

Countywide Integrated Pest Management Program

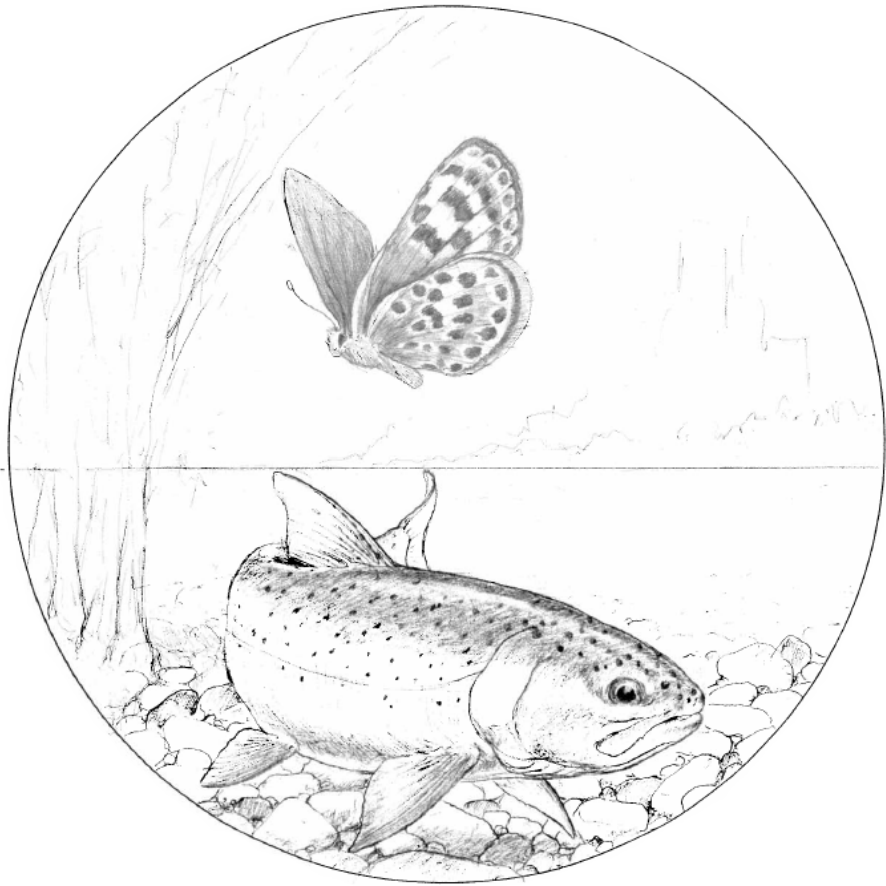


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COUNTYWIDE INTEGRATED PEST MANAGEMENT PROGRAM

INTRODUCTION

1.0 EXECUTIVE SUMMARY

Integrated Pest Management (IPM) is a strategy for managing pests that is informed, long-term and sustainable. It is a science occupying a field of study in colleges and universities, and volumes have been written on the subject. The purpose of this Countywide IPM Program (Program) is not to write another book or produce more experts in the field. Instead, the main purpose of this Program is to provide enough IPM principles, useful information, resources, and support to allow managers of County facilities to successfully manage pests and apply fertilizers at the facility with minimum or no adverse impacts to the environment, including surface water. This document establishes new requirements for County employees and vendors as well as reaffirms existing ones. These requirements are found throughout the document and presented as a summary in Section 21. This document contains a considerable amount of information on pesticides, among other things. However, it is not a comprehensive guide to pesticide use, nor does it constitute the pesticide safety training required by state law.

Certain County departments have large scale or highly specialized pest management needs which fall outside the scope of this general, countywide program. For these situations, additional programs have been or will be developed which adhere to the basic tenets and principles of quality IPM.

2.0 ACTIVITIES COVERED

The activities covered by this Program include outdoor applications of pesticides and fertilizers on property owned or managed by Los Angeles County. The activities shall include those performed by County employees as well as contractors.

3.0 PROTECTION OF LOS ANGELES COUNTY'S SURFACE WATER

In the State's urbanized areas, the concrete and asphalt freeways, roads, parking lots and driveways constitute miles of impervious surface area where rainwater is efficiently channeled into storm drains and water bodies. In Los Angeles County and many other areas in the state, the storm water infrastructure (gutters, drains, culverts, etc.,) are not part of the sanitary sewer system and therefore water traveling through them enters its final destination (in many cases the ocean) untreated. This runoff of storm water from impervious surfaces is proving to be a significant source of pollution, including from fertilizers, pesticides and other contaminants.

Although it might be surprising to some people, agricultural pesticide use is not the largest contributor to surface and groundwater contamination. Recent investigations by the University of California and the California Department of Pesticide Regulation have shown that

surface waters fed by urban runoff may contain a concentration of monitored pesticides up to three times higher than those fed by agricultural runoff.

4.0 COUNTY'S COMMITMENT TO ENVIRONMENTAL STEWARDSHIP

Los Angeles County government consists of individual departments, commissions and their governing body, the Board of Supervisors. Many are guardians of public resources including water, fragile watersheds and wildlife habitat. They take their responsibilities seriously and are deeply committed to protecting the environment through careful stewardship which includes adopting the IPM tenets, policies and procedures established in this document.

5.0 ENVIRONMENTAL PARTNERS

Los Angeles County government, through many of its departments and commissions, has forged some extremely strong and lasting professional relationships with a wide variety of environmental partners. The Department of Agricultural Commissioner/Weights and Measures (ACWM) is a permanent co-chair of the County's enduring Weed Management Area (WMA) through which grants are acquired, habitat restored and invasive species detected and controlled. ACWM receives funding from the California Department of Pesticide Regulation (CDPR) and, under their guidance, regulates pesticide use, stops illegal pesticide sales, and investigates environmental damage related to pesticides. ACWM works directly with the California Department of Food and Agriculture (CDFA) to prevent the introduction into the County of some of the nation's most destructive pests of watershed and other fragile habitat. Over the decades, joint CDFA/ACWM efforts at excluding *agricultural* pests have allowed agricultural as well as backyard fruit and vegetable growing possible with literally thousands of pounds less pesticide active ingredients being required. The Department of Regional Planning worked directly with CDPR to set up and now update the innovative ZAPUR-NET web application which allows anyone to search all of Los Angeles County for documented Endangered/Threatened/Rare species habitat, among other potentially sensitive areas. The Department of Public Works has established an entire division (Watershed Management Division) to work with the Regional Water Quality Control Board, and others, to help protect and restore the County's watersheds and surface water. In some way, an individual, team, unit or division within a Los Angeles County department is working with one or more environmental partners to:

- Prevent illegal dumping
- Cleanup illegal dumpsites
- Test ground and surface water for the presence of contaminants
- Protect native trees
- Prevent overgrazing
- Restore habitat
- Control invasive species
- Prevent contamination from landfills

PART 1 - PRINCIPLES OF INTEGRATED PEST MANAGEMENT

6.0 MANAGING PESTS WITH REDUCED RISK PESTICIDES-OR WITHOUT PESTICIDES

Why Should Less Pesticides Be Used?

Pesticides are a legitimate and valuable tool for managing pests, but they may provide only a short term solution to many pest problems. If the conditions contributing to the pest problems are not modified, the pests may simply return requiring another pesticide application. Some *insecticides* kill natural insect predators making a resurgence of the original pest likely as well as providing a safer environment for new ones to thrive. Every time a pesticide is used, it enters the environment and, as discussed in a previous section, certain pesticides are increasingly being detected in the state's waters, especially from urban runoff. To the extent practicable, the County should show leadership and take the steps necessary to help prevent this problem in Los Angeles County. In addition to helping protect the environment, following the principles found in this Program may allow management of some facilities without using any pesticides thus eliminating the need for employee licensing and training as well as the required pesticide storage.

7.0 WHAT IS IPM

Integrated Pest Management is a strategy that seeks to identify and then change the underlying factors that are allowing or contributing to a pest infestation at a damaging level. When the conditions that are contributing to a pest infestation are changed or modified to the extent that the pest can no longer find what it needs to thrive, the result is long-term, sustainable prevention of the pest with significantly reduced reliance on pesticides. In many cases, successful IPM programs involve combining or "integrating" several strategies into the overall management approach. Pesticides can be part of an IPM program, but are used only after monitoring indicates they are needed according to established guidelines, and treatments are made with the goal of removing only the target organism. Pesticides or control materials are selected and applied in a manner that minimizes risks to human health, beneficial and non-target organisms, and the environment.

8.0 COMPONENTS OF AN IPM PROGRAM

Successful IPM programs all share the same five major components:

1. Pest Prevention
2. Pest and symptom identification
3. Regular pest surveys
4. Action thresholds and guidelines
5. Sound management methods that include integrating biological, chemical, cultural and physical/mechanical management tools

Pest Prevention

"Deciding" to Minimize Pests

The University of California, Division of Agriculture and Natural Resources (UC ANR) are the State's leading experts in IPM, among other things. According to UC ANR, landscape managers have many opportunities to make decisions that minimize pests. For example, healthy and vigorous plants are much less likely to become infected or infested with pests and most landscape pest problems can be avoided by taking the four steps shown below:

1. Chose pest resistant varieties that are well-adapted to local conditions
2. Correctly prepare sites before planting
3. Use proper planting techniques
4. Provide optimum conditions for plant growth
5. Remember that healthy and vigorous plants can frequently outgrow damage from pests

Proper Planting, Plant Selection and Resistant Species/Landscape Choices

According to UC ANR, "effective pest management begins when you select plants that are well adapted to that location." Some plants may be popular choices but may also be prone to common pests and diseases, or require too much water to maintain. APPENDIX D has a list of resources to help identify substitutes for common landscape plants that are more resistant to pests and are more drought tolerant. Continued failure of a plant variety to thrive strongly suggests the plant is not right for the area and should be changed. Not sure what to do? You are not alone. APPENDIX H has a list of resources and contact information where you may be able to get answers to your questions. In addition to the plant type (species), careful selection of the plants based on their condition and other factors *before* they are planted can have long range effects on plant health and future pest problems.

Keeping Pests Outside

In some cases, insect pests like ants may only become an actionable problem when they invade buildings, so a pesticide application may not be needed if the ants stay outside and aren't otherwise doing anything undesirable. Research has shown that most of the pesticides found in California's urban runoff are there as a result of outdoor applications of insecticides. It is highly likely that many of these insecticide applications are perimeter treatments made around a home or other building in an effort to keep pests from getting inside. If possible, ants and other pests should be kept out of a building by its design. In other words, buildings can be designed or retrofitted to prevent pests from gaining entry. An excellent resource on designing pest-proof structures is available as an online publication, *PEST PREVENTION BY DESIGN*¹ developed by the San Francisco Department of the Environment and the International Code Council.

Proper Pruning

Proper, selective pruning can frequently be used to control pests without pesticides as well as prevent future infestations. This is especially the case with plant diseases. However, improper or unnecessary pruning can severely damage trees by causing wounds which are entry sites for insects, decay and disease organisms. Pruning can require a degree of skill as well as a fair amount of specialized knowledge on when and how much to prune depending on the plant species. The general guidelines provided

¹ Chris A. Geiger, Caroline Cox, *Pest Prevention by Design*, San Francisco Department of the Environment, http://www.sfenvironment.org/sites/default/files/fliers/files/final_ppbd_guidelines_12-5-12.pdf (November 28, 2012)

at the end of this section should allow successful pruning of moderate size landscape plants in many of the routine situations likely to be encountered by facilities managers. For more information on proper pruning, readers are encouraged to consult the UC ANR publication *PESTS OF LANDSCAPE TREES*

SAFETY ALERT! Only qualified arborists should prune large trees or those near power lines

*AND SHRUBS*². Minimize future pruning by selecting species that mature to a size appropriate for that location (“*You cannot prune a big tree to make it a healthy small tree no matter how you try*”³)

- Respect the natural form! (do not try to make a round tree tall and thin or vice versa)
- Prune plants properly when young and small to minimize the need to remove large limbs later
- Prune out pests confined or concentrated in a small area of the plant
- Prune off limbs that are infested with wood-boring insects
- Make pruning cuts correctly to minimize the likelihood of disease
- Prune deciduous trees during the winter when they are dormant
- Avoid drastic pruning by doing a little each year

Proper Plant Watering

According to UC ANR, poor water management is probably the biggest problem suffered by landscape trees and shrubs. This is consistent with the experience of the County Plant Pathologist, Dr. Jerrold Turney, who has assisted countless County residents with their plant and landscape concerns. According to Dr. Turney, “if you don’t water properly, it doesn’t matter what else you do.”

