 Light - $3.25/gal Heavy - $8.81/gal
Azatrol 1 qt 32 oz / 946 ml / 1 qt 1.2% Aza	.7 oz : 1 gal makes 46 gallons	2 oz : 1 gal makes 16.9 gallons	$112.95 Light - $2.45/gal Heavy - $6.68/gal
AzaPlus 250 ml 8.4 oz / 250 ml / .26 qt 3% Aza	1 ml : 1 liter makes 64 gallons (3x Azamax / 1.5x Azatrol)	2 ml : 1 liter makes 33 gallons (4x Azamax / 2x Azatrol)	$119.95 **Light - $1.87/gal** **Heavy - $3.63/gal** **Best Value!!!**

Multiple Modes of Action



Azadirachtin A



Azadirachtin B

Anti-feedant

Repellency

Insect Growth Regulation (IGR)

Resistance Inhibition

Reproduction Interference

Pesticide Combinations

Ovicidal Effects

Broad Spectrum

The Key to Preventing Resistance

The complex chemical structure of azadirachtin makes it virtually impossible for insect resistance to develop.

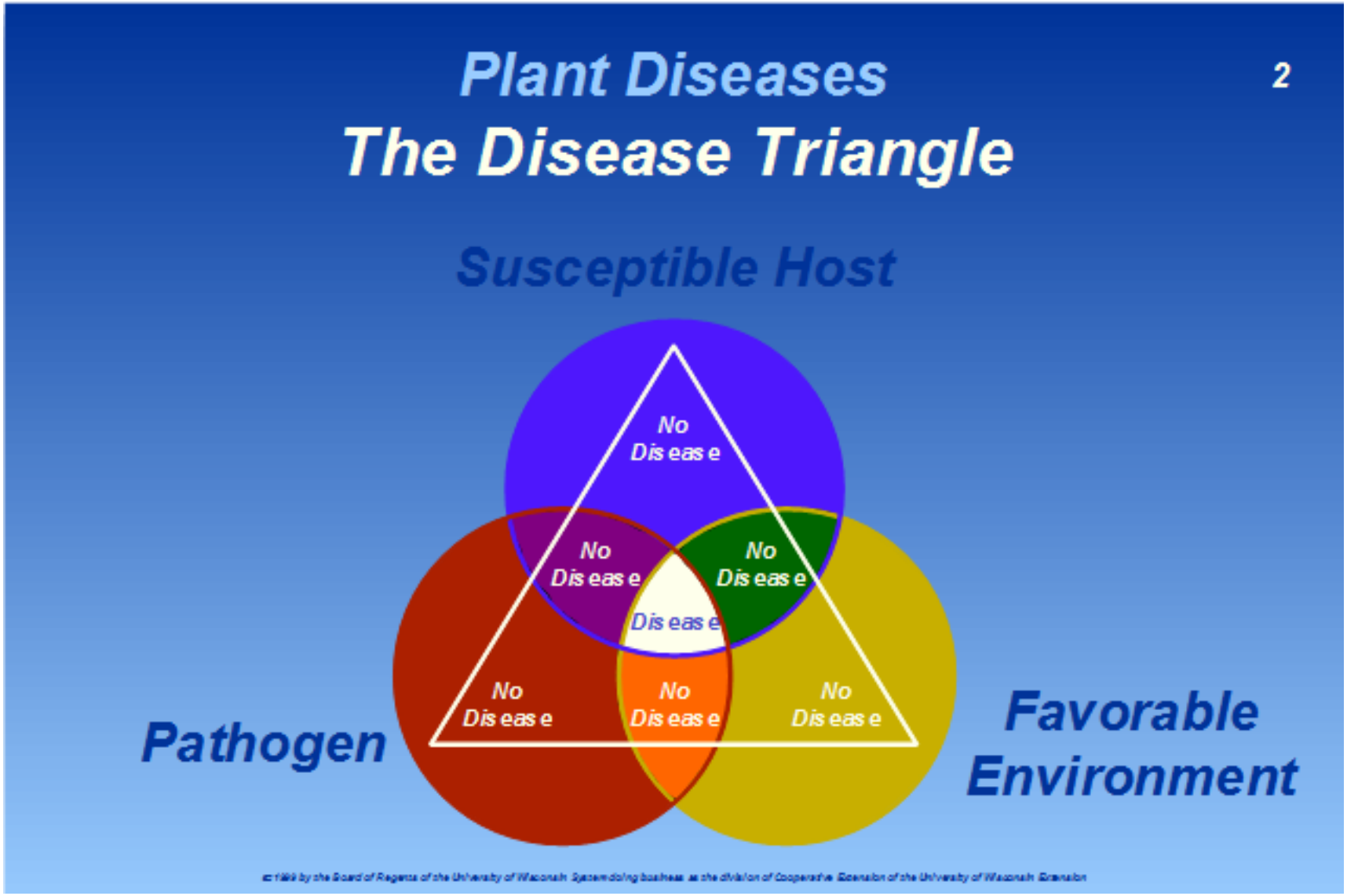
Azatrol's control of different orders of insects or insects in different phases of their life cycle is due to the complexity of the azadirachtin molecule and the many modes of action inherent in azadirachtin.

More pesticide safety tips

http://www.gemplers.com/img/pesticide-storage-area-126066.jpg

- Keep pets and people away from the area where you store, mix, and apply pesticides. Stay away from a treated area for as long as the label directs.
- Do not spray on a windy day or when air temperatures will be above 85°F before the spray solution dries.
- Clean equipment and mixing tools as soon as you finish spraying.
- Dispose of pesticides properly
- After spraying, change your protective clothing and bathe. Wash the clothes you were wearing separately from your regular laundry.
- Keep records of where and when you sprayed, what pesticide you used, and how much you used. Give the treatment time to work, then evaluate and record your results.

