Linking Integrated Pest Management to Improvements in Urban Water Quality

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HEALTHY ENVIRONMENTS

University of California
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Making a Difference for California

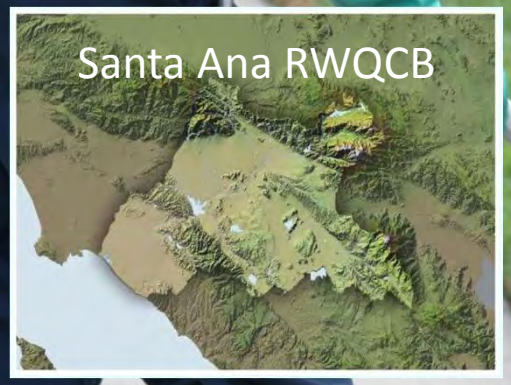
Concerns Over Water Quality

Regulatory Response to Urban Pesticide Detections and Toxicity

- Voluntary removal of products by manufacturers.
- Label changes to restrict certain uses.
- Re-registration evaluation of entire groups of pesticides (i.e. synthetic pyrethroids).
- More stringent NPDES* requirements for permit holders.
  - Water quality monitoring
  - Implementation of integrated pest management programs by permit holder and co-permitees.

**National Pollutant Discharge Elimination System*

NPDES Response by Regional Water Quality Control Boards



Santa Ana RWQCB (Order No. R8-2009-0030)

- Pesticide toxicity identified in previous NPDES water quality monitoring programs.
- Previous permits implemented the “Management Guidelines for Use of Fertilizers and Pesticides”.
- Permittees must continue programs and policies to address pesticide use.
- Commercial inspections: pest control service facilities specifically listed.
- Residential programs: programs to address the use and disposal of pesticides.
- Further development of BMP guidance documents distributed to public, trade associations, etc…
- Implement Integrated Pest Management Programs

NPDES Response by Regional Water Quality Control Boards

San Diego RWQCB (Order No. R9-2009-0002)

- "Co-Permitees must implement BMPs to reduce the contribution of storm water pollutants associated with the application, storage, and disposal of pesticides, herbicides, and fertilizers from municipal areas and activities…"
- At a minimum, BMPs must include IPM measures that rely on non-chemical solutions.
- Identify residential areas and activities that pose high threat to water quality. At a minimum, these must include home and garden care activities and product use such as pesticides, herbicides, and fertilizers.

Integrated Pest Management NPDES Permit Requirements

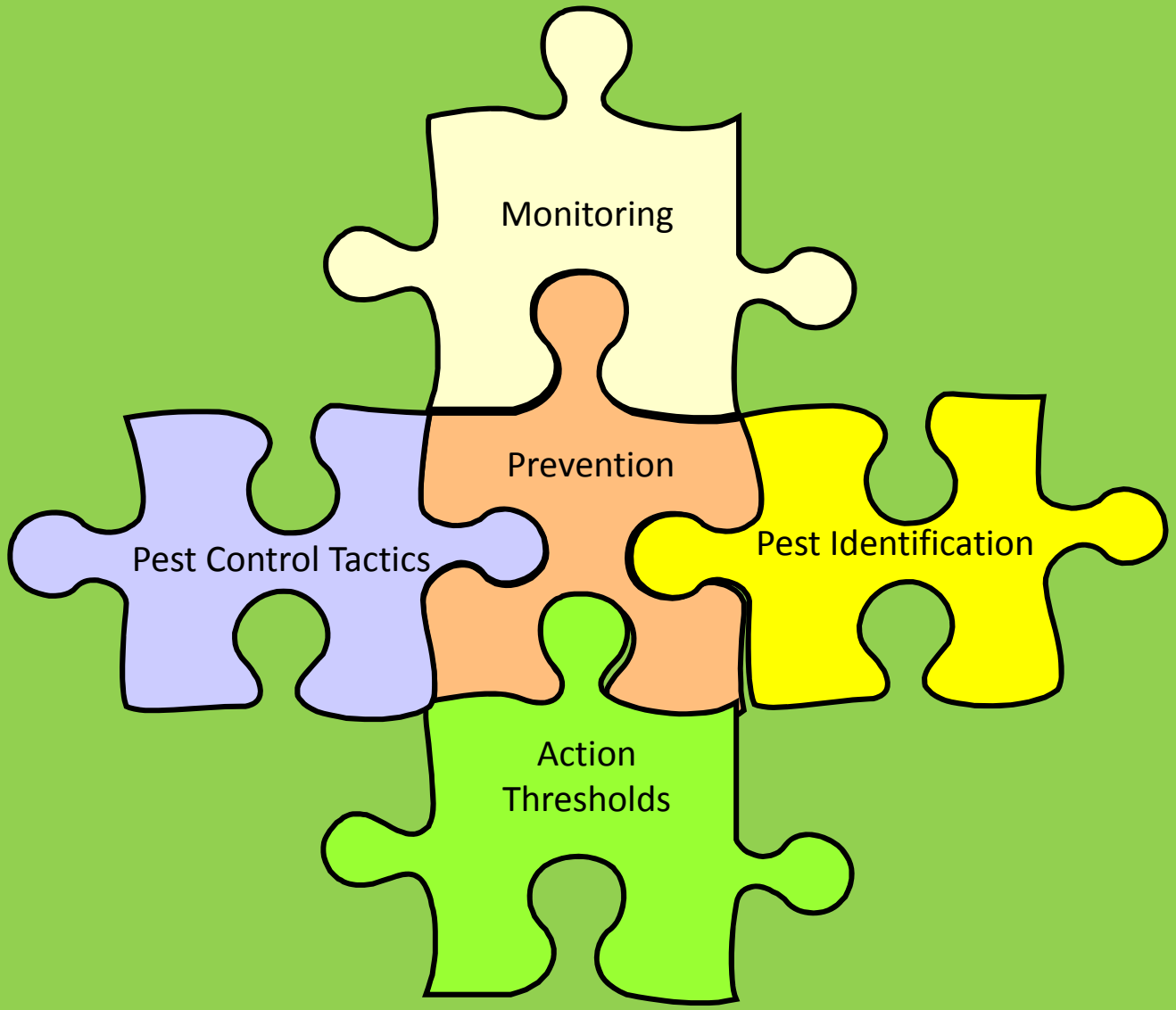
- Conduct annual integrated pest management self-audits.
- Implement the Model IPM, Pesticide, and Fertilizer Guidelines.
- Provide proper training to municipal and contract staff involved in these landscape activities.
- Within 1-year of adoption of this order, revise the LIP to include an integrated pest management program.*
- Evaluate the need to revise the Guidelines and determine the need for developing pesticide use indicators.