Underwatering (too little water) can result in plants that are drought or water-stressed which makes them more susceptible to certain insect pests. Overwatering, which is probably a more common problem in landscaping than underwatering, can contribute to plant diseases and other undesirable conditions. The following plant watering practices can help reduce the potential for plant diseases and other problems associated with watering:

- Water at the plant root zones and not on the trunk
- Avoid overhead watering
- Practice Hydrozoning which is grouping plants with similar water needs

Section 13 has much more information on the principles of water management in landscaping. It is becoming increasingly apparent that wise use of water is vital to the sustainability of our urban environment. Overall water use, as well as some of the challenges of landscape watering, can be reduced by selecting plant species that are well-adapted to the locale. In fact, some native plants require virtually no watering aside from normal rainfall. Appendix D lists resources where more information on drought resistant plants is available. One of the

² Steve H. Dreistadt, et al., *Pests of Landscape Trees and Shrubs, An Integrated Pest Management Guide* (California: Regents of the University of California, Publication 3359, 1994)

³ Shigo, Alex L. 1989 *Tree Pruning, a World-Wide Photo Guide*. 143

very best places to start is *THE DROUGHT TOLERANT GARDEN, LOS ANGELES COUNTY HANDBOOK*.⁴

Biological Control and Conservation/Augmentation of Natural Predators

Natural enemies are important allies in the battle against harmful landscape pests, especially insects. They include predators, parasites and pathogens (diseases). In general, the release of commercially available parasites or predatory insects for successful biological control of damaging insects in landscape or open space settings has not been as extensively studied as it has in agriculture. However, almost all pest insects in Los Angeles County already have one or more natural enemies occurring naturally in the area making protection/conservation of these an important IPM principle. Natural enemies are often more susceptible to pesticides (insecticides) than pests. As a result, pesticides can severely disrupt biological control; therefore, whenever possible, the following steps should be taken to help protect natural enemies from the adverse effects of a pesticide application:

- Avoid the use of broad spectrum and/or long persistence pesticides
- Use only spot treatments
- Use bait stations

Common Argentine ants actively protect honeydew-producing insects like aphids, whiteflies and scale insects which are prey to many predators. Whenever possible, prevent Argentine ants from protecting prey species by using a sticky barrier like TANGLEFOOT® (see image) or by denying access to branches that ants can use to get to where the prey species are.

The natural enemies in an area can be enhanced by creating a favorable habitat. For example, the adults of many species of predatory insects only feed on pollen and nectar, so maintaining flowering and nectar producing plants can provide natural enemies with both food and shelter. APPENDIX E has a list of common plant species that provide food or a favorable habitat for predatory insects. Areas with plants dedicated to augmentation of beneficial insects are sometimes called “insectaries” and the plants within them “insectary plants”.

Pest and Symptom Identification

Identification of the pest species or plant disease is vital for decisions regarding control measures, if any, including proper material selection and application rates. Before a pesticide is applied, a determination must be made if the damage observed is actually being caused by a pest and not an abiotic (non-living) factor such as over-watering, chemical damage or sunburn. If a pest is identified as having caused the observed damage, a qualified person will decide if the timing is appropriate for a pesticide application. In other words, is the pest that

⁴BKI and Green Gardens Group, *The Drought Tolerant Garden, Los Angeles County Handbook*, Los Angeles County Department of Regional Planning http://planning.lacounty.gov/assets/upl/project/green_drought-tolerant-garden.pdf (2012)

caused the damage already gone for some reason or has it entered a life stage where pesticides would not prevent any further damage. An ACWM Entomologist, Plant Pathologist and/or Certified Arborist are available to provide an identification of the actual cause of any observed damage and assist with a determination if a pesticide application will help.

ACWM operates entomology and plant pathology laboratories capable of providing rapid and accurate identification of insects and other invertebrates (snails, slugs, spiders and mites) as well as diagnosis of plant diseases. The two labs process over 8,000 pest specimens annually for Los Angeles County residents, schools, governmental agencies, growers, plant nurseries, and pest control operators. Specimens can be taken directly to the labs (call first) or mailed in. When mailing a specimen, careful handling is required. Appendix I has information on how to properly submit a specimen invertebrate or plant disease sample by mail. Appendix H contains resources and contact information for County departments seeking assistance with identification of potential weed or vertebrate pests (mammals and birds).

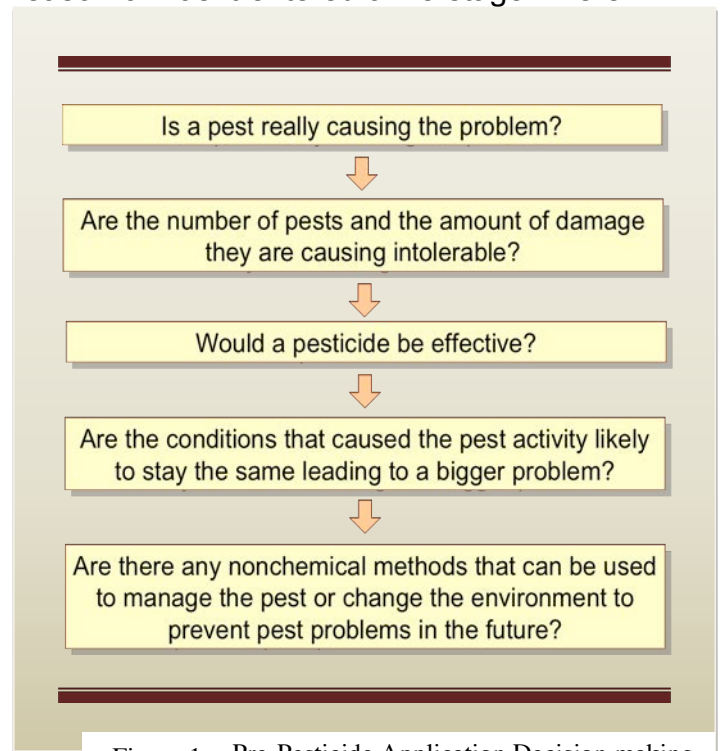


Figure 1 Pre-Pesticide Application Decision making process

Regular Pest Surveys

Regular surveys allow you to detect damage in the early stages and then do something about it before a pesticide application may become necessary. If detected early enough, damage can be pruned out, or changes made to the habitat, to cultural practices, etc. Once pest populations get high, management options can become limited. Regular surveys result in a familiarity with the local landscape environment allowing more precise determinations of pest control methods/ timing, or if any is needed at all.

Action Thresholds and Guidelines

Applications of pesticides should never be made based solely on a calendar schedule, but only after monitoring indicates a pest presence and a threshold of damage has been met, or is likely to be met. Action or damage thresholds help guard against applying pesticides unnecessarily because any damage being caused by an actual pest that could be controlled by a pesticide may simply be tolerated if it does not exceed the established threshold. Don't forget that sometimes damage can even be managed at a tolerable level by selective pruning as previously described. Figure 1 outlines a pre-application decision making process that summarizes much of what has been discussed in this section.

The use of this process is required for any outdoor application of a pesticide at a facility owned or managed by Los Angeles County

A persistent or reoccurring problem requiring multiple pesticide applications suggests a weak point in a facility's IPM plan. These situations should be examined by an ACWM biologist or other qualified person who may recommend changes in landscaping (pest tolerant species), better exclusion or other changes in management strategy.

Sound Management Methods

Management methods for pests should integrate the range of available and effective options including cultural, physical, mechanical, chemical, and biological. The following is a brief description of each:

Cultural Control

Cultural control is modifying or changing the environment, or the way something is done (the practices) in an attempt to make an area less attractive to pests, or less likely the pests will find what they need to thrive. Cultural control includes changing from overhead watering to drip irrigation, appropriate plant pruning and fertilizing, and removing bird feeders to make an area less attractive to rats.

Physical/Mechanical Control

These are usually control measures that directly kill or remove pests. They include things like using steam or hand-pulling to kill weeds, trapping for rodents and pruning out infested plant foliage.

Chemical Control

Chemical control means using a pesticide to control, prevent or repel pests. Pesticides include: insecticides, fungicides, herbicides, rodenticides and other chemicals like many household cleaners/sanitizers.

Biological Control

Biological control is when natural enemies of pests maintain the pests' population levels below a damage threshold. In some agricultural areas, biological control agents are actually purchased and released onto a crop. In urban Los Angeles County, biological control will most often mean protecting, conserving and augmenting natural enemies that are already occurring in the area.

The following sections contain pest management information for some of Los Angeles County's common vertebrate, invertebrate, weed and disease pests. In addition to management methods, the sections also contain information on the other components of a successful IPM Program, which, in case you forgot, are Prevention, Pest Identification, Surveys and Thresholds/Guidelines. It is not possible to cover every pest, or pest scenario, in this document. However, managers of County facilities needing additional help are encouraged to utilize the resources in the Appendix Section or to contact an ACWM biologist for support.

9.0 MANAGING VERTEBRATES

The term *Vertebrate* refers to animals with backbones such as mammals, birds, reptiles, fish and amphibians. Although a variety of vertebrates can sometimes become pests including birds, bats, skunks, opossums, raccoons and even deer, the species which will be briefly discussed here are rodents since they are the only ones for which pesticides are routinely used as a management method. However, any sanitation/exclusion used to prevent rodent infestations will almost certainly help with other vertebrate species as well. Also, since the pesticides used to control rodents are very unlikely to enter surface water through urban runoff, rodent management options will not be extensively covered in this document. For additional information on rodent identification and control options, contact ACWM using the resource information provided in Appendix H. The rodent species most likely to be to require management are the non-native commensal rodents and native burrowing rodents. A brief discussion of each is provided in the following.

SAFETY ALERT! Do not handle rodents without rubber gloves. All dead rodents should be buried or placed in plastic bags in the trash.

Natural Predators

All of Los Angeles County's rodents have natural predators including hawks, owls, coyotes, weasels and snakes. Protection and conservation of these species will help control rodent populations to an extent; however, they will never be able to overcome high rodent populations caused by poor sanitation or other anthropogenic modifications to the habitat. Feral cats should not be introduced or encouraged in an attempt to control rodents because, although they may kill a few rats, they will also destroy many native birds, reptiles and other small mammals. In most cases, feral cats must receive supplemental food from people in order to survive which, if not managed carefully, may result in other pest problems or the cats themselves becoming too numerous.

Commensal Rodents

The commensal rodents are non-native invaders and include roof rats, Norway rats and house mice. The word "commensal" refers to the fact that these species live in close association with humans and are rarely able to survive in truly natural areas. They are frequent invaders into homes, buildings, warehouses, etc. Roof rats are way more common in Los Angeles County than the larger and more aggressive Norway rats which are usually more closely associated with dense human population, trash, food processing etc., than places like landscaped areas and parks. However, Norway rats can be lured to almost any area by poor sanitation and harborage where their extensive tunnels and large, open burrows distinguish them from roof rats. Any infestation suspected to be Norway rats should be reported to the Department of Public Health.⁵

High populations of roof rats can girdle tree limbs causing the limbs to die back. Beyond this, the amount of actual landscape damage caused by commensal rodents is probably minimal;

⁵ Los Angeles County Department of Public Health, Environmental Health Division

however, steps can and should be taken to ensure an area is not attractive to them for the following reasons:

- All of the commensal rodents have the potential to spread diseases to humans and pets⁶
- The sight of a rat at a lunch area would be an unpleasant (not to mention potentially unhealthy) experience for employees and visitors
- If commensal rodents are present in any number, they will exert constant pressure to enter buildings
- Chewing damage to a variety of substrates including vehicle and irrigation wires
- A County facility should never be the source of rodents invading the surrounding community

Unlike many of the pests covered in this document, commensal rodents are usually only able to live in an area due to anthropogenic (human origin) food sources. Table 1 below outlines conditions that contribute to an infestation of commensal rodents and which should be avoided or eliminated.

Table 1. Conditions that Contribute to Commensal Rodent Infestations

<p>Accessibility of food and food-related trash</p>	<p>If any of the following conditions are allowed to persist, there WILL eventually be a problem with rats, mice or both;</p> <ul style="list-style-type: none"> • sloppy employee or visitor lunch areas • overflowing trash or trash cans without tight fitting lids • food leftovers at picnic areas • improperly stored, leftover or spilled pet food or feral cat feeding locations <p>If trash dumpsters are routinely filled to overflowing, it's time to get a bigger one, an additional one or schedule extra pickups. Locating dumpsters 25 feet or more away from the exterior of a building helps reduce the overall quality of habitat for commensal rodents.</p>
<p>Bird Feeders/Bird Feeding</p>	<p>The leftover and spilled seeds from bird feeders can contribute to severe commensal rodent problems. If a bird feeder is absolutely essential to the character of the facility for some reason, it should be tightly covered or brought in each night and the spilled seeds cleaned up.</p>
<p>Water</p>	<p>Leaking sprinklers, faucets and over irrigation provide an almost constant supply of water for unwanted rodents.</p>
<p>Harborage</p>	<p>Commensal rodents don't like to be out in the open and need a place live and hide. Eliminate things like dense vegetation, brush piles, piles of scrap wood and building materials, and pallets.</p>

Glue Boards

⁶ Dr. Joe Ramirez of the Department of Public Health, Environmental Health Division, reports that 68 cases of murine typhus were confirmed in L.A. County in 2013. It is also his opinion the disease is greatly underreported.

The most common methods of non-chemical control of commensal rodents are glue boards and traps. Glue boards are completely non-selective and will trap almost anything that attempts to walk across them. If a non-target animal is caught in a glue board, it is virtually impossible to release it unharmed. For this reason, they should only be used in locations where non-target animals, including birds, do not have access to them. Glue board covers or “tunnels” are commercially available which



Not all injuries to non-target species are a result of pesticides. This brown towhee was the tragic victim of a rodent glue board inappropriately placed outdoors.

may provide a margin of safety for non-target animals in some situations.