The Disease Triangle



Powdery Mildew - *Sphaerotheca pannosa* fungus

http://www.extension.umn.edu/distribution/horticulture/DG1163.html

- Susceptible: Rose family, Dogwoods, Honeysuckles, Sycamores, Willows, Sunflower
- Occurs during warm, damp/humid weather; spores overwinter in infected wood & fallen leaves
- Preventive cultural practices:
  - Provide good air circulation, appropriate sunlight conditions
  - Don't over-water; no overhead irrigation
  - Remove & dispose of infected leaves
  - Cut back & dispose of infected branches; dispose of fallen leaves
- Chemical controls: fungicides – copper, sulfur, horticultural oils & Neem Oil

http://gardeningwebguide.com/GardeningBlog/category/garden-pests/

http://www.omafra.gov.on.ca/english/crops/pub360/notes/rasporustf1.jpg

Rusts – large group of foliage fungi attacking many plant species

- Occur during warm, damp/humid weather; spores overwinter in infected wood & fallen leaves
- Preventive cultural practices:
  - Provide good air circulation, appropriate sunlight conditions
  - Don't over-water; no overhead irrigation
  - Remove & dispose of infected leaves
  - Cut back & dispose of infected branches; dispose of fallen leaves
- Chemical controls: fungicides – copper, sulfur, horticultural oils & Neem Oil


READ SAFETY DIRECTIONS BEFORE OPENING.
WARNING S5
KEEP OUT OF REACH OF CHILDREN
Soluble Corrective Elements
Copper Sulphate
- BLUESTONE -
Helps to correcting Copper deficiences common in Acid Soils and apply directly to soil surrounding root system
Cu
500g Net
Manutec
GARDEN CARE PRODUCTS

Fungal Canker Diseases

FireBlight

Borers Attack Stressed Plants

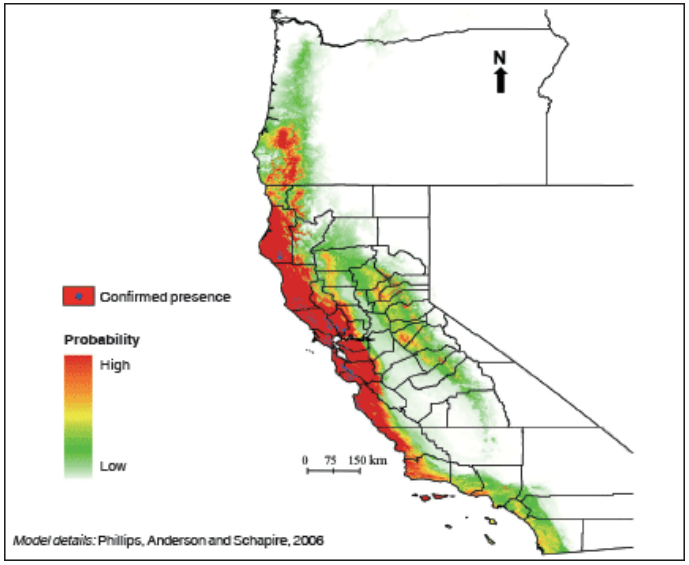
Borers

Blights & Branch Die-back

Blights & Branch Die-back

Phytopthora

Sudden Oak Death Syndrome - *Phytophthora ramorum*



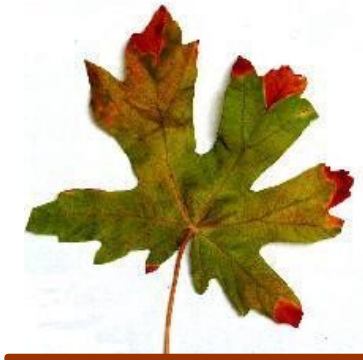
- Kills CA native oaks and other trees/shrubs in N. CA & OR (for now)
- Toyon (*Heteromeles arbutifolia*), Coffeeberry (*Rhamnus californica*), CA Buckeye and Honeysuckle (*Lonicera hispidula*) and others are susceptible. Disease symptoms have not been well characterized on these hosts at this time.
- Leaf lesions are characteristically round with a bulls-eye appearance of alternating light and dark rings

Toyon Heteromeles arbutifolia

A number of other native broad-leaf species harbor *Phytophthora ramorum* in California and Oregon (See the complete list in Part 1.). Little is known about the role of these species in the life cycle and spread of the disease. The pathogen is difficult to culture from many of these species, and is difficult to diagnose because of the presence of other foliar diseases.

Evergreen huckleberry
Vaccinium ovatum

California buckeye
Aesculus californica



Bigleaf maple Acer macrophyllum

California honeysuckle
Lonicera hispidula

Pacific madrone
Arbutus menziesii

Wood rose
Rosa gymnocarpa

All photos: Garbelotto Lab, UC Berkeley

Sycamore anthracnose - *Gnomonia leptostyla*

- The only serious disease of sycamores; will not kill the tree.
- Common in cool wet weather of spring.
- Monitoring:
  - First symptoms appear on young leaves as they unfold.
  - Older leaves turn brown, and dead areas occur along the leaf veins. Brown areas eventually include the whole leaf.
  - The ends of twigs may be killed back 8 to 10 inches.
  - Cankers may develop on the tree trunk and main branches
- Preventive cultural practices:
  - Proper tree spacing and pruning to promote good air circulation
  - Gather and destroy all fallen leaves and twigs.
  - Prune out all infected twigs and branches and destroy them. Remove the dead, cankered tissue down to healthy wood.
  - Dry winters weaken trees, increasing the effects of diseases. To reduce this problem, water trees once a month during dry winters.
- Chemical controls:
  - Chemical sprays normally are not necessary to control anthracnose


That's all Folks