*UCCE created an IPM program template that was adopted by OC Permittees in 2010.

Integrated Pest Management

- A sustainable approach that combines the use of prevention, avoidance, monitoring and suppression (PAMS) strategies in a way that minimizes economic, health, and environmental risks. (1998)
- Manages pests through a systematic approach.
  - Improves quality of plant care while minimizing non-target impacts and reducing pesticide use.
  - Environmental concerns, consumer demands, and public opinion influence pest management practices.
  - Delays pesticide resistance prolonging the use of an effective pest control tool.

Pieces to the IPM Puzzle



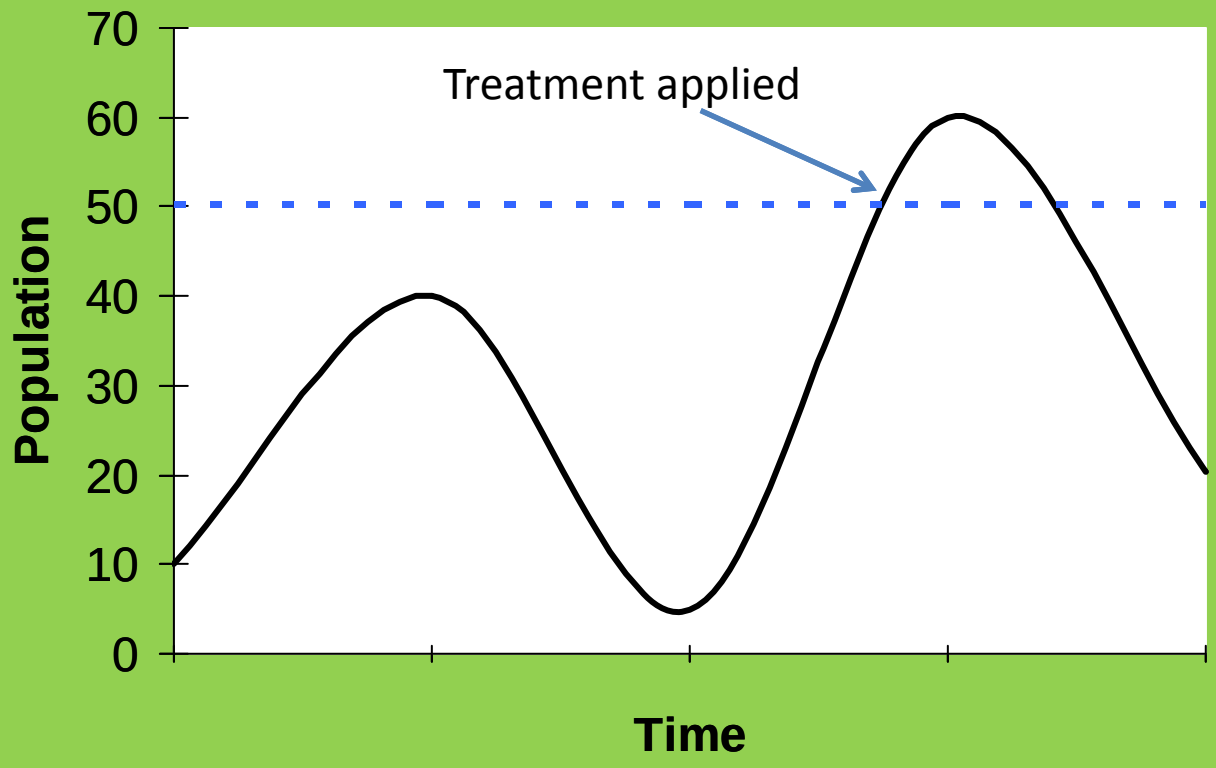
Why Monitor for Pests?

The **economic threshold** is the pest count or damage where the benefit of taking action is greater than the cost of the control.

Should pests be controlled?

What is it worth to you if not controlled *at this time*?