Traps

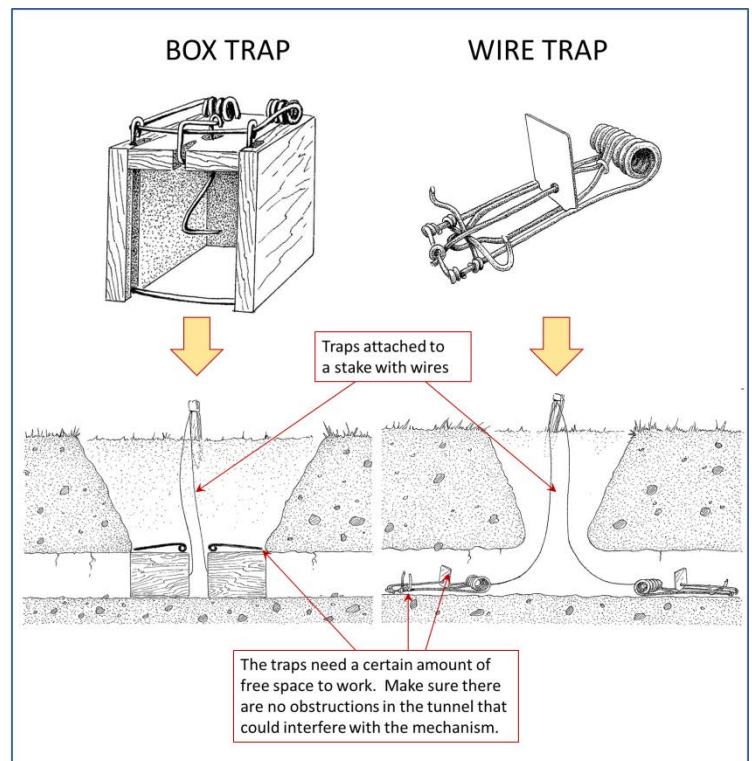
All rodent traps fall into two basic groups which are those that kill the rodent and those that catch them alive. Traps are a little more selective than glue boards since in most cases animals are lured to them with bait. However, the kill types still pose a hazard to non-target animals, especially if something universally attractive is used as bait like peanut butter. Some degree of protection for birds can be achieved by deactivating traps or bringing in glue boards during the day when birds are active and rodents generally are not. Glue boards and traps all pose the problem of disposing of the rodents once trapped.

Rodenticides

Rodenticides, including anticoagulants, are a valuable tool but their use outdoors should only be done by a certified professional using extreme care. They should never be used in an attempt to compensate for weak sanitation or poor cultural practices. Facilities managers considering using a rodenticide outdoors should contact an ACWM biologist who can confirm the use contemplated is appropriate and safe.

Native Burrowing Rodents

The burrowing rodents most likely to be encountered in the urban areas of Los Angeles County are pocket gophers (gophers), California ground squirrels and meadow mice (Voles). Moles will also be included in this section, even though they are not a rodent⁷, because their tunneling and mounds are similar to and



Trapping can be an effective method for gopher control in some situations, but the traps must be properly set or they won't work!

⁷ Moles are insectivores

often confused with gophers'. With all of the burrowing rodents, it is frequently possible to achieve an acceptable level of management without pesticides.

Pocket Gophers

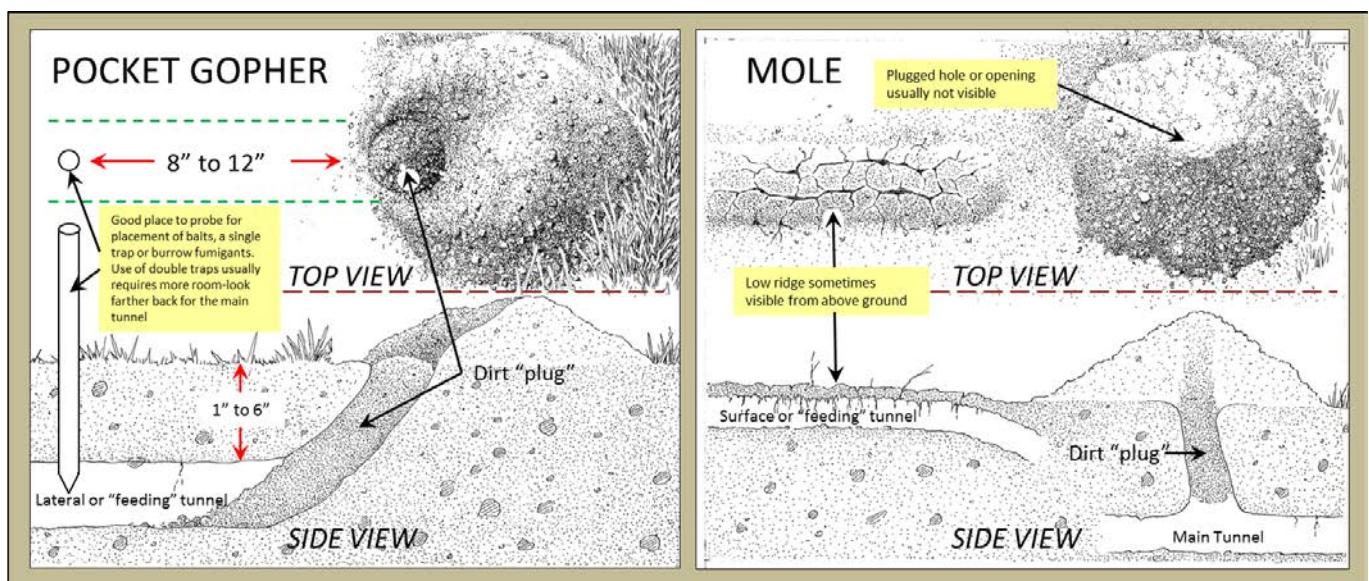
Pocket gophers (gophers) are an extremely common native mammal. They spend most of their time underground consuming a wide variety of plant roots, bulbs and sometimes even bark. Gophers can become damaging in many situations especially small gardens, areas with new plantings and in turf. They are less of a problem in areas with established plants or in natural areas. The damage probably most closely associated with gophers is the extensive tunneling and mound building in turf. The shallow tunnels can be a trip hazard and the dirt mounds can ruin the aesthetics of a lawn as well as kill the grass underneath them creating bare spots allowing weeds to invade.



Gophers are not easily scared and will investigate any sort of disturbance or thing within their burrows including a trap placed there. For this reason, they can be fairly easy to trap making this control method a viable option for small populations. All of the commercially available traps work, but at least one study suggests the wire-type might work a little better than the box-type and they are also easier to set.

None of the following have been scientifically proven to be effective against gophers when placed in or near burrows:

- Gas cartridges (“smoke bombs”)
- Water hoses
- Chewing gum
- Dog or cat feces
- Laxatives
- “Frightening” devices like vibration producing windmills and ultrasonic wave



Was that mound caused by a gopher or a mole? The illustration on the left shows a gopher mound with its characteristic crescent shape and visible dirt plug. The illustration on the right shows a mound made by a mole which is more conical in shape (like a volcano) and usually does not have a visible dirt plug.

generators

It is possible to manage gopher damage using pesticides. The materials available are treated baits and burrow fumigants. If baits are used, they must be very carefully placed within the burrow system or the gopher won't be able to find them. Moist soil conditions can spoil the bait in as little as a day rendering it ineffective. For most of the treated baits, only a small amount of kernels represent a lethal dose for a gopher so even less will kill a bird. For this reason, applicators must ensure that absolutely no bait remains above ground - not even a single kernel.

By far the most effective material for gopher control, especially in large turf areas, is the burrow fumigant aluminum phosphide. Aluminum phosphide is a potentially dangerous Category I pesticide requiring a special permit to use and possess, a site-specific fumigation management plan, posting of the property, a 24-hour Notice of Intent for some uses, among other requirements. Anyone contemplating using aluminum phosphide should first contact an ACWM biologist for advice. Gophers are just one reason why serious consideration should be given to replacing turf with more pest resistant and drought tolerant landscaping.

Moles

Moles are not actually rodents but insectivores. Their tunnels and mounds bear a resemblance to gophers which are a way more common and damaging pest. Moles' diet consists mostly of subsoil invertebrates like earthworms and grubs. The only significant plant "damage" is from the mounds and raised tunnels. Unless the tunnels are causing a trip hazard or the mounds are ruining prized turf, mole damage can simply be tolerated in many cases. The raised tunnels are frequently only used once by the moles that made them; therefore, walking on them can often "repair" the damage. A few deft moves with a shovel or rake each day can prevent the mounds from killing the grass underneath them. If control is needed, there are traps available but they require considerably more skill to set than gopher traps. Chemical control of moles includes poison bait and burrow fumigants. Only limited success can be expected from the former and the latter involves the use of aluminum phosphide which should only be used following a review by an ACWM biologist.

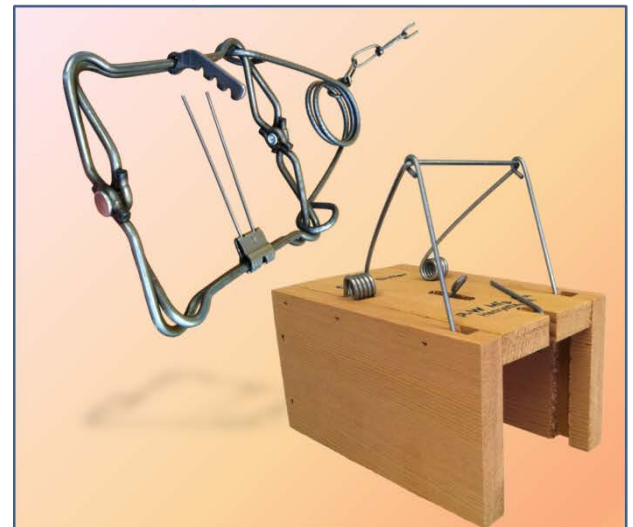
Ground Squirrels

California Ground Squirrels are probably Los Angeles County's most destructive vertebrate pest. They have the ability to flourish in disturbed habitat reaching population densities many times the level supported by natural areas. Extensive burrowing by ground squirrels can disfigure landscaping, expose tree roots to desiccation, completely cover grass and small plants, weaken earth berms and undermine buildings, roads, culverts, drains, and driveways.

High populations of ground squirrels next to wild areas can degrade the area's natural biodiversity by burrowing, eating native plants and even predation on the eggs of ground-nesting birds⁸. Ground squirrels are also a health risk posing a very real danger of plague-if unusual numbers of dead squirrels are observed; the Department of Public Health, Environmental Health Division should be notified.

Ground squirrels are greedy consumers of food leftovers resulting from poor sanitation and very quickly become habituated to food handouts, both of which will almost certainly result in very high populations. For this reason, good sanitation is critical to prevent excessively large populations in areas prone to ground squirrels. Did you know that it is against the law to intentionally feed ground squirrels in Los Angeles County?⁹

As mentioned previously, ground squirrels prosper in disturbed areas and many parts of Los Angeles County are prone to high populations. In these and other areas, there is no practical way of excluding ground squirrels using fencing or any other type of barrier.



The two main types of ground squirrel kill traps are the wire-type like the Conibear 110 above (shown not set) and the box-type. Both work well but the box trap is easier to set and bait. The Conibear also has some pretty serious sign posting requirements (see text) which limits their use in many areas.

A good bait for the box trap is a slice of apple stuck on the trigger. The Conibear is probably most often used without bait by placing over the burrow entrance as shown in the inset photo below.

The Conibear is a very powerful trap and should only be used in areas not accessible to children, pets or non-target wildlife. Both traps need to be secured. Watch your fingers!



⁸Salmon, T.P. and W.P. Gorenzel, *GROUND SQUIRREL: Integrated Pest Management for Home Gardeners and Professionals*, University of California Agriculture & Natural Resources, <http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7438.html> (February 2010)

⁹ Los Angeles County Code, Title 10, Section 10.84.010

The following are some general action thresholds for deciding when to attempt direct control of ground squirrels.

- Anytime the burrows threaten to undermine roads, driveways or foundations
- When burrows threaten to damage infrastructure designed for drainage control or to channel, hold back or store water such as concrete V-ditches, levees and dirt berms
- High or increasing ground squirrel populations are detected near areas frequented by County employees or visitors such as parking lots, picnic areas and well-used trails
- Degradation of landscaping becomes intolerable

Trapping is a practical way of managing small to moderate populations of ground squirrels. As with other rodent traps, there are live-catch and kill-types available. Use of the former is accompanied with the problem of what to do with the trapped squirrels. It is not legal to release or “relocate” ground squirrels into another area. The kill-type traps include the box and wire (Conibear) kind. When any Conibear trap is set on publicly owned land or land expressly open to public use, the law¹⁰ requires posting of signs at every entrance and exit to the property indicating the presence of Conibear traps and at least four additional signs posted within a radius of 50 feet of the trap, one in each cardinal direction, with lettering that is a minimum of three inches high stating: "Danger! Traps Set For Wildlife. Keep Out." Signs shall be maintained and checked daily.

Chemical control of ground squirrels consists of burrow fumigants and treated baits. Gas cartridges are one of the burrow fumigants which are relatively easy and safe to use. In order for them to be effective, there must be some soil moisture. Since they are like a pyrotechnic device, they should NOT be used in dry conditions or around dry vegetation or other flammable materials. Remember, gas cartridges are also a pesticide so any employee using them must first be fully trained according to the requirements outlined in Appendix B. In addition, the pre-application checklist is required. The other burrow fumigant is aluminum phosphide which is a highly effective but potentially dangerous Category 1 pesticide requiring special licensing and permits to apply. Baits treated with diphacinone or zinc phosphide are also extremely effective, but most, like aluminum phosphide, are restricted-use materials. It is illegal and totally inappropriate to use most of the commercially available “rat” poisons in an attempt to control ground squirrels. ACWM is the principal regulatory agency for all pesticide use in Los Angeles County. In that



¹⁰ Fish and Game Code, Section 4004(f)

capacity, it is ACWM's experience that some pest control companies do not always seem to fully understand this nuance. For this reason, it is recommended that an ACWM biologist review any

program for chemical control of ground squirrels by a County employee or a vendor.

Meadow Mice (Voles)

Meadow mice (*Microtus spp.*) are small grayish-brown rodents that look very similar to “regular” mice (house mice) except for the characteristic short tail. They are an intermittent pest in Los Angeles County usually associated with dense ground covers. They can damage a wide variety of plants by feeding and gnawing on trunks, stems, and leaves. Meadow mice need fairly dense and continuous plant cover to move around from their burrows to feeding areas and back. For this reason, habitat modification is particularly effective in deterring them. Removal of weeds, heavy mulch and thick vegetation will help make an area much less suitable for meadow mice. Meadow mice will often use old gopher burrow systems so filling them in after the gophers have been controlled can be helpful.

Small or localized populations of meadow mice can be controlled by trapping. The most common trap used is the standard mouse “snap” trap baited with peanut butter, apple or oatmeal. Be careful, traps can kill non-target animals including native birds. Chemical control of meadow mice includes treated baits and burrow fumigants. Before any of these are employed, an ACWM biologist should be consulted for advice.

10.0 MANAGING INVERTEBRATES

The term *Invertebrate* refers to animals without backbones such as insects, spiders, worms, and snails. This section contains information on many of Los Angeles County’s most common invertebrate pests that injure landscape plants. An internet search using any of the scientific names provided will reveal a wealth of additional information including images. Can’t figure out what it is that’s causing the damage? The County Entomologist may be able to help. Refer to Appendix I for contact information and proper submission of specimens.

Insects

Beetles

Beetles and their larvae may feed on and damage a wide variety of landscape plants. Representatives of such families as *Bostrichidae* (false powderpost beetles), *Buprestidae* (metallic wood-boring beetles), *Cerambycidae* (longhorned beetles), *Chrysomelidae* (leaf beetles), *Curculionidae* (weevils), *Scarabaeidae* (scarab beetles), *Scolytidae* (bark and ambrosia beetles) are often leading the pest charts. Beetles may notch or chew holes in leaves, completely skeletonize foliage and lead to plant death. Some beetle families (*Bostrichidae*, *Buprestidae*, *Cerambycidae*, *Curculionidae*) tunnel in the inner bark of the trees killing branches and tops or girdle the cambium layer reaching the heartwood and creating extensive galleries. These attacks may produce large amounts of sawdust, gumming and bleeding on trunks and branches and can result in dieback and structural weakening. Several representatives of *Chrysomelidae*, *Scolytidae*, and *Curculionidae* may vector injurious diseases that can seriously affect plants. Adults and larvae of some beetles may feed on the same host plant, but attack various parts of it. Good examples are weevils and scarab beetles where adults commonly feed on plant foliage and larvae attack roots.

Many pest species can be found in Los Angeles County including green fruit beetle (*Cotinis mutabilis*), ten-lined June beetles (*Polyphylla spp.*), common June beetles (genera *Cyclocephala*, *Serica*, *Phobetus*), bark beetles (genera *Euwallacea*, *Dendroctonus*, *Ips*, *Monarthrum*, *Scolytus*, *Pityophthorus*), Stout's hardwood borer (*Polycaon stouti*), diaprepes root weevil (*Diaprepes abbreviatus*), California prionus (*Prionus californicus*), eucalyptus longhorned beetles (*Phoracantha spp.*) and others.

Good cultural practices are recommended to maintain healthy plants. Stressed, slow growing or injured plants are particularly susceptible to attack by beetles and their larvae and may display lower survival rates. Infested plant parts often should be removed and properly disposed. Growing plants adequately adapted to the area is essential. Preserving natural enemies (assassin bugs, birds, checkered beetles, click beetles, flat bark beetles, lizards, robber flies, spiders, tachinid flies, braconid and ichneumonid wasps, etc.) is important for managing pest populations. There are several broad spectrum contact insecticides available, but the impact their use might have on natural insect predators must be carefully considered before they are used. If used, insecticides should be applied in the beginning states of infestation (early pest detection is critical); they may not be very effective when populations are high. Spraying plants during blooming season should be avoided due to its toxicity to honey bees and other pollinators.

Caterpillars (butterflies and moths)

Various caterpillars (larvae of butterflies and moths, order *Lepidoptera*) may injure landscape plants. They often chew large sections or skeletonize the leaves, produce silken tents or fold and create shelters on foliage. Some caterpillars bore in and damage branches, others feed on the roots of plants. Initial damage often may not be immediately recognizable. Early in the season, high numbers of caterpillars on young newly established trees and shrubs may seriously affect plants, leading to defoliation, branch dieback and death.

Several pest species are well known to residents of Los Angeles County. Among the most noteworthy are California oakworm (*Phryganidia californica*), fruittree leafroller (*Archips argyrospila*), citrus leafminer (*Phyllocnistis citrella*), omnivorous looper (*Sabulodes aegrotata*), tent caterpillars (*Malacosoma spp.*), tussock moths (*Orgyia spp.*), imported cabbageworm (*Pieris rapae*), carpenterworm (*Prionoxystus robiniae*), owlet moths (*Helicoverpa spp.*, *Agrotis spp.*, *Euxoa spp.*, *Spodoptera spp.*) and clearwing moths (*Synanthedon spp.*, *Paranthrene spp.*).

Controlling caterpillar pests is often difficult. Depending on one type of control (biological, cultural, or chemical) is not as satisfactory as an integrated pest management program where several means of control are utilized. Larvae can be successfully treated by using the bacterium, *Bacillus thuringiensis* which is relatively safe to use around humans and pets. It is most effective when used against newly hatched larvae. Several broad-spectrum contact insecticides are also effective against caterpillar species. Unfortunately, these products often kill many beneficial invertebrates, which may lead to outbreaks of other destructive pests. Conservation of natural enemies (assassin bugs, bigeyed bugs, damsel bugs, birds, ground beetles, lizards, pirate bugs, spiders, various species of parasitic wasps, etc.) is very important since many caterpillars are often under effective biological control by various predators, parasites, viruses, etc.

Aphids, Mealybugs, Whiteflies and Scale Insects

There are several species of aphids, mealybugs, whiteflies, soft and armored scale insects that become pests of landscape plants where they may be commonly found sucking juices on various parts of the plant. The majority of the species prefer young shoots and leaves. Most plants can sustain moderate numbers of these pests without adverse effects, but high population levels can cause stunted growth, curled and yellowed leaves, or distorted stems and fruit. Populations may build up rapidly, when conditions are favorable, reaching pest proportions. Many sap sucking insects excrete honeydew, a sweet, sticky substance that attracts Argentine ants which are ubiquitous in the LA Basin. The Argentine ants consume the honeydew and in return protect these pests from various natural enemies. A black sooty mold often develops on leaves contaminated by honeydew which blocks light transmission to foliage and affects plant growth. Aphids, whiteflies and mealybugs are also known to transmit several destructive plant viruses.

Several factors may boost the sap sucking pest numbers on landscape plants: environmental stress due to overwatering or underwatering, fertilization with high rates of nitrogen fertilizer, or frequent pruning that promotes quick succulent growth.

Many different pest species can occur in Los Angeles County, including brown soft scale (*Coccus hesperidum*), nigra scale (*Parasaissetia nigra*), hemispherical scale (*Saissetia coffeae*), barnacle scale (*Ceroplastes cirripediformis*), latania scale (*Hemiberlesia lataniae*), boisduval scale (*Diaspis boisduvalii*), oleander scale (*Aspidiotus nerii*), citrus mealybug (*Planococcus citri*), longtailed mealybug (*Pseudococcus longispinus*), obscure mealybug (*P. viburni*), pineapple mealybug (*Dysmicoccus brevipes*), coconut mealybug (*Nipaecoccus nipae*), woolly whitefly (*Aleurothrixus floccosus*), giant whitefly (*Aleurodicus digesii*), mulberry whitefly (*Tetraleurodes mori*), sweet potato whitefly (*Bemisia tabaci*), crown whitefly (*Aleuroplatus coronata*), ash whitefly (*Siphoninus phillyreae*), spirea aphid (*Aphis spiraeicola*), oleander aphid (*A. nerii*), melon aphid (*A. gossypii*), conifer aphids (*Cinara spp.*) and green peach aphid (*Myzus persicae*), and others.

There are many parasites and predators of aphids, mealybugs, whiteflies, and scale insects. These pests often are well controlled by ladybird beetles, lacewings, minute pirate bugs, bigeyed bugs, parasitic wasps, and predatory flies. Parasites and predators do not eliminate these pests, but rather keep populations at a level where they do not cause significant damage. Use TANGLEFOOT® or other sticky barrier to keep Argentine ants off trees and shrubs, and trim all branches touching the ground. Wash dirt and dust (detrimental for natural enemies) from infested plants. Yellow sticky cards placed near problem area may help trap large numbers of whiteflies and aphids that are attracted to the yellow color.

Neem oil, narrow-range oil or insecticidal soap can be used to control aphids, mealybugs, whiteflies, and scale insects. Their low residual effects allow natural enemies to move in and establish shortly after the treatment. Broad spectrum contact insecticides should be used only in those limited parts of the plant where sap sucking insects are abundant in order to preserve natural enemies. Systemic insecticides are preferable (they help conserve parasites and predators) and often are relatively more effective than contacts.

Psyllids

Psyllids can be found on wide range of plants and tend to be relatively specific in their hosts, often attacking a single species, genus or family of plants. Saliva injected during feeding process may distort the foliage, turn it yellow and can stunt the growth of the plant. Psyllids may also induce galls on leaves and transmit injurious plant pathogens. Many psyllid species produce large amounts of honeydew and their nymphs can excrete waxy secretions or form wax caps (lerps) of various shapes over their bodies.

Several psyllids are well known to Los Angeles County residents, including Asian citrus psyllid (*Diaphorina citri*), eugenia psyllid (*Trioza eugeniei*), redgum lerp psyllid (*Glycaspis brimblecombei*), bluegum psyllid (*Ctenarytaina eucalypti*), spotted gum lerp psyllid (*Eucalyptolyma maideni*), and pepper tree psyllid (*Calophya schini*).

Control measures are similar to that of aphids, mealybugs, whiteflies and scale insects mentioned above.

Leafhoppers, Planthoppers and Treehoppers

Leafhoppers, planthoppers and treehoppers are active, mobile insects attacking various plant groups. They suck the plant sap often leaving white flecking on the foliage and curled leaves. Some species produce honeydew on which sooty mold grows. Several pest species are important vectors of plant pathogens that cause various injurious diseases.

The following species are the most commonly encountered pests in Los Angeles County: glassy-winged sharpshooter (*Homalodisca vitripennis*), smoketree sharpshooter (*H. liturata*), blue-green sharpshooter (*Graphocephala atropunctata*), two-spotted leafhopper (*Sophonia rufofascia*), keelbacked treehopper (*Antianthe expansa*), oak treehopper (*Platycotis vittata*), buffalo treehopper (*Stictocephala bisonica*) and torpedo bug (*Siphanta acuta*).

Control of leafhoppers, planthoppers and treehoppers is often problematic. Management of weeds (that may harbor large populations of these pests) around landscaped areas is important. Screening of individual plants with various physical barriers (floating row covers, plant cages, etc.) can also be helpful. Many egg parasites, naturally occurring in the environment, provide some control of these pests. Broad spectrum contact insecticides should be used with caution to preserve these natural enemies.

Thrips

Thrips are relatively minute (very tiny) insects that injure plants by puncturing the leaves and sucking the released sap. Damaged leaves display stippling, expanded silvery spots and are often shriveled. Some species may induce galls (leaf folds) which create a safe environment for adults to deposit their eggs and immatures to develop. Heavy infestations may retard the growth and lead to defoliation of the host plant. Thrips are known to transmit several injurious plant pathogens.

Our local species include: Cuban laurel thrips (*Gynaikothrips ficorum*), myoporum thrips (*Klambothrips myopori*), western flower thrips (*Frankliniella occidentalis*), and onion thrips (*Thrips tabaci*).

Controlling thrips often presents certain difficulties. Management should include conservation/augmentation of natural enemies, proper cultural practices and insecticides. If insecticides are used, low toxicity, narrow spectrum and short duration products should be selected to avoid harming natural predators.

***Grasshoppers and Katydid*s**

Grasshoppers and katydids consume a wide variety of plant materials. They attack plants leaving holes and notched edges on leaves or create scarring and distortion of developing fruit. Large populations of grasshoppers, often building up around foothills and empty lots (especially during certain years with moist and warm springtime conditions), can occasionally cause some measurable damage in nearby landscaped areas.

Among most noteworthy local species are devastating grasshopper (*Melanoplus devastator*), gray bird grasshopper (*Schistocerca nitens*), pallid-winged grasshopper (*Trimerotropis pallidipennis*), chaparral katydid (*Platylyra californica*), angle-winged katydids (*Microcentrum spp.*), and bush katydids (*Scudderia spp.*).

Controlling grasshoppers and katydids may present some challenges. Pesticide treatments of weedy areas adjacent to gardens early in the season when these pests are in their immature stages may give adequate control. Using various baits containing insecticides around the perimeter of landscaped areas can be helpful too. Individual plants can be protected with various physical barriers such as plant cages and plastic covers similar to the floating row covers used in agriculture.

Ants

Ants are among the most commonly encountered insects in landscaped areas. They have a wide range in habits and their impact on cultivated areas can be highly variable. Only a handful of ant species directly damage plants. Many ant species feed on other insects and are beneficial predators attacking and eliminating plant pests. Others gather and consume seeds or tend aphids, mealybugs, whiteflies and soft scales harvesting sweet liquids ("honeydew") they produce and protecting these pests from attacks of predators and parasites. At the same time, some ant species may create serious nuisance and health problems by inflicting painful bites or stings.

The most notable and common ant species in Los Angeles County are carpenter ants (*Camponotus spp.*), Argentine ants (*Linepithema humile*), bigheaded ants (*Pheidole spp.*), California harvester ants (*Pogonomyrmex californicus*), field ants (*Formica spp.*), pyramid ants (*Dorymyrmex spp.*), red imported fire ants (*Solenopsis invicta*), southern fire ants (*Solenopsis xyloni*), and velvety tree ants (*Liometopum occidentale*).