Action Thresholds

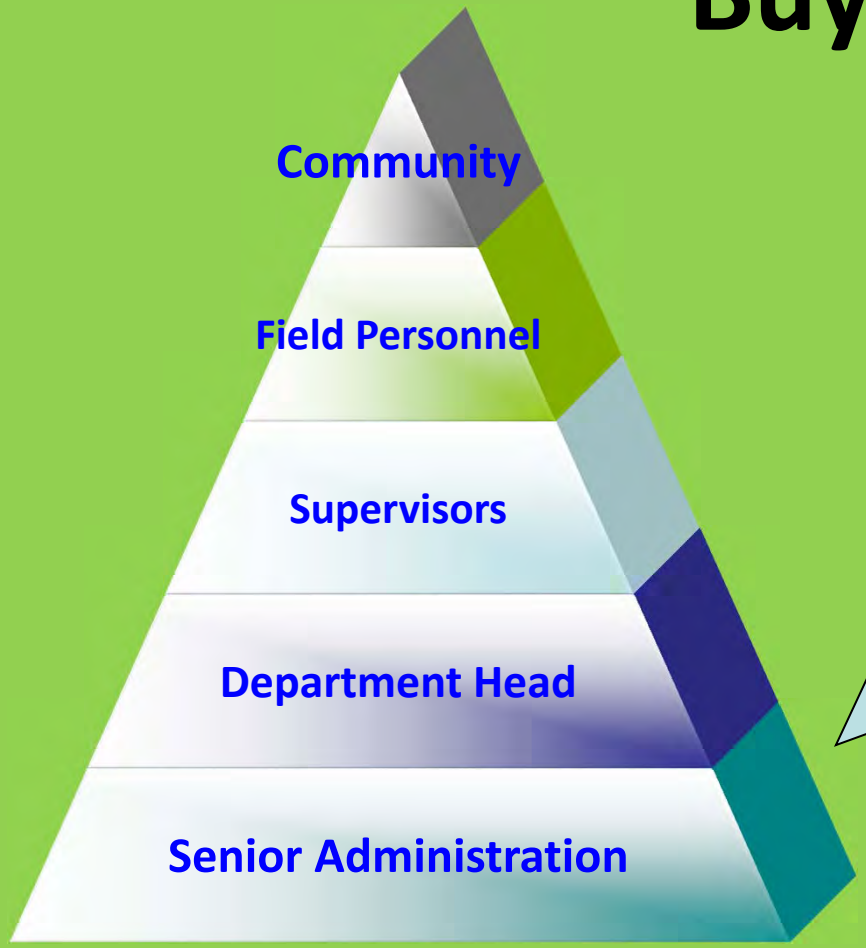


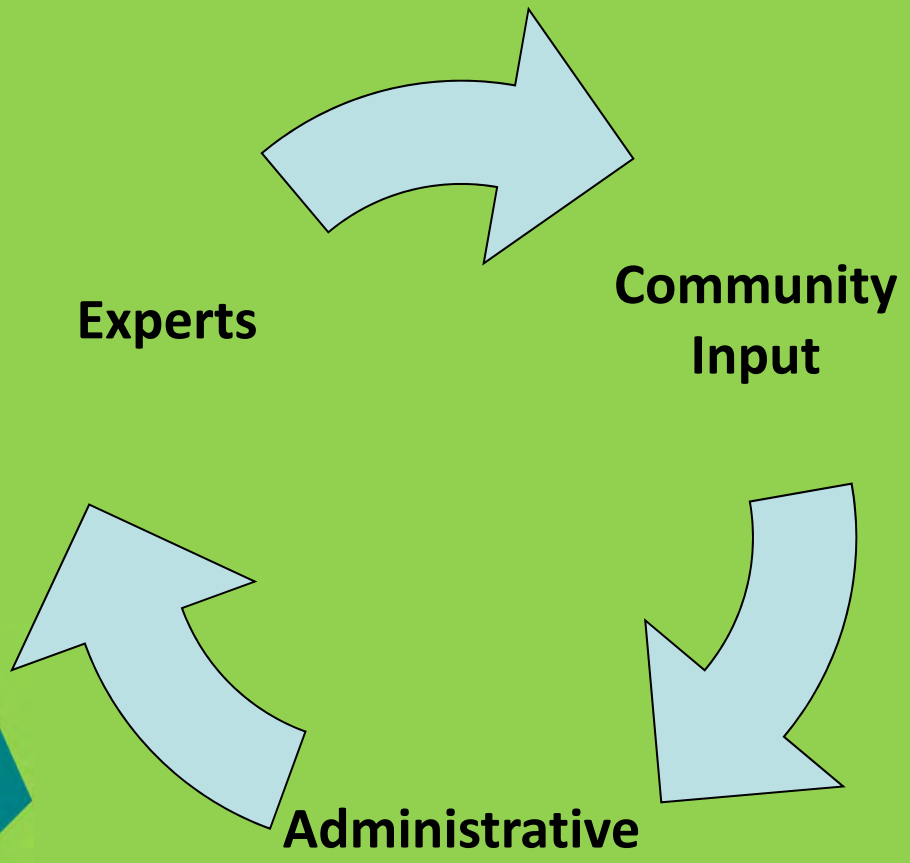
Pest Control Tactics

Questions to Ask Prior to Using a Pesticide

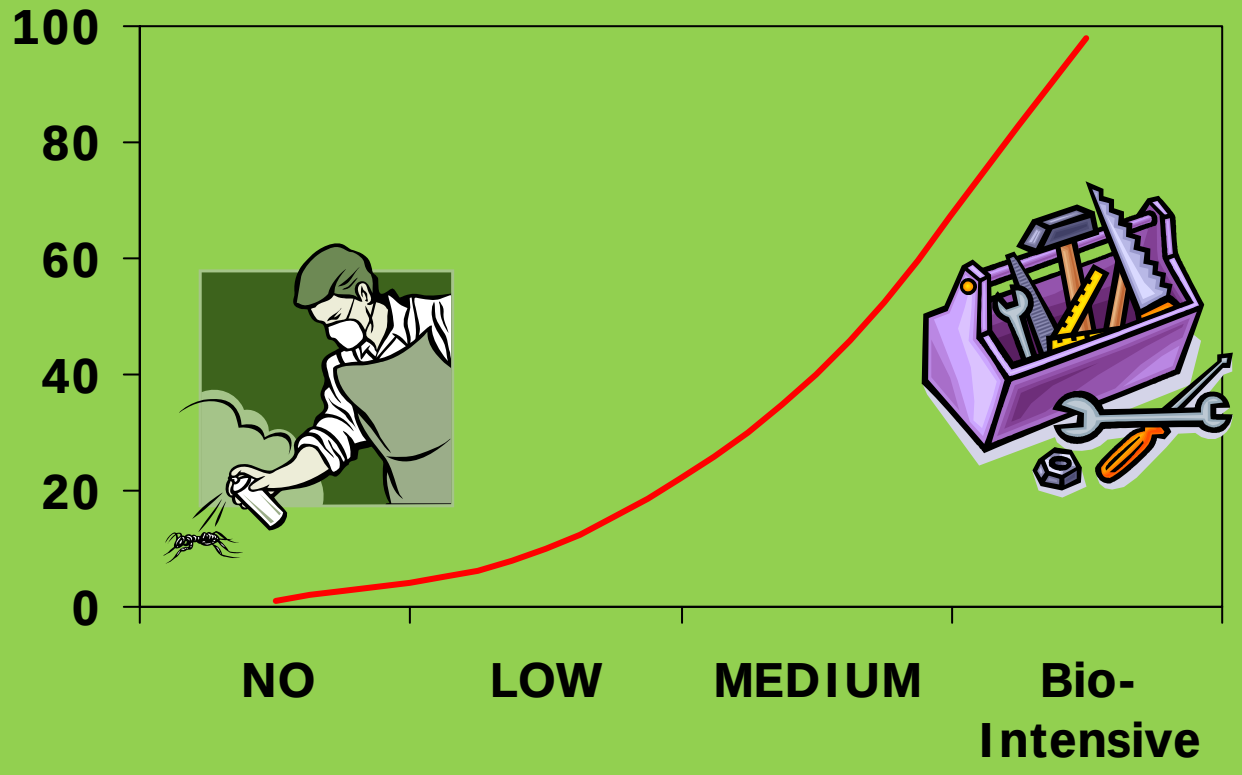
- Can you limit pesticide use to areas where pests actually found or are reasonably expected?
- Is your application device calibrated ?
- Is the pesticide actually measured correctly?
- Are the rates adjusted based on soil type or pest pressure?

Administrative and Community Buy-In

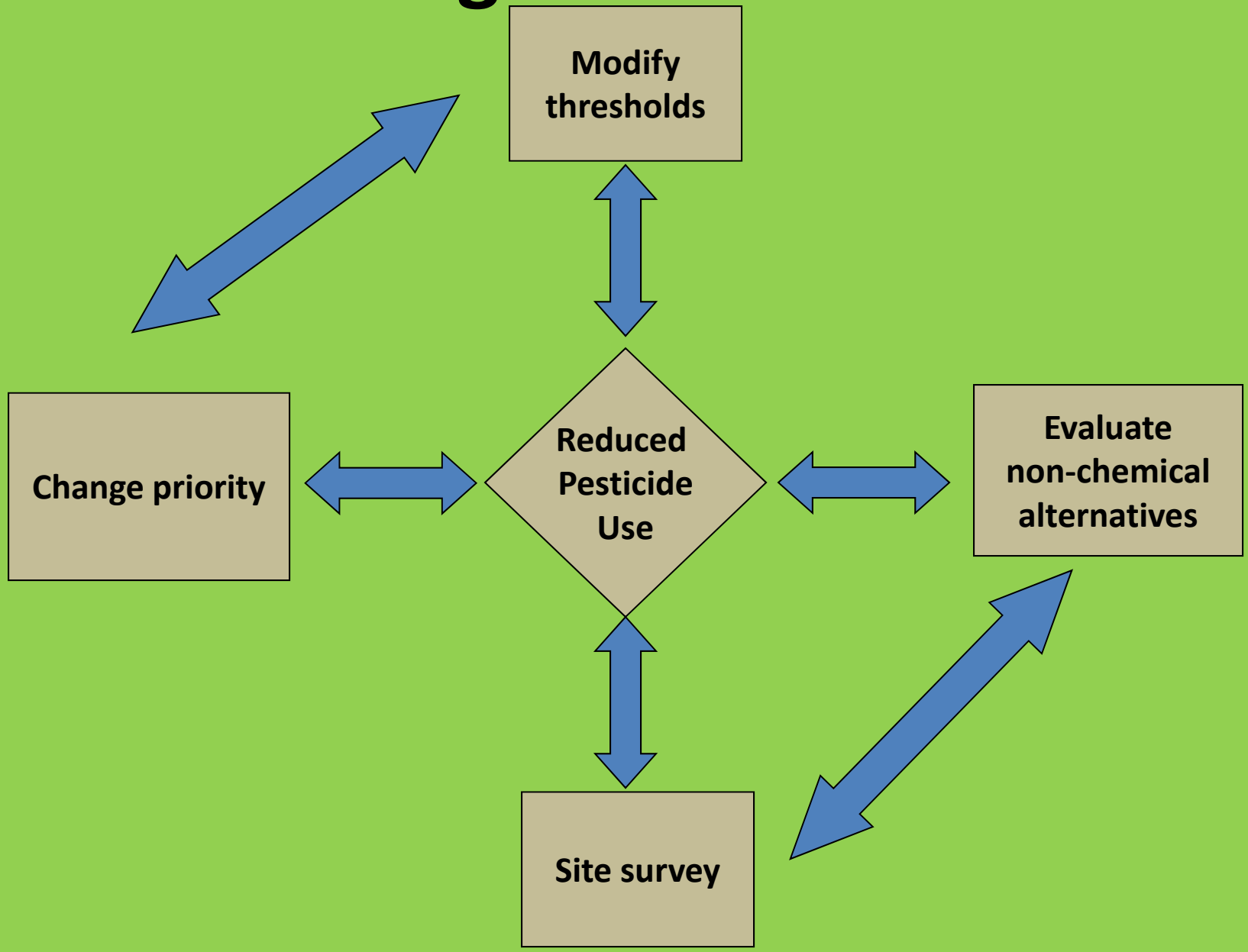




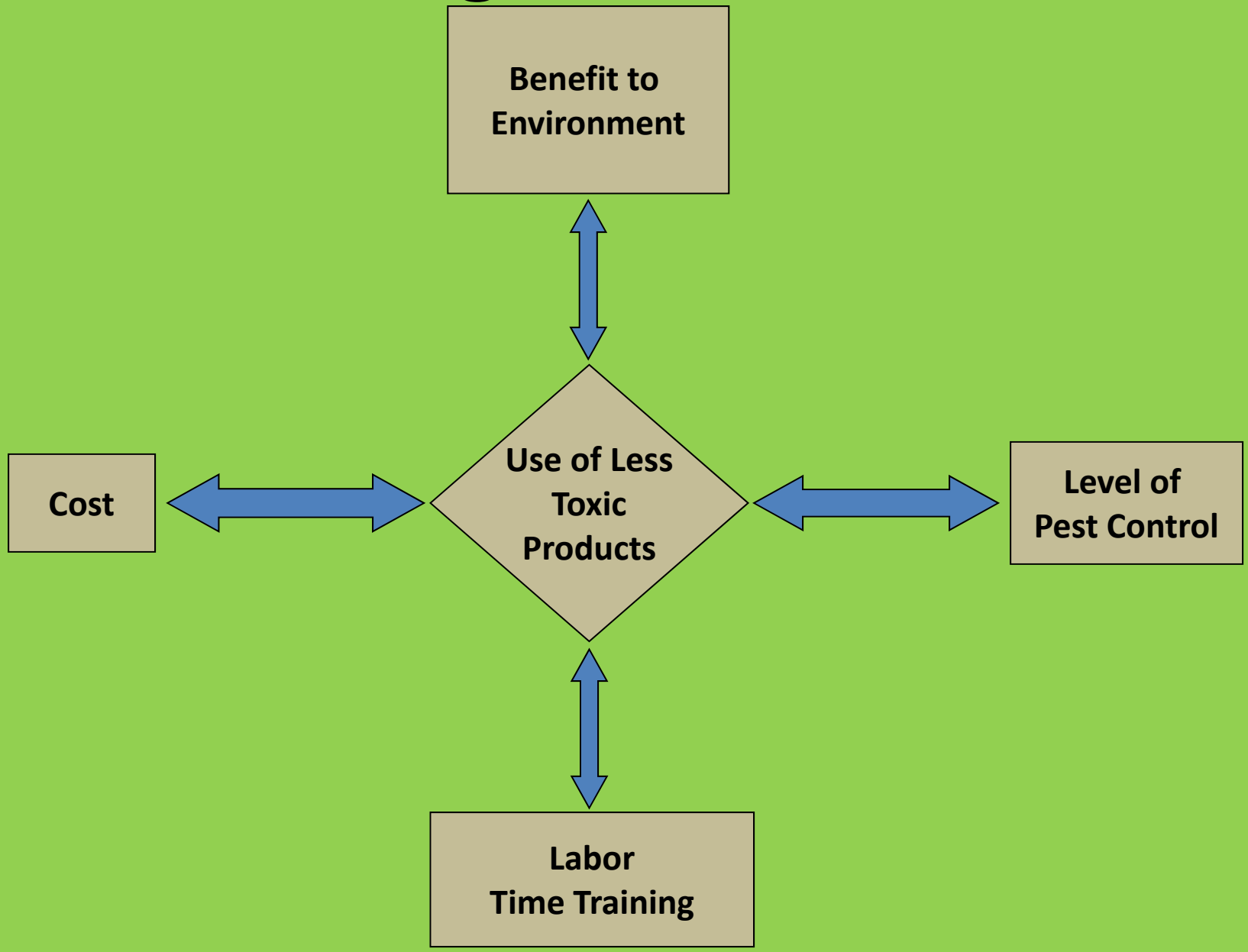
What is the IPM Continuum?