Ant control often needs application of several integrated pest management methods and also perseverance. It is particularly important in situations where ants are associated with honeydew producing insect pests. Excluding ants from trees and shrubs is often sufficient for reestablishing successful biological control of various plant sucking insects. Trimming branches that touch the ground and banding plants with special sticky substances (such as Tanglefoot®) will keep ants from climbing up the trunk.

Several solid and liquid ant baits are available and contain insecticides along with food attractant (protein or carbohydrate based). They are more selective and effective in controlling ants than contact insecticides. Ant bait products must be slow acting to allow enough time for workers to reach the nest before they are killed and share it with their nestmates.

Arachnids (Mites)

Plant feeding mites are often very tiny, slow moving creatures that are hard to detect. Although they bear a superficial resemblance to insects, they are actually arachnids and, therefore, more closely related to spiders. Most pest mite species feed on plant foliage often stippling and shriveling leaves. Some mites attack the bark of woody plants, form extensive webbing around their congregation sites or induce galls where they seek protection. At the same time, mites are known to transmit several plant diseases. Low population levels are often tolerable for some plants and may remain unnoticed, but heavy infestations commonly lead to severe plant damage.

The following are a few notable examples of local plant feeding mites: twospotted spider mite (*Tetranychus urticae*), pacific spider mite (*Tetranychus pacificus*), perseae mite (*Oligonychus perseae*), sixspotted mite (*Eotetranychus sexmaculatus*), citrus bud mite (*Eriophyes sheldoni*), and European red mite (*Panonychus ulmi*).

There are numerous predators that feed on plant feeding mites and limit their populations. Some species are even commercially available in California. Any chemical control measures used against pest mites should also address the conservation and monitoring of beneficial predatory invertebrates essential for their management. Use of the broad spectrum pesticides can actually cause mite outbreaks and should be avoided if possible. Insecticidal soaps and oils are often more effective for mite control and are least toxic to environment. Many plant feeding mites prefer dusty, hot locations and are commonly found in landscaped areas adjacent to unpaved roads and empty, dry lots. Plants growing in these conditions should have proper irrigation and can be periodically washed with strong water pressure. This latter measure will also create an environment that is favorable for predators of mites.

Mollusks (Snails and slugs)

Snails and slugs are well known landscape pests that mostly feed at night. The feeding injury and the slime trail are commonly noticed before the pest is detected. Snails and slugs feed on a variety of living and decaying plant material. They often attack foliage leaving irregularly shaped holes that have smooth edges. Young seedlings are particularly vulnerable.

Population numbers are particularly large in cool, moist, well-watered environments. During long dry spells, snails and slugs seek shelters. Snails may seal themselves and keep attached on various solid objects until conditions become more favorable.

Among the most common mollusks of Los Angeles County are brown garden snail (*Cornu aspersum*), banded slug (*Lehmanna valentiana*), tawny garden slug (*Limacus flavus*), gray garden slug (*Deroceras reticulatum*), and greenhouse slug (*Milax gagates*).

Control measures are necessary if new seedlings have been planted or when excessive plant damage was observed. Elimination of hiding places of snails and slugs (stones, weeds, ground covers, wood piles etc.), handpicking and controlling excessive watering (switching to drip irrigation) may noticeably reduce their numbers. Several effective bait products and copper barriers are available for combating snails and slugs. Ground beetles (*Scaphinotus spp.*), devil's coach horse beetle (*Ocypus olens*), and many birds and mammals are well known natural enemies of snails and slugs. Additionally, predatory decollate snails (*Rumina decollata*) can be purchased and released in Los Angeles County to manage brown garden snail populations.

11.0 MANAGING WEEDS

Management of weeds in Los Angeles County can range from techniques as modest as a few swipes each week with a scuffle hoe in landscaping, to large scale herbicide applications requiring integration of complex chemistries and almost surgical removal of individual invasive weeds in wildland settings. The following section contains general information on how to manage weeds in landscaping, turf and other areas. In large areas such as right-of-ways, vacant lots and flood control infrastructure, successful management of vegetation can be one of the most challenging missions facing any county department charged with maintaining those areas. The scale and complexity of the challenges exceed the scope of this general IPM Program. However, with literally decades of experience in abatement, management and eradication of weeds, ACWM is ideally suited to assist departments with this challenge including weed identification and development of management programs.



An ACWM (formerly Horticultural Department) employee examines the newly arrived invasive weed, puncturevine, in 1929.

In many of the western states, the type of damage most closely associated with weeds is probably the severe and, in most cases, irreversible, damage to wildland areas, natural habitat and grazing land. In Los Angeles County, most of the problems caused by weeds fall into one of the following categories:

- Unsightly appearance in landscaping or turf
- Competing for resources (water and nutrients) with desirable plants
- Posing a fire hazard when dry
- Obstructing visibility along roads
- Environmental degradation caused by invasive weeds in watersheds and other sensitive habitat
- Compromised flood control and other infrastructure

With respect to the last category, recent court rulings hold the State¹¹ and local agencies¹² liable for flood related damages which means vegetation encroaching in these areas may not be something that can simply be ignored.

Weeds can be classified into three general categories: broadleaves, grasses, and sedges. Broadleaves are those plants that have wide leaves of various shapes with veins branching out in different directions. Grasses have narrow leaves with parallel veins, arranged in sets of two, and have round or flattened stems. Sedges resemble grasses, but have leaves arranged in sets of three and stems that are triangular in cross section (the old adage “sedges have edges”).

Weeds have three different life cycles as well: annual, biennial, and perennial. Annual weeds complete their life cycle in one year, biennials in two years and perennials survive for many years.

Identifying what type of weeds you are dealing with (often a combination of all of these described here) will allow you to better plan for their management. This information will allow you to anticipate when the weeds you are trying to control will likely germinate, which in turn helps you to time your surveys to look for them and finally can help you to plan your integrated weed management plan. The following table lists many of Los Angeles County’s most common weeds. Almost all of them are exotic invasive which means they did not originate here, and, for a variety of reasons, are able to out-compete native plants in some situations, especially in disturbed areas.

INVASIVE SPECIES ALERT! Appendix K has a list of weeds that are of limited distribution in Los Angeles County, but are known to be, or have the potential to be, extremely destructive. Suspected detections should be reported immediately to AOWMI

¹¹ Paterno v. State of California 2003

¹² Arreola v. Monterey County 2002

Table 2. List of Common Weed Species in Los Angeles County

LIST OF SOME COMMON WEEDS IN LOS ANGELES COUNTY		
A= Annual B=Biennial P=Perennial		
• Annual bluegrass (A)	• English Daisy (P)	• Poison hemlock (B)
• Annual sowthistle (A)	• Hairy fleabane (A,B)	• Prickly lettuce (A)
• Arundo (giant reed) (P)	• Horehound (P)	• Puncturevine (A)
• Bermuda grass (P)	• Horseweed (A)	• Purslane (A)
• Bermuda buttercup (P)	• Indian (tree) tobacco (P)	• Ragweed (A,P)
• Blessed milkthistle (A)	• Italian thistle	• Redstem fillaree
• Bristly oxtongue (B)	• Kikuyugrass (P)	• Salt cedar (P)
• Brome (red, ripgut, California) (A)	• Knotweed (A)	• Slender thistle (A)
• Bull thistle (A)	• Lamb's quarters (A)	• Smartweed (A)
• Castorbean (P)	• Mallow (cheeseweed) (A)	• Sowthistle (A)
• Clover (black medic and burclover) (A)	• Marestalk (A)	• Spurge (prostrate and creeping) (A)
• Cocklebur (spiny, common) (A)	• Mustard (A)	• Sweetclover (A,B,P)
• Common groundsel (A)	• Nettleleaf goosefoot (A)	• Telegraphweed (A,P)
• Crabgrass (A)	• Nightshade (A,B,P)	• Tocolote (Malta thistle) (A)
• Creeping woodsorrel (P)	• Nutsedge (P)	• Tumbleweed (Russian thistle) (A)
• Curly dock (P)	• Perennial pepperweed (P)	• White clover (P)
• Dallisgrass (P)	• Pigweed (A)	• Wild oat (A)
• Dandelion (P)	• Plantains (P)	• Wild radish (A)

MANAGING WEEDS IN AND AROUND LANDSCAPING

Preventing Weeds Prior to Planting Landscaping

When putting in new landscaping, or when renovating an existing site, following the steps outlined below may help prevent weed some problems:

1. *Site Assessment*: Before planting the site and while it is in its “natural” state, it should be evaluated as to what condition the soil is in, the slope of the site, what weeds are currently present, and any other factor that can be corrected or future problems avoided. Such things as drainage, shading, soil compaction, water filtration rate, and soil fertility may affect weed growth and be considered as you create your management plan. For example, poor soil fertility can favor nitrogen fixing weeds such as clovers. Heavily compacted soil destroys the soil structure and can lead to poor drainage. Poor drainage allows water to pool which will deoxygenate the soil leaving “dead” spots that can be invaded by weeds.

2. *Site preparation:* If possible, it is a good idea to attempt to control any weeds that exist on the site prior to beginning any other operation, such as grading or planting. Perennial weeds are of the utmost importance to control because if they are not eliminated at the beginning of the project, there is a strong likelihood they will be one of the first plants to establish themselves in the new landscape. Herbicides are sometimes used for this; however, soil solarization can be very effective if done sufficiently prior to the site development (minimum 6 weeks) and the optimum time of the year (best if done between June and August). Clear (not black) plastic should be used. Solarization is a good prevention and control method for weeds, plant diseases and other pests. Appendix L has more information on effective Solarization.

With sufficient advance planning, the amount of viable weed seeds, or “seed bank”, in a given area can be exhausted by watering the area to promote seed germination, and then destroying the resulting weed seedlings by cultivating alone or with an herbicide followed by cultivation. Repeat this step two or more times for best results.

3. *Define the type of planting:* Weed control options are more varied if landscaping consists entirely of woody plants as opposed to a mix of woody, herbaceous annuals and/or perennial plants. Borders and planter beds can be very effective to reduce weed encroachment and also help define planting types. Group plants with similar cultural needs together and keep grass from becoming a weedy invader in planters by using mowing strips or headers.
4. *Avoid planting weeds:* If soil is imported from other sites, or when using potted transplants, weeds may be introduced to the site. Potted plants should be checked for weeds and, if present, they should be exchanged for weed-free planting material from the supplier or control the weeds in the pots before planting, most often by pulling them out during the planting process.
5. *Encourage rapid establishment of plantings:* Newly planted areas should be monitored frequently and to ensure the plantings are establishing themselves as quickly as possible so that they can be competitive with the weeds that will surely try to establish themselves. This is a good time to hand pull small weeds as they appear and try to keep them from flowering and setting seed. A good pre-emergent herbicide could be an option as well.

Preventing Weeds in Existing Landscaping

The fact that many of Los Angeles County's invasive weeds are prolific seed producers means that there will be almost constant pressure for invasion or reinvasion into an area if the conditions are correct. Most seeds need a place to germinate (soil), exposure to sunlight, and water. Modifications to the landscape environment that serve to interfere with one or more of these critical needs will help prevent weeds from becoming established. In keeping with this principle, it is best to avoid watering large areas where there are no established plants as it only favors weed growth. Using drip irrigation and micro sprinkler heads instead of traditional overhead sprinkler or flood irrigation will go a long way to prevent weeds, is a more efficient use of water and reduces the chance of offsite runoff. Avoiding deep soil disturbances can prevent weed seeds from being moved to the top where they can more readily germinate, and to the extent practicable, weeds should be controlled before they can produce seeds.



Mulch used in this planter at the Hall of Administration helps prevent weed growth, conserves water and reduces runoff.

The sight of well-managed turf in an area where it's appropriate can be a very attractive landscape feature. However, many turf (grass) species can become invasive in planters, and the sight of weedy grass growing up through landscape plants can be particularly unappealing.

Mowing strips and headers should be used to help prevent grass invasion into areas where it is unwanted.

If topsoil or soil amendments are used, avoid reintroducing weed seeds by using products that have been sterilized or kiln dried.

Mulches are a very effective method for preventing weeds. They look good, and are also desirable because they conserve water as well as reduce water runoff. If caught early enough, occasional weed "break outs" in mulch are usually very easy to control by hand pulling or herbicide spot treatments. Mulches suppress weed growth by physically blocking sunlight required for weeds to establish themselves. In order for them to be effective, mulches have to be at least 3 to 4 inches thick. Many types are available to choose from; the following is a generalized listing of what is currently available.

- **Organic Mulches:** Organic mulches as the name implies are made of naturally occurring elements. These include wood chips, sawdust, leaf clippings and bark chips. The important thing to remember when using organic mulches is that it is the thickness or depth of the material that provides the weed suppression. Onsite composting of vegetation can be a good and renewable source of organic mulch. It is not recommended that food items such as leftovers and table scraps be included in compost/mulch as it will almost certainly result in unwanted rodents.
- **Inorganic Mulches:** These can include both artificial and naturally occurring materials. These include such things as sand, gravel or pebbles.
- **Synthetic Mulches:** These are all synthetic material that has been engineered to replace other more conventional products. These include fabrics or geotiles that are substitutes for the more traditional black plastic.

Weed Identification, Surveys and Action Thresholds

Becoming familiar with the weed species common to an area helps with decisions regarding which weeds can simply be tolerated and which ones will need some sort of management. Weed identification and surveys also allow the detection of early stages of weed growth at which time they are much easier to control with virtually any of the management methods, including herbicides. If mulch is used, the early appearance of weeds can be an indication the mulch needs to be thicker, or, in the case of organic mulch, is beginning to break down and needs to be refreshed.

The best way to see changes occurring over time is to monitor the grounds at regular intervals. A good way to put this into practice is to perform regular “walks” about the area and create a check list of problem weeds / areas within the landscape that can help refine an overall Weed Management Program. Often times, seasonal control trends can be identified which can be anticipated and perhaps even prevented. Table 2 has a list of common weeds of landscaped areas in Los Angeles County. ACWM is also capable of identifying any weed occurring in Los Angeles County.