Management Choices



Management Choices



IPM Policy Template

INTEGRATED PEST MANAGEMENT (IPM) POLICY & IMPLEMENTATION GUIDELINES

FOR THE COUNTY OR CITY OF

***GENERAL IPM POLICY:**

For the last 55 years, the trend in pest management has increasing relied on synthetic chemical pesticides. The result has been not only a tremendous increase in the use of many dangerous chemicals, but also an increase in the number of pests that are resistant to the pesticides or new organisms becoming pests. Additionally, some pesticides used for terrestrial pest management have been found in waterways causing problems in the aquatic environment.

Pest control managers are now moving away from their reliance on pesticides alone toward an integrated approach that combines limited pesticide use with more environmentally friendly pest control techniques. This system is known as integrated pest management (IPM), a strategy that focuses on the long-term prevention of pests or their damage through a combination of techniques, including preventative, cultural, mechanical, environmental, biological, and chemical control tactics (**Figure 1**). The techniques are utilized simultaneously to control pest populations in the most effective manner possible.

Developing a comprehensive Integrated Pest Management (IPM) Program and approach allows us to focus on our primary efforts of pollution prevention. By monitoring and preventing pests as well as minimizing heavy pest infestations we can reduce the need for chemicals and/or multiple applications.

IPM programs utilize monitoring techniques and injury and economic thresholds to determine when to implement control strategies. Treatments are used only used according to established guidelines after monitoring indicates that such treatment is appropriate. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and non-target organisms and the environment.

The use of pesticides is often a measure of last resort. Because of this, the management guidelines for pesticide use are presented in a separate section immediately following the IPM guidelines.

* Original language is contained in Orange County Drainage Area Management Plan, Section 5.5.2 Integrated Pest Management adopted in 2003.

IMPLEMENTION GUIDELINES:

Enter Designated IPM Coordinator or IPM Contact Information in Box Below:

John Doe

City of Bug Beach

555-1234

Personnel responsible for the care and maintenance of facilities under the above-mentioned jurisdiction agree to implement a suite of basic integrated pest management procedures selected from the following five main components of an IPM program:

I) Prevention

II) Pest and Symptom Identification

III) Monitoring for Pests and Problems

IV) Action Thresholds and Guidelines

V) Selection of Appropriate Management Methods (Control Tactics)

The procedures seek to increase the long-term prevention and suppression of pest problems (insects, weeds, diseases, and vertebrates) with the minimum impact on human health, the environment, and non-target organisms. Emphasis is placed on improving cultural practices to prevent problems and utilizing alternative control measures instead of broad spectrum pesticides.

Information on the latest IPM information including management of new pests in the landscape is obtained from local UC Cooperative Extension Advisors, UC IPM Regional Advisor, or the Statewide UC IPM Web Site at www.ipm.ucdavis.edu.

IPM Policy Template continued…

I. PREVENTION

A. Landscape Design Procedures *(a minimum of three must be selected)*

- ☐ Drainage, soil characteristics, water quality and availability are considered during plant selection.
- ☐ Sun exposure, heat, and high temperature conditions are considered during plant selection.
- ☐ Adequate space is allowed for root growth, especially trees.
- ☐ Nursery stock is inspected and rejected if not healthy (injuries, diseased, circling roots/potbound, poor staking and/or pruning).
- ☐ Pest resistant species and cultivars are selected.
- ☐ Plants with similar growth characteristics and irrigation requirements are grouped together.
- ☐ Landscape design matches available irrigation technology to avoid excess water use and to minimize surface runoff.

B. Site Preparation and Planting Procedures *(a minimum of three must be selected)*

- ☐ Assess soil drainage properties and improve compacted soils prior to planting.
- ☐ Conduct a soil analysis to determine chemical and physical properties of the existing soil and then add appropriate amendments such as organic matter.
- ☐ Ensure irrigation is installed as designed in order to avoid poor uniformity once plants are in place.
- ☐ Follow proper planting procedures for particular plant species to avoid planting too deeply or too shallow.
- ☐ Nursery tree stakes are removed at planting and replaced with staking that allows trunk to flex; removing these stakes after 1 to 1.5 years.
- ☐ Utilize a soil probe or other soil moisture measurement device to monitor soil moisture levels in existing root ball and surrounding soil during establishment period.

Appendix A

Ranking public areas for weeds (or other pest) management:

Areas ranked as **HIGH** may include areas that the public sees and expects to be well-maintained. Examples are entrances to public buildings such as city hall and libraries.

These areas are allowed to use pesticides based on established thresholds.

Areas ranked as **MEDIUM** may include areas the public sees but does not expect a high level of maintenance. Examples are landscaped areas away from the entrance, recreational and picnic areas. These areas can tolerate a higher lever of weeds.

These areas are allowed to use pesticides but the threshold is much higher and pesticides are used infrequently and only after consultation with IPM coordinator.

Areas ranked as **LOW** may include areas the public rarely sees or does not expect a high level of maintenance. Examples are medians, landscaped areas in parking lots, wildlands. These areas can tolerate a higher lever of weeds.

These areas are not allowed to use pesticides except in extreme cases and only after consultation with IPM coordinator.

Annual Program Effectiveness Assessment

Pesticide Use Reporting

High Risk* Pesticide Class	Active Ingredient (Sub-class)	Brand Name	EPA Registration Number	% Active Ingredient	Total Amount Applied	Units
Pyrethroid	**Bifenthrin**					
	Permethrin					
	Cypermethrin					
	Cyfluthrin					
Organo-phosphate	**Malathion**					
	Dimethoate					
	Diazinon					
	Chlorpyrifos					
Phenylpyrazole	**Fipronil**					
Herbicides	**Glyphosate**					
	2,4-D (phenoxy)					

* Pesticides regularly detected in urban runoff water quality monitoring programs.

Important Role of Pest Control Advisors

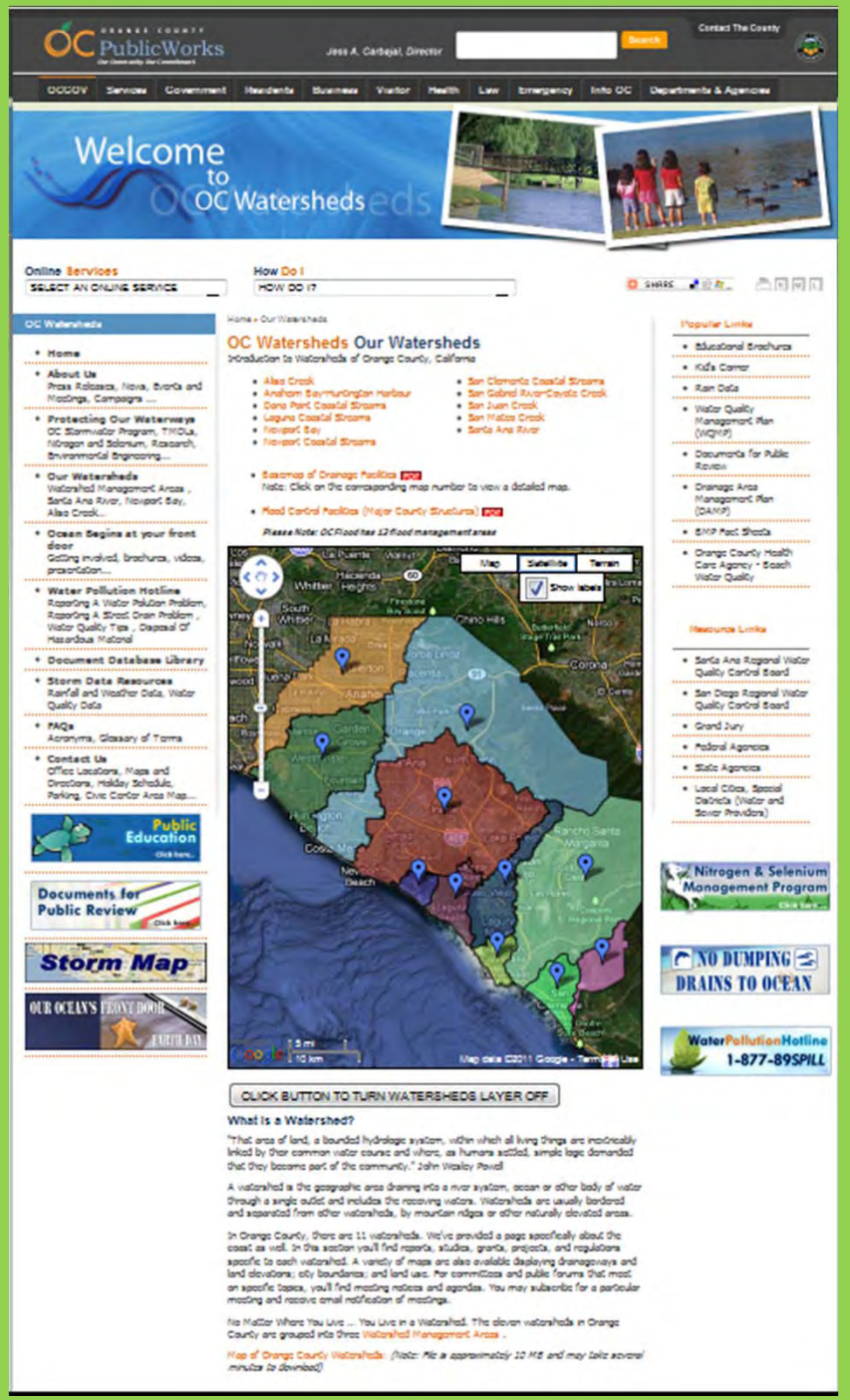
- Recognized experts in the selection of appropriate pest control tactics in the context of IPM.
- Coupled with knowledge of water quality issues could provide recommendations protective of local surface and groundwater conditions.
- Thoroughly written and implemented recommendations would reduce unintended movement of pesticides off-target.

PCA Written Recommendation Considerations

- Preserve natural enemies.
- Suggest cultural or mechanical controls, such as
  - Replacing problem plants with species that are resistant to common pests,
  - Pruning,
  - Improving irrigation management.
- Choose bio-rational (often “least-toxic”) pesticides if available.
- Consider the potential impacts of recommendations on local water quality conditions.

Available Water Quality Resources

OC Watersheds
www.ocwatersheds.com



UC IPM Web Site

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UC IPM Online

STATEWIDE INTEGRATED PEST MANAGEMENT PROGRAM

Search

Announcing...

- Sudden Oak Death Pest Note updated
- Birds on Tree Fruits and Vines, new Pest Note!
- Fleas Pest Note updated
- Green Bulletin newsletter, new issue for September
- Leafrollers Pest Note updated
- Wild Blackberries Pest Note updated
- Kiosk schedule updated for September
- Pecan guidelines updated

Solve your pest management problems with UC's best information, personalize it with interactive tools, or find out about pest management research and extension projects.