Each facility will have to develop its own action threshold for responding to weeds with the understanding that is almost always better to attempt to control weeds when they are in an early growth stage. Removing young weeds immediately with a scuffle hoe is a successful weed management strategy used at hundreds, if not thousands, of landscaped areas in Los Angeles County.

Management Practices

In reasonably well managed landscaping, there are a number of viable control options which, if used, can reduce the dependency on herbicides.

Hand Weeding and Cultivation

Hand pulling or using a hoe (cultivation) is the oldest form of weed control. The selective removal of weeds that are still in the early stages of growth before they have had the chance to set seed can be a very effective method to maintain landscapes in a weed free condition.

Mowing

Mowing does not usually kill or remove weeds as much as it manages them to the extent that an area can look presentable even though the weeds may still be there. Mowing before the weeds produce seeds will help diminish the seed bank. In non-irrigated areas, mowing can usually be discontinued after about mid-May until the rainy season generates new growth.

String Trimmers

String trimmers (also known as “weed-eaters”) are similar to mowing in that they don’t always kill weeds, but maintain them at such a low growth height that an area can look acceptable even though the weeds may still be there. Weeds cut closer towards the onset of summer may actually die and not return until the rainy season. String trimmers are useful for maintaining a separation between invasive turf grass and planter areas. Using them too close to existing landscape plants can severely damage the plants over time.

Flaming

Flaming involves using a propane burner to kill weeds. It can be a very effective technique for broadleaf weeds in cracks, crevices, along fences or in mulch. It is less effective on grasses. Flaming works best on young plants and they don’t have to be completely toasted as only briefly heating to the point of wilting will usually kill them in a few days. For obvious reasons, this technique should never be used next to dry weeds, brush or other flammable material.

Steam, Hot Water, Hot Foam

These are techniques that require a machine to produce steam or hot sugary foam to kill weeds. They will kill weeds on direct contact and are most effective against very young herbaceous weeds. The equipment can be very expensive to purchase or lease, and then maintain. Because of this and the hazard posed by tanks full of boiling liquids, steam/hot water/hot foam are probably not viable options for most weed management situations.

Herbicides

Herbicides can be a very effective tool for management of weeds in landscaped areas, especially spot treatments of weeds in mulch, cracks and crevices, along fence lines, etc. Many of the commonly available herbicides will harm plants on contact so their use to manage weeds mixed in with landscaping is limited. Some of the pre-emergent herbicides can injure plants if absorbed through the roots. Before any of these are used, an ACWM biologist should be consulted. Application timing is important because most weeds are easier to control when in an early growth stage at which point they also require less herbicide. Herbicides are pesticides so all of the requirements related to pesticide-use outlined in Section 14 and summarized in Appendix A must be followed including employee training, contractor licensing and proper storage. The use of herbicides to control vegetation beyond simple landscaped areas is a considerably more challenging task requiring experience and skill which is often best left to experts.

MANAGING WEEDS IN TURF

Prevention

Site preparation

The healthy lawn starts with a properly prepared site before planting. All of the methods discussed in the landscape section apply to the establishment of a new turf area as well including amending the soil with organic matter or nutrients to improve seed plant establishment and improvement of drainage.

Selection of Grass Species

Turf grass species vary widely in their tolerance of sun, shade, drought and the amount of water needed to maintain them. The selection of the turf grass for site should be discussed with knowledgeable experts in the field; it is suggested that you contact ACWM or University of California Extension office for this input as we/they can provide advice regarding selection of an appropriate grass species.

Irrigation

Incorrect irrigation practices can weaken turf grass growth allowing weeds to invade. Proper irrigation is discussed in Section 13 but it can be reiterated here that one of the keys to maintaining a healthy lawn rests on a well-thought-out irrigation plan. The entire success or failure of your weed management plan may revolve around this fundamental basis.

Mowing

Proper mowing can help keep lawns from being susceptible to weed invasion by keeping them healthy and growing vigorously. The correct height depends on the actual grass species making up the turf. Consultation with ACWM or UC Extension can help determine the correct turf height.

Fertilizing

To maintain healthy turf, fertilization guidelines need to be followed carefully. In general, turf areas need to be fertilized approximately four times per year with no more than 1 pound of actual nitrogen per 1,000 square feet per application. Consultation with ACWM or UC Extension personnel can help you determine the requirements for your specific turf grass species.

Thatch Removal and Aeration

Regular thatch removal will help keep your turf grass healthy and competitive with weeds. Thatch is defined as the layer of organic matter that develops between the soil surface and the turf grass blades. A thin layer of thatch is beneficial; however, you should dethatch your turf when the thatch layer is more than ½ inch thick. Depending on the species of turf grass, this may need to be done yearly or every 5 years or not at all. Dethatching improves the circulation of air, water and nutrients into the soil. Dethatching can be done in small areas by use of a dethatching rake or over larger areas by a motorized or towed dethatcher.

Heavy traffic can compact soil over time. Soil compaction restricts the flow of oxygen, water and nutrients into the roots causing the turf grass to grow slowly and making it more susceptible to weed infestation. Depending on the soil type, soil aeration may need to be done several times per year as with the case with heavy clay soils or heavy foot or vehicular traffic areas to as little as once per year or less for areas with light activity. Aeration can be accomplished with a hand held device for small areas to large and machine driven aerifiers for larger turf areas.

Weed Identification and Monitoring

Just as with landscaped areas, turf areas need to be monitored for the invasion of weeds, and key to that process is being able to identify the weeds encountered so that they can be controlled before they get out of hand. The ability to differentiate between broadleaves, grasses, perennials and annuals will also help with decisions about the available control options.

Management Practices

Hand weeding

As with landscaped areas, sometimes in well maintained and regularly inspected turf areas, hand weeding can be an effective, and cost efficient weed management technique if done on a regular basis.

Herbicides

In general, if turf areas are well maintained, herbicides are not necessary. However, when they are needed they should be a part of your overall weed management plan that includes good cultural practices.

MANAGING WEEDS IN NON-LANDSCAPED AREAS (INTEGRATED VEGETATION MANAGEMENT)

Managing weeds in large areas qualifies as Integrated Vegetation Management (IVM), which, as mentioned in a previous section, can be one of the most challenging missions facing any county department charged with maintaining those areas. Much of it involves a scale and complexity that are outside the scope of this general IPM Program requiring specialized IVM programs developed on a case-by-case basis. Notwithstanding the likely complexity of any IVM programs, they will all still follow the same five basic elements of successful IPM which are:

- Pest Prevention
- Pest and symptom identification
- Regular pest surveys
- Action thresholds and guidelines
- Sound management methods

Prevention

Much of the prevention element of IVM falls outside of the ability/authority of most County departments and includes things like:

- Plant Quarantine laws at the federal and state Level
- Local enforcement of restrictions on the sale or movement of certain plants, soil or other potentially infested carriers
- Requiring the use of Certified Weed Free Forage in recreational areas

Mulch is a prevention method that can be employed by County IVM programs including in relatively large areas. For it to work properly, the mulch will need to be applied thick enough initially (3 to 5 inches) and then monitored periodically to make sure it is not getting thin in spots or weeds will break through. It is not a good choice in areas where it will be washed away by rain or subject to frequent disturbance. Cleaning equipment before moving it into a new area can help prevent the introduction of seeds or other plant propagules. Once established, certain invasive weeds can be spread by weed abatement mowing or discing. In these situations, the source plants or seedlings may need to be controlled with herbicide spot treatments.

ALLIGATORWEED HOLD AREA ALERT! Areas in and around Puddingstone Lake, the San Gabriel River, Los Angeles River and other aquatic features in south east Los Angeles County are under a hold order. Before entering these areas, see Appendix L for

Plant (Weed) Identification

The degree to which weeds/plants need to be accurately identified depends on the purpose of the control and the control method selected. For fire prevention using mechanical methods (discing, mowing, string trimmers), there is rarely a need to know the actual plant species except that it may help to time the control to prevent weeds from producing seeds. Also, careful timing can reduce the number of times control may be needed.

For vegetation management using herbicides, identification of the weeds is very important. The weed species dictate the herbicide product choice, application rate and seasonal timing. Some herbicides can harm desirable plants, including full-sized trees, by volatilization or when applied in the root zone. Knowing which plant species are susceptible to this kind of damage will help keep you out of trouble! CAUTION! Most open area herbicide applications fall into the category of non-production agricultural use of a pesticide and require a written Pest Control Recommendation. Section 15 has more information on this as well as other requirements for pesticide use in these areas.

Weed Surveys

For weed abatement intended for fire prevention using mechanical methods, weed surveys are not always critical although cutting the weeds right as they start to get brown at the approach of summer very often prevents them from growing back until the next season. When herbicides are used, surveys allow precise timing of the application at a growth stage of the weeds during which they are most susceptible.

Applying herbicides when weeds are most

susceptible also reduces the amount of herbicides required making surveys for this purpose a very important element to a successful and environmentally responsible IVM program.

Damage Thresholds

Damage or action thresholds for weeds are very difficult to establish in a document like this one. The amount of weeds that can simply be tolerated will range from 0 (none!) for certain highly invasive species all the way to somewhere at the other end of the spectrum. Each department will need to develop their own based on the purpose for controlling the weeds at all.



This is the invasive weed Mareostachys. The image in the center shows an only partially successful attempt at control, possibly because of the late growth stage. The plant is much more vulnerable in the rosette stage shown on the right. Much less herbicide is also required.

Management Practices

IVM practices include tractor mowing and discing, handwork with string trimmers and other tools, herbicides and goats. Small area control methods like flaming, steam, hot foam, etc., are generally impractical for larger IVM areas. Biological control is also a management method, but usually one only undertaken by Federal and State agencies.

Tractor Mowing

Mowing is a very cost effective method of weed management, especially for fire prevention, large open areas for aesthetics, roadside clearance, etc. It is the only method recommended for tumbleweed abatement projects of any size. Over the seasons, mowing tends to smooth out minor land imperfections resulting in a very pleasing park-like appearance. One of the most significant downsides to mowing is the very real potential for mower-sparked fires which must be carefully considered before deciding to mow. Compared to discing (see below), mowers are also relatively fragile so expect a few breakdowns during the course of a season. Mowing is probably not a good choice for rough, rocky areas, or properties with a significant amount of trash.

Tractor Discing

Discing is a management method most often used for fire prevention. It is very efficient, and ideal for large fire breaks, steep hills and rocky terrain. If a well-maintained tracked (crawler) tractor is used, the operation is very reliable and rarely ever has to be stopped for break downs. If necessary, discing can actually plough

under a certain amount of trash/illegal dumping. Discing is without question the cheapest and most effective method for fire prevention, but it must be timed properly or dust can become a problem. There are AQMD restrictions on discing in much of Los Angeles County.

Handwork

This method of weed control usually involves a crew using handheld equipment such as string trimmers, chainsaws and polesaws. Handwork is more expensive than mowing or discing, but a large enough and experienced crew can move through an area with reasonable speed and leave it looking very neat and well-trimmed. This is a viable method for fire prevention, roadside clearance or vegetation management in other large areas, especially where tractor access is limited. There are a fair number of safety requirements associated with handwork, including Cal-OSHA regulations related to Heat Illness Prevention, power equipment safety, hearing conservation and traffic safety (for roadsides).

Herbicides

Herbicides are a valuable tool for vegetation management. They are virtually the only method recommended for situations where practically no amount of weeds can be tolerated such as flood control levees and petroleum tank farms. They can be used with almost surgical precision to remove invasive plants intermixed with desirable vegetation such as the case with arundo¹³ in fragile watershed areas. Properly chosen and carefully applied, selective herbicides are commonly used to reclaim/restore land that has been overrun by exotic invasive plants like yellow starthistle. Herbicides are a good choice for vegetation control along roadsides where speed and efficiency translate to worker and motorist safety.

The use of herbicides in the situations described above requires an excellent understanding of product chemistry, accurate plant identification, careful calibration of equipment, and a host of other requirements including virtually everything outlined in

PART 2 (SAFE AND EFFECTIVE USE OF PESTICIDES AND FERTILIZERS).

Goats

The use of goats to graze down vegetation is a method used occasionally in Los Angeles County. Goats are actually a good choice for very steep slopes where fuel reduction is the management goal, and goats will even eat poison oak! Goat clearance is



Goats hard at work clearing weeds in the Thompson Creek Dam, Los Angeles County, October 2012. (Image courtesy Gemelee Cruz)

¹³ Arundo (*Arundo donax*) or Giant Reed, is probably Los Angeles County's most hated invasive weed.

very slow compared to the other vegetation management methods, and they also leave the area looking somewhat trampled over. Since it might take goats several days or longer to finish their “work”, an onsite staging area for the herder and his or her trailer as well as a place where the goats can be safely penned up at night, is a requirement. Hay or other forage used as supplemental food for goats while they are “working” can contribute to the spread of invasive weeds. Consider using certified weed-free forage and allowing the goats to purge for a few days before entering the new area to avoid any invasive weed seeds that may have been consumed from their last assignment.

Chicken Tractors

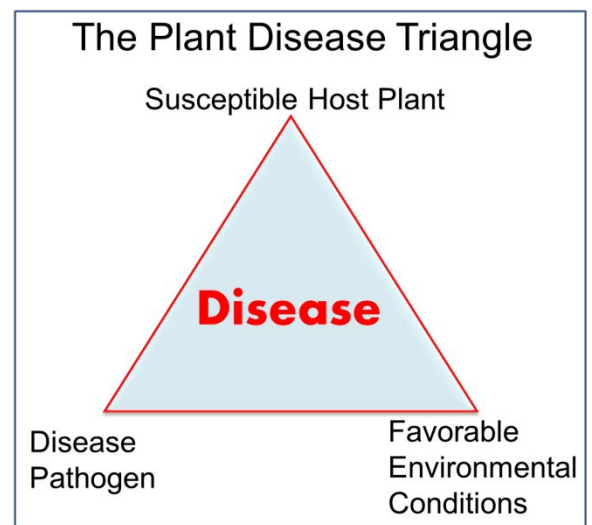
Chicken tractors can be a fun way to manage weeds in small situations, especially if the area is maintained for kids or educational opportunities.

12.0 MANAGING PLANT DISEASES INTRODUCTION TO PLANT DISEASES

Landscape plants suffer from a wide variety of plant diseases and disorders. Plant disease can be separated into biotic diseases and abiotic disorders. Biotic diseases are caused by living microorganisms such as fungi, bacteria, viruses, or phytoplasmas. Abiotic disorders are caused by environmental factors such as frost, saline soil, extreme heat, drought, or herbicide drift.

The Disease Triangle

Plant diseases result from the interaction of a susceptible host, a disease causing agent, and an environment that is favorable to disease development. Disease can be controlled by altering one of the three elements in the disease triangle. If the host is not susceptible, the pathogen is not present or the environment is not favorable, then the disease will not develop. Host resistance is the most effective means to control plant diseases. When selecting plants for a landscape, it is critical to take into account diseases that are prevalent in the area and select species or varieties that are immune or highly resistant. It is not practical to depend on treatments or frequent application of pesticides to control plant diseases.



The Importance of Proper Plant Selection

The most effective means to control plant disease is the use of resistant varieties. This is true for all plant diseases. In many cases there are no treatments or chemical controls that will prevent infection or control the pathogen responsible for the disease. The following contains general information on the most common diseases seen in Los Angeles County landscapes which includes powdery mildew, rust, root rot, fire blight, bacterial scorch, cankers, leaf spots, anthracnose, galls, downy mildew, and vascular wilt. For assistance with plant disease identification and control, as well as identification and management of abiotic plant disorders, contact the County Plant Pathologist using the information in Appendix I.

Tips for Recognizing Abiotic Disorders of Plants

Disease-causing fungi, bacteria, and viruses are all living organisms so plant damage caused by them is considered “biotic”. Non-living, or “abiotic”, factors can also cause plant damage and include things like sunburn, frost, herbicide drift, and mechanical damage. The symptoms are often very similar between biotic diseases and abiotic disorders. Patterns and how fast a plant is affected are more important than specific symptoms when trying to decide if it is an infectious disease or an abiotic disorder. Diseases usually start at one spot or several spots in a field and spread out over time, for example rust or powdery mildew. If a group of plants show symptoms very quickly, like overnight, and it does not spread, it is more likely abiotic. Think about herbicide drift or frost. If the plants look good on one day and in poor condition the next, but then over the next week or two no other plants show any symptoms, this suggests a one-time event damaged the plants. On the other hand, an actual disease usually starts on one plant, and, as that plant declines or shows progressive symptoms, other plants of the same species start showing the same symptoms as the disease spreads. Another example would be a brown spot on turf from dog urine. The grass shows rapid death where the dog urinated but the spot does not get any bigger over time. If it were a fungal disease, the spot would get bigger over time and more spots would appear that also enlarge over time.

FUNGAL DISEASES

The most common fungal diseases in Los Angeles County are powdery mildew, downey mildew, rust, anthracnose, leaf spots, phytophthora root rot, and armillaria root rot. Refer to the following for general information on each.

Powdery Mildew

Powdery mildew is common on many landscape plants and can be expected to occur whenever a susceptible host is used in a landscape. Powdery mildew appears as grayish or white powdery growth on leaves, stems, and fruit. New growth is highly susceptible and can be dwarfed and distorted due to infection. Species that are susceptible to powdery mildew include euonymus, strawberry, grape, stone fruits, heavenly bamboo, apple, crape myrtle, rose, and sycamore. **The most effective means to manage powdery mildew is to select species that are not susceptible to powdery mildew or resistant cultivars of susceptible species.** Some common landscape species, such as heavenly bamboo (*Nandina domestica*), become infected with powdery mildew when planted in shade. Powdery mildew on crape myrtle (*Lagerstroemia indica*) is more severe on heavily shaded trees compared to trees growing in full sun.

Resistant cultivars are available for many roses, euonymus, crape myrtle, and sycamore. Several varieties of London plane tree (*Platanus acerifolia*) are resistant to powdery mildew including ‘Columbia’, ‘Liberty’, and ‘Yarwood’. The native western sycamore, *Platanus racemosa*, is highly susceptible to powdery mildew. Resistant roses include ‘Meidiland’, ‘Simplicity’, *Rosa rugosa* varieties, and glossy-leaved varieties of hybrid tea and grandiflora.

Chemical control of powdery mildew requires frequent sprays to achieve effective control. Various fungicides are available that act as either foliar protectants or as a curative treatment. Potassium bicarbonate, sodium bicarbonate, and sulfur are

common treatments that act as foliar protectants. These materials need to be applied prior to infection or before the infection becomes extensive. Applications need to be repeated at regular intervals to protect new growth or replace material that has washed off of leaves and stems. Horticultural oils such as JMS Stylet Oil, jojoba oil, Sunspray and Neem oil can act as curatives when applied early to slight or moderate infections. There are broad spectrum fungicides that act as foliar protectants and are effective for the control of powdery mildew. There are also fungicides that are curative. Before using any of these, the County Plant Pathologist should be contacted for a positive identification and management advice.

Downy Mildew

Downy mildew should not be confused with powdery mildew. Downy mildews are caused by Oomycetes (watermolds) in the genera *Bremia*, *Sclerospora*, *Pernospora*, *Plasmopara*, *Pseudoperonospora* and other genera. Downy mildew is characterized by soft or fluffy gray, purple or light brown growth on the underside of leaves. It rarely occurs on the tops of leaves. The tops of the leaves will show pale yellow or purplish to brown lesions. While downy mildew can be mistaken for powdery mildew, downy mildew almost always occurs on the underside of leaves while powdery mildew will occur on both sides. Environmental conditions that favor downy mildew include low temperatures, high humidity, and free moisture on the leaves (wet foliage will actually suppress powdery mildew). Ornamental plants that are susceptible include rose, aster, impatiens, foxglove, pansy and coneflowers. Vegetables and fruit vines that are susceptible to downy mildew include spinach, squash, watermelon and grape.

Control downy mildew by selecting resistant varieties or species, avoiding overhead irrigation and increasing air circulation by thinning canopies. There are fungicides that will control downy mildew, but as with other plant diseases, the County Plant Pathologist should be contacted for a positive identification and management advice.

Rust

Rust diseases are common on a variety of ornamental plants used in landscapes. The fungi that cause rust disease may have up to five spore stages and two or more different hosts. Susceptible hosts include carnation, chrysanthemum, birch, cottonwood, fuchsia, hawthorn, juniper, pear, pine, poplar, rhododendron, grasses and rose. Rust diseases are characterized by reddish, orange, purple or black spore masses that form on infected tissue, usually on the undersides of leaves. Rusts that infect pines may form galls on branches or sporulate directly on the trunk. The disease usually begins as yellow spots on the upper surface of leaves. Mild and moist environmental conditions favor spore germination and infection. Rust spores are moved by wind and rain splash.

Control of rust diseases depends on the selection of resistant varieties or immune species. Avoid overhead irrigation as this can move rust spores and favors spore germination. Remove any infected plant parts. Collect and dispose any infected leaves, needles, and branches. Improve air circulation by increasing the space between plants. Spring applications of fungicides can reduce some rust diseases but the application frequency required may not be practical.

Anthracnose

Anthracnose (pronounced anne-THRAK-nōs) is a disease that occurs on caused by fungi from various genera including *Colletotrichum*, *Glomerella*, *Discula*, *Gleosporium*, *Gnomonia* and others. The most common symptoms are angular leaf spots and foliar blight. Species that are most susceptible include redbud, ash, elm, oak, sycamore, and dogwood. Anthracnose fungi occur mostly on leaves and twigs but can cause large cankers on some hosts such as elm. The fungi responsible for anthracnose overwinter as infection on twigs on deciduous hosts. Wet and cool conditions in spring favor infection. Repeat infections occur when wet weather is prolonged. The progress of the disease slows and stops during warm dry conditions.

Management of anthracnose depends on selecting resistant varieties and pruning out infected twigs and branches. If the infection becomes severe, the disease cannot be controlled during the current season. Applications of fungicides are usually not practical for medium to large trees. Smaller trees such as dogwood can be sprayed with broad spectrum fungicides in early spring. Through coverage of all new growth as buds open is required. Spraying will need to be repeated about every two weeks if wet conditions persist.

Leaf Spots

Several fungi can cause leaf spots on susceptible hosts. Septoria species can infect aspen, azalea, cottonwood, hebe, and poplar. Septoria leaf spots may be angular or round and sunken, occurring mostly on older leaves. The spots may start out dark brownish purple and then develop light brown or gray centers with dark borders. Environmental conditions that are conducive to infection are similar to anthracnose diseases. Select resistant varieties or species. Avoid overhead irrigation and remove infected twigs and leaves at the end of the season. Entomosporium leaf spots can occur on apple, crabapple, hawthorn, loquat, pear, photinia, pyracantha, quince, and toyon. The leaf spots start as small red spots and can be bordered by red, purple or yellow. Leaf spots will enlarge as the leaf matures. Spores are spread from infected leaves and twigs by rain and overhead irrigation. The fungus overwinters in fallen leaves. Wet weather during the onset of new growth is highly favorable to disease development. Manage the disease by removing infected leaves and stems. Collect and dispose of fallen leaves that were infected and avoid overhead irrigation. Copper-based fungicides can be effective when applied prior to infection, usually in early spring.

Phytophthora Root Rot

Phytophthora (pronounced fy-TOF-thor-a) is a genus of pathogenic fungus-like organisms that infect plants, especially roots, causing root rot. Phytophthora is a type of water mold, growing best in an environment of free water in the soil or on foliage. The name Phytophthora means 'the plant destroyer'. Phytophthora is arguably the most destructive plant pathogen in the world, being the most serious disease of numerous agricultural crops and landscape plants. The cost of damage to crops caused by *Phytophthora* species in the United States alone runs into billions of dollars every year. The most infamous species of Phytophthora is *P. infestans*, which is the disease that destroyed Ireland's potato crop in 1845 and 1846, resulting in the Irish potato famine.

Common phytophthora root rots include those of avocado, citrus, pine, pineapple, camellia, azalea, tomato, carrot, rhododendron, oak, and many more. Some species of *Phytophthora*, such as *P. infestans*, can cause disease on only a few plant species, while others, such as *P. cinnamomi*, cause disease on more than 900 species of plants. Although most *Phytophthora* species cause root rot, many also cause diseases that affect leaves, branches, twigs, and fruit. A new disease of oaks, sudden oak death, was observed in 1995 in California and has since been shown to be caused by a new species of *Phytophthora*, *P. ramorum*.

Symptoms of Phytophthora

Plants in the early stages of phytophthora root rot show symptoms of drought and starvation because the damaged roots can no longer draw water from the soil. Trees and shrubs exhibit poor growth, thinning of the canopy, tip die-back, small leaves, cupping of the leaves, poor leaf color, wilting, bud drop, poor flower production and small fruit or no flowers or fruit.

Shrubs will often die one stem or branch at a time. Young trees suffering from phytophthora root rot are usually stunted and tend to just sit for long-periods with no new growth. Phytophthora can move from the roots to the trunk causing cankers that bleed and exude gum. Trunk cankers can appear dark brown or black and be sunken or depressed. In the absence of controls infected plants usually die.

Usually the tips of the roots are infected and killed first. Healthy root systems have many white root tips, and the roots are plump and firm. The root systems of infected plants have very few or no white root tips. The small feeder roots that are infected by *Phytophthora* will be dead and dark brown or black. In some plant species, such as citrus, the infected roots will slip or sluff off leaving a thin white thread or strand, which is the center of the root. In other plant species, such as avocado, the feeder roots will turn black and become brittle. Large roots will develop dead, dark brown to black lesions. Infected strawberry roots show a red-colored core which is diagnostic of strawberry red stele root rot caused by *P. fragariae*.

Phytophthora Life Cycle

Most *Phytophthora* species produce three different spores: oospores, chlamydospores, and zoospores. Each of these spores plays a different role in the life cycle of *Phytophthora*. The swimming zoospores are the main source of new infections in the root system. They are released when the soil becomes saturated during irrigation or rain, and can swim for hours seeking the roots of a susceptible host plant.

Control of Phytophthora

Limiting the frequency of irrigation is the most important means of controlling phytophthora root rot. Prolonged soil saturation caused by frequent watering, poor drainage or heavy rains can lead to severe root rot. Watering less frequently limits the production of the zoospores that infect new roots and the number of infectious cycles that occur. Improving soil drainage will also help control phytophthora root rot. This can be accomplished by amending the soil with mulch, breaking up hardpans or by planting on raised mounds. High levels of organic matter and calcium in the soil can create an environment which suppresses phytophthora root rot.

Phytophthora can also be controlled with several different fungicides which are applied as either a root drench or directly to the foliage. An accurate identification of the disease should be obtained first from the County Plant Pathologist who will also be able to help with proper timing of any application.