- About UC IPM
- 2009 Annual Report

How to manage pests

Manage and identify insects, mites, diseases, nematodes, weeds, and vertebrates

- Homes, gardens, landscapes, and turf *(including Pest Notes)*
- Agriculture and floriculture *(Pest Management Guidelines)*
- Natural environments
- Exotic and invasive pests

Use tools to help make decisions

- Weather data and products
- Degree-days
- Interactive tools and models

Educational resources

- Publications and other materials
- Workshops and events
- Training programs
- Pesticide information

Research and IPM

Turfgrass

Cutworms and Armyworms

Scientific Names:
Black cutworm: ***Agrotis ipsilon***
Variegated cutworm: ***Peridroma saucia***
Granulate cutworm: ***Agrotis subterranea***
Armyworm: ***Pseudaletia unipuncta***
(Reviewed 9/09, updated 9/09)

In this Guideline:

DESCRIPTION OF THE PESTS

Cutworms and armyworms are larvae of heavy-bodied, night-flying moths in the family Noctuidae. The white or greenish eggs of these noctuids are laid in masses, darkening as they approach hatching. Larvae can grow up to 2 inches (5 cm) long and typically curl up and lie still when disturbed.

Although damage is similar, armyworms are distinct from cutworms in their behavior. While cutworms are usually solitary feeders, armyworm eggs are laid in masses and larvae will feed as a group. When populations are high and food is scarce, armyworms will move as a group, feeding indiscriminately on plants in their path. Variegated cutworms are also known to march like armyworms when populations are high.

SUSCEPTIBLE SPECIES

All turfgrass species.

DAMAGE

Cutworms and armyworms are active from mid-March to October. They feed on leaves and crowns and may cut off plants near the soil surface. Larvae feed at night and hide in the thatch layer or in a burrow in the soil during the day. Turfgrass may be closely clipped around aeration holes, which larvae commonly occupy. Damage appears as circular spots of dead grass or depressed spots. Armyworms, especially, prefer damp areas.

MANAGEMENT

Manage armyworms or cutworms by dethatching the turfgrass and ensuring that irrigation does not cause wet areas in the turf. When monitoring indicates a need to treat, treatment choices include parasitic nematodes and *Bacillus thuringiensis* (Bt).

Biological Control

Larvae are parasitized by braconid wasps *(Apanteles* spp.) and by tachinid flies. Birds also commonly feed on armyworms and cutworms. The extensive contact noctuid larvae have with soil or thatch makes *Steinernema carpocapsae* nematodes a valuable control measure.

Cultural Control

Remove thatch to eliminate much of the daytime resting habitat for larvae. Avoid wet areas by irrigating according to evapotranspiration needs of turfgrass, because armyworms prefer laying eggs in damp areas containing stressed plants.

Monitoring and Treatment Decisions

Threshold levels are five larvae per square yard. Conduct a drench test (see MONITORING AND TREATING INSECTS AND MITES) to determine the infestation level. Consider treatment when there are more than five larvae per square yard. Mow and irrigate the site before applying insecticide and do not mow or irrigate the turfgrass for at least 24 hours after treatment unless nematodes were applied, in which case apply a post-treatment irrigation. *Bacillus thuringiensis* subsp. *kurstaki* (Bt) is not as effective against cutworms and armyworms as for sod webworms and should only be used on younger larval stages (first and second instars). When Bt is applied, do not irrigate for 2 days after treatment.

Common name (trade name)	Amount/1000 sq ft**	Ag Use R.E.I.+ (hours)	NonAg Use R.E.I.+ (hours)

The following materials are listed in approximate order of usefulness in an IPM program, taking into account efficacy and impact on natural enemies and the environment. Not all registered

How to Manage Pests

Pesticides: Water-Related Risks of Active Ingredients

About this database

All values are from the Pesticide Properties Database developed and maintained by USDA-NRCS, except where noted. The risk ratings include the NRCS WIN-PST adjustments for application area, rate, and method. Soil type and field conditions may be customized.

Turfgrass: Cutworms and Armyworms

Comparison among pesticides included in UC IPM Pest Management Guideline
when applied under these conditions.

See detail
Table
Data file
Report

Soil type and field conditions Change soil/field conditions

- DEFAULT soil highly susceptible to pesticide movement
- Field slope is less than 15% (Default)
- Field does not have macropores (Default)
- Field does not have a high water table (Default)

Site conditions Change*

- Low probability of rainfall/irrigation expected within 7-14 days of pesticide application (Default)

Application conditions Change^

- Application to more than 50% of the field (M) (Default)
- Surface applied (S) (Default)
- Application rate more than 1/4 pound AI per acre (Q) (Default)

⚠ **Application rate, method, soil type, field conditions, and site condition may not be typical for this crop or your location.**
To change these conditions to match your own, use the "change" buttons or links.

Delete row	Active ingredient (AI) (Sample trade name)	Application conditions	Change^?	Potential Pesticide Hazard on High-Risk Soils					
				Fish (Long-term)			Human (Long-term)		
				Leaching	Adsorbed runoff	Solution runoff	Leaching	Solution runoff	pH
☐	**Azadirachtin** (Azatrol)	M-S-Q	○	I	H	L	V	V	n/a
☐	**Bacillus thuringiensis ssp. aizawai**	M-S-Q		no known risk**	no known risk**	no known risk**	no known risk**	no known risk**	no known risk**
☐	**Bacillus thuringiensis ssp. kurstaki**	M-S-Q		no known risk**	no known risk**	no known risk**	no known risk**	no known risk**	no known risk**
☐	**Bifenthrin** (Talstar)	M-S-U	○	I	L	H	V	L	n/a
☐	**Carbaryl** (Sevin)	M-S-Q	○	L	L	I	L	I	n/a
☐	**Spinosad** (Conserve)	M-S-Q	○	V	V	V	V	V	n/a

Change/Delete Reset AIs

No mitigation measures needed Mitigation measures may be needed
Shorter bars indicate less risk

** No known risk: UC IPM knows of no water quality risk associated with this pesticide.

Information for pest management professionals and pesticide applicators

UC IPM Green Bulletin

University of California
Agriculture and Natural Resources

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Efficacy of Argentine Ant Treatments

During the last several summers, UC Riverside entomologists John Klotz, Michael Rust, and Les Greenberg have tested several insecticide materials and methods to see which treatments most effectively control Argentine ants around homes.

Ant numbers and effectiveness of treatments were estimated by the ants' consumption of sucrose water put out in vials over 24 hours. Previous studies have shown that 1 milliliter of consumption corresponds to about 3,300 ant visits to the sucrose water. The vials are weighed before and after to determine ant consumption. Control vials that did not allow ants to enter corrected for evaporation.

One week, 2 weeks, 4 weeks, and 8 weeks after treatment, the vials were placed for 24 hours both around the house foundation and in the yard. Unless otherwise noted all treatments were sprays applied with a fan nozzle, which treats 1 foot up and 1 foot away from the house foundation (Fig. 1).

Treatments, Efficacy and Water Quality Issues

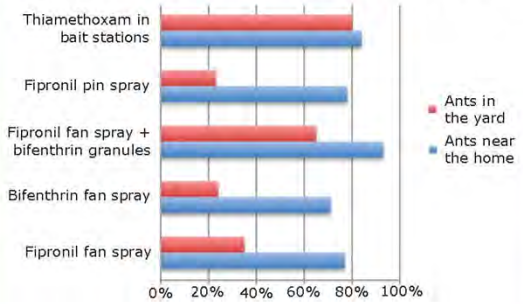
Reduction of ants around the house foundation and in the yard after 8 weeks for each treatment is shown in Figure 2 below. All treatments achieved acceptable control of ants near the home. A combination treatment consisting of 3 gallons of fipronil spray plus bifenthrin granules (2.3 pounds per 1,000 square feet) scattered under bushes and trees gave the best ant control of the methods tested here. Almost as good control was obtained with 0.03% thiamethoxam liquid ant bait in KM AntPro bait dispensers. (See the article on these bait dispensers in the June issue of *UC IPM Green Bulletin*). This treatment, which almost eliminates runoff of pesticide product, would be the best from a water-quality point of view. However, thiamexthoxam bait is not currently registered for this use.

Figure 1. Applying a fan spray 1 foot up and 1 foot out from a house foundation.

Two treatments using fipronil alone applied at 0.06% were tested. These were a standard fan application treatment using 3 gallons of fipronil and a 1-gallon application of fipronil using a pin stream spray applied as a narrow band 2 inches up and 2 inches out from the house foundation. Although the pin stream used one-third as much fipronil as the fan spray, this treatment was almost as effective in controlling ants. Furthermore, with this treatment there was very little runoff of the fipronil into the street, as shown by analyzing the irrigation runoff. Therefore, we have shown that pest control operators can reduce their use of fipronil to 1 gallon if it is carefully applied in a narrow band to the house foundation.

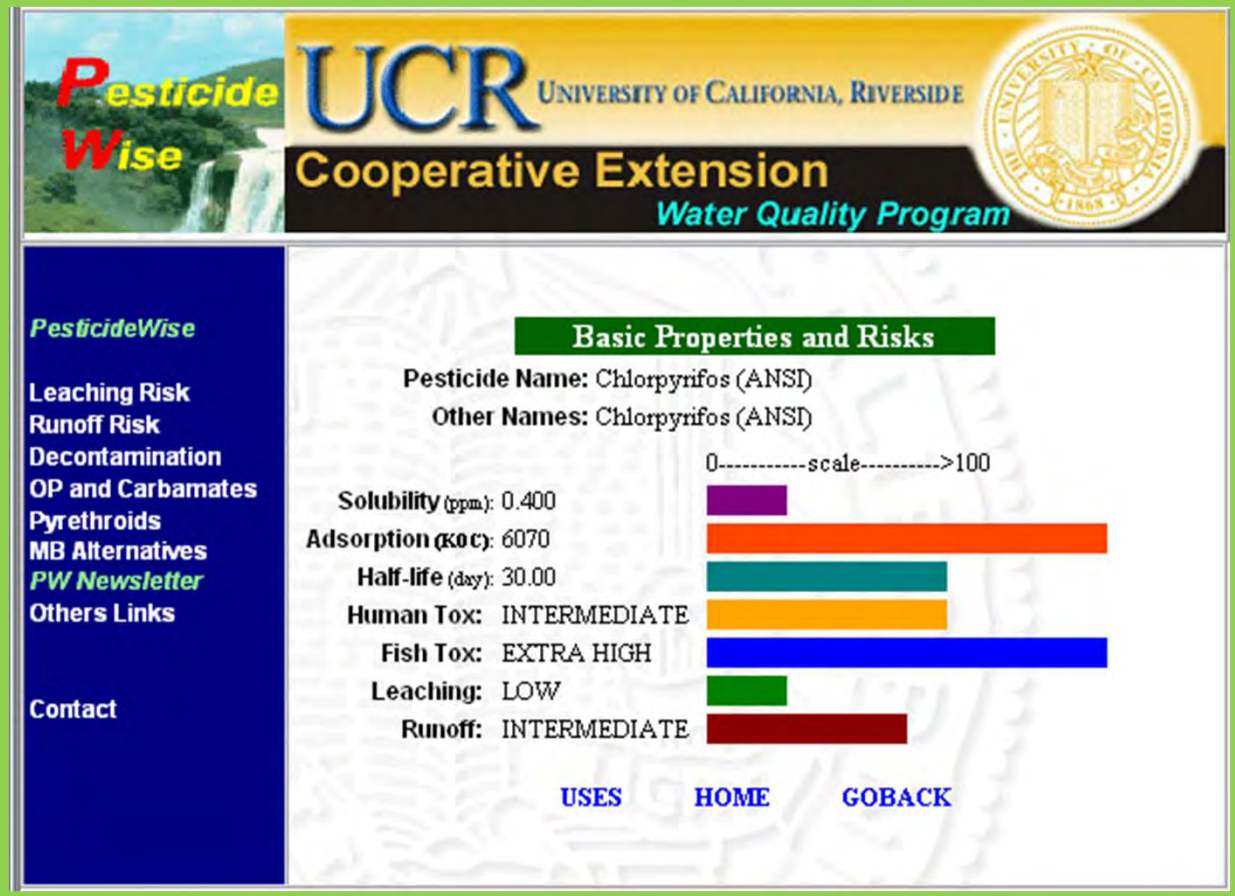
—Les Greenberg, Specialist, Department of Entomology, UC Riverside, les.greenberg@ucr.edu

Figure 2. Percent Reduction in Ant Visits after 8 Weeks



WHAT'S INSIDE ...

UCR's Pesticide Wise www.pw.ucr.edu



http://ucanr.org/sites/urbanwatermgmt/


Questions?