Armillaria Root Rot

Armillaria root rot is caused by *Armillaria mellea*, also known as the oak root rot fungus. Symptoms may not develop until after the disease is well established. The first symptoms are poor growth or dieback of shoots, small yellowish leaves and premature leaf drop. Diagnostic features are the mycelial fans that form under the bark, the mushrooms that develop at the base of the trunk of infected trees and rhizomorphs that can extend from the mycelial fans or wrap around the roots. Although there are 11 species of *Armillaria* in North America, *A. mellea* is the only species that attacks landscape trees and shrubs in California.

Armillaria mellea can survive for decades in dead stumps and large roots. The fungus spreads from tree to tree by root contact or through rhizomorphs, which can grow short distances in the soil and contact and penetrate tree roots. There are no chemical controls for Armillaria root rot. Management of Armillaria root rot depends on preventing infection of new trees. Infected stumps and roots from killed trees should be removed. It is not possible to save infected trees. Once infection of a tree has become apparent it is recommended that the tree be removed.

BACTERIAL DISEASES

There are two common bacterial diseases that occur in landscapes in Los Angeles County: fire blight and diseases caused by the bacteria *Xylella fastidiosa* which include bacterial leaf scorch as Pierce's Disease.

Fire Blight

Fire blight is caused by the bacterium *Erwinia amylovora*. It is common on apple, pear, crabapple, and pyracantha. It also occurs on cotoneaster, hawthorn, loquat, mountain ash, serviceberry, spirea, and toyon. The bacterium infects flowers, stems, and fruit. Infection in stems causes cankers which ooze brown droplets during wet weather. Insects acquire the bacteria from bleeding cankers and spread it to flowers in spring. Bees and splashing water can also spread the infection to other flowers. The infection spreads down the petiole of the flower into twigs and branches. Branches are girdled due to the infection and the branch dies beyond the point of infection. Leaves wilt and die quickly after the branch is girdled. Dead leaves remain attached to the branch resulting in dead branches scattered throughout the canopy giving a burned or blighted appearance to the tree. Infection can be extensive if it rains while the tree is blooming. The bacteria overwinter in infected cankers in branches and twigs.

Management of fire blight depends on selecting resistant varieties and quickly removing any infected branches. Application of copper and systemic fungicides during bloom can prevent new infections but will not cure existing infections. Fungicides that are effective at controlling new infections include Bordeaux powder, fixed copper, and Aliette. Applications of fungicides are not needed in the absence of rain during the blooming period.

Diseases Caused by *Xylella fastidiosa* (Bacterial Leaf Scorch and Pierce's Disease)

Pierce's disease and bacterial leaf scorch are caused by the bacteria *Xylella fastidiosa* (*Xf*). It is proving to be one of the most significant causes of plant diseases in Southern California. The bacterium is moved from plant to plant by many genera of insects such as sharpshooters, leafhoppers, and spittlebugs, which are referred to as vectors. In addition to cultivated plants and fruit trees, wild grasses, sedges, and lilies are frequent hosts in some areas as are some native bushes and trees.

Transmission of Pierce's Disease and Leaf Scorch

Xf lives in the water conducting tissue of plants (the xylem) and is spread (vectored) from plant to plant by leafhoppers and spittlebugs. The most important insect vector in Los Angeles County is the leafhopper known as the glassy-winged sharpshooter. The glassy-winged sharpshooter was first observed in Orange County in the early 1990's and is now well established throughout Southern California. Other sharpshooters, such as the native smoketree sharpshooter and the blue-green sharpshooter, also act as vectors, but are less efficient at doing so. The insect vectors acquire the bacteria from infected plants while feeding on the xylem sap. Once the bacterium is acquired, an adult vector retains the bacteria for the remainder of its life. The isolates of *Xf* from grape do not infect oleander and the isolates from oleander do not infect grape; therefore, the removal of oleanders will not prevent the infection of grapes that are nearby.

Symptoms of Pierce's Disease and Leaf Scorch

On oleanders, leaves on one branch will turn pale green and wilt. This is quickly followed by scorching of the tips or margins of the leaves. As one branch develops symptoms and dies, other branches start showing symptoms. Since the mid-1970s, many other strains of *Xf* have been discovered, and almost all of these cause similar leaf scorching of woody perennials such as American elm, maple, mulberry, plum, liquidambar, olive and crepe myrtle. In some plants, such as peach, the bacterium slows and stunts the plant's growth.

Control of Pierce's Disease and Leaf Scorch

There are no effective controls or pesticides for diseases caused by *Xf*. Controlling the vector and removing infected plants has not been effective at preventing the spread of *Xf* to healthy grapes or oleanders. Experimental treatments with antibiotics have inhibited symptom development but are not commercially feasible. Appendix G has a list of websites containing more information on *Xf* diseases. In the coming years, *Xf* caused diseases may prove to be a major impediment to landscape managers. The County Plant Pathologist is available to help with long-term management strategies and up-to-date information.

VIRAL DISEASES

Viruses can cause a variety of symptoms in woody landscape plants. Typical symptoms include mosaic patterns in leaves, color break in flowers, stunting and distorted growth. Some species are intentionally infected with a virus to create variegated flowers such as in Camellia. Roses are commonly infected with several viruses that cause a mosaic pattern in the leaves. Viruses can be transmitted to other

plants by insects, grafting, and by mechanical transmission. There are no treatments that cure or control virus infections in plants and generally treatment is not needed.

13.0 MANAGING WATER

How water is managed can have a significant effect on plant health as well as pest infestations. This Section contains a comprehensive guide to proper plant watering including how much, how often and how different soil types may effect plant watering. While it may be possible to maintain plants with a high water requirement in hot areas of the County, it is strongly advised that they be replaced with plants better suited to the local climate, including with drought-tolerant native plants. Turf (grass, lawns, etc.) has an exceptionally high water requirement, and, if practicable, should be replaced at County facilities unless it is somehow essential to the character of the facility, or to its purpose (playground, park, etc.). The following information on landscape watering can seem a little intimidating at first, but don't give up! It may not be as complicated as it looks. The Los Angeles County, Plant Pathologist is an irrigation/water management expert and prepared this section on water management. He is also available to directly assist County departments with their irrigation needs. He can be reached at the contact information in Appendix H.

How to Irrigate a Landscape or Home Garden

There are several basic concepts that need to be understood in order to correctly irrigate a landscape or home garden. These concepts include evapotranspiration rate, crop coefficients, application rate, field capacity, and the permanent wilting point. When developing a watering schedule, it is also important to take into consideration the soil texture (clay, loam or sand), and the prevailing weather conditions for the location. When irrigating landscapes and gardens, the goal is to water the soil to the depth of the root zone for the plants that are being irrigated.

Evapotranspiration

The reference evapotranspiration rate (ET) is the total water loss from the soil by transportation through the plant and by evaporation from the soil surface. Reference evapotranspiration rate is defined as the water loss from 4-7 inch tall cool season grass, in an open field, that is not water stressed. ET is measured in inches just as we measure rain fall and the rates are given in inches per day, per week or per month. ET rates vary by season and location. Average ET rates along the coast in S. CA are 0.75 inches per week in spring and fall, 1.5 inches per week in the summer and 0.5 inches per week in the winter. Average ET rates in S. CA hot inland valleys are 1 inch per week in the spring and fall, 2 inches per week in the summer and 0.5 inches per week in the winter. Average ET rates in S. CA deserts are 1.5 inches per week in the spring and fall, 3 inches per week in the summer and 0.5 inches per week in the winter.

Crop Coefficient

The crop coefficient is the percentage of ET a plant species needs. The crop coefficient for citrus is 66%. This means that citrus grown in a hot inland valley need 0.66 inches per week in the spring/fall and 1.32 inches per week in the summer. The crop coefficient for cool season grasses is 80% and 60% for warm season grasses. This means that a cool season grass such as a tall fescue, growing in a hot inland

valley, needs 0.8 inches per week in the spring/fall and 1.6 inches per week in the summer.

Shrubs and trees can vary tremendously in their drought tolerance and crop coefficient. The crop coefficients for landscape plants have not been as extensively researched as those for agricultural crops. Very low water use plants have crop coefficients below 10%, low water use plants have crop coefficients in the 10% to 30% range, moderate water use plants have crop coefficients in the 40% to 60% range, and high water use plants have crop coefficients in the 70% to 90% range. Some plant species may have low water use needs in a cooler region and moderate water use needs in a warmer region.

Application Rate

Although there are several ways to apply irrigation water the most common application of irrigation water uses sprinklers. Sprinklers allow for the calculation of the application rate in inches per hour. The easiest way to determine the application rate for a sprinkler system is to place straight-sided cups (tuna cans, coffee cups) in the area where the sprinklers apply the water. Turn on the sprinklers for 15 minutes and then measure the amount of water in each cup. Add the depth of water in each cup, divide by the number of cups and multiply by 4 to determine the application rate in inches per hour. Typical lawn sprinklers apply water at approximately two inches per hour, although this can vary considerably. Two inches per hour is a very high application rate as most soils will not absorb water faster than 0.5 inches per hour. It is best to apply water at low application rates to avoid runoff. Older sprinkler systems can be converted to low application rate sprinkler heads that will apply water at rates lower than 0.5 inches per hour.

When water is applied using drip irrigation, soaker hoses or by filling water basins around trees and shrubs it is difficult to determine application rates in inches per hour. When water is applied using the above techniques the depth of water penetration into the soil should be determined by probing the soil with a metal rod or use a sampling tube. Push a metal rod into the soil after applying the irrigation water until it is difficult to push it any further. The rod will penetrate to the same depth as the water. Sampling tubes are used to collect a column of soil which can be examined to determine the depth that applied irrigation has penetrated.

Depth of Irrigation

The goal, when irrigating landscapes and gardens, is to have the water penetrate to the depth of the root zone. The depth that irrigation water penetrates the soil is dependent on the soil texture and the number of inches applied. One inch of water applied to sandy soil will penetrate to about 12 inches. One inch of water applied to a loam soil will penetrate to about 7 inches. One inch of water applied to a clay soil will penetrate to about 4-5 inches.

Rooting Depth

Plants are not all rooted to the same depth. Lawns are typically rooted to a depth of between 6-12 inches. Small and medium size shrubs are typically rooted to a depth of 18 to 24 inches. Large trees and shrubs are typically rooted to a depth of 24 to 36 inches.

Watering Lawns

Lawns have shallow roots in the upper 6-12 inches of the soil. One half inch to one inch of water will wet the soil to the depth of the root zone. The upper 6-12 inches of soil dries out quickly and water has to be applied frequently to prevent wilting and drought stress in lawns. In the spring and fall, lawns will need to be watered once or twice a week. During the hot summer months, lawns will need to be watered two to three times per week. Drought tolerant grasses such as Bermuda and St. Augustine have crop coefficients of 60 %. Cool season grasses such as tall fescue and Kentucky blue grass have crop coefficients of 80%. This means Bermuda grass will use 25% less water than a tall fescue.

Watering Small to Medium Sized Shrubs

Small and medium size shrubs will require enough water to penetrate to 18-24 inches. This will require 2-3 inches of water. Water that reaches to a depth of 24 inches will remain in the soil, and be available to the plants roots, longer than water that penetrates to a lesser depth. This means you do not need to water as often when watering small to medium sized shrubs. Generally, shrubs of this size can be watered every two weeks in the spring and fall and once a week in the summer.

Watering Large Shrubs, Large Trees, and Fruit Trees

Most fruit trees and large trees will require enough water to penetrate to a depth 24-36 inches. This will require 3-4 inches of water. Water that reaches to a depth of 24-36 inches will be available to the tree for two to four weeks depending on the season. Large shrubs, large trees and fruit trees should be watered once a month in the spring and fall and every 2-3 weeks in the summer. Tropical fruit trees such as avocado will require more frequent irrigation than more drought tolerant fruit trees such as Citrus or Pomegranate. Deciduous fruit trees, such as Peach, Nectarine and Plum, have a lower crop coefficient in the spring (0.5) when they have few leaves and a higher crop coefficient (0.95) in the summer when they are fully leafed out.

How Soil Affects Watering

Soil is composed of mineral particles, living and dead organic matter and pore spaces containing water and air. Pore spaces can be as much as 50% of the soil volume. The mineral particles are defined by their size. Clay particles are microscopic at less than 1/125,000 of an inch. Silt particles are between 1/125,000 of an inch and 1/500 of an inch. Fine sand particles are between 1/500 of an inch and 1/250 of an inch, medium sand up to 1/50 of an inch and coarse sand up to 1/12 of an inch. The relative proportions of the mineral particles determine the soil texture (see soil texture triangle). When a soil has been fully irrigated and allowed to drain it is said to be at Field Capacity. Field Capacity is the amount of soil moisture or water content held in the soil after excess water has drained away and the rate of downward movement has decreased. The Permanent Wilting Point is when the soil has dried to the point that plants wilt and they will not recover unless water is applied to the soil.

Soil Pores

Pores vary in size and are classified as macropores, mesopores or micropores. Macropores are too large to have any significant capillary force. Macropores are full of air at field capacity. The mesopores are those that are full of water at field capacity. Mesopores are also called storage pores because they have the ability to store water that is available for plant use. Micropores are those pores that stay filled with water at

the permanent wilting point. The water in micropores is adsorbed to the surface of clay particles and is generally not available to plants without great difficulty.

Clay soils have fewer macropores and more micropores. Sandy soils have fewer micropores and more macropores. The result is that clay soils drain slowly and stay wet longer while sandy soils drain quickly and dry out faster. Loam soils have the best distribution of pores, draining well but also retaining water in mesopores that is available for plant use. The time period between irrigation can be extended in clay soil and shortened in sandy soil.

How do you know what kind of soil you have? The publication *THE DROUGHT TOLERANT GARDEN, LOS ANGELES COUNTY HANDBOOK*¹⁴ has an easy-to-use section on how to identify soil texture by measurement or by feel.

Water Scheduling

With many different plant species and varying climate conditions in Southern California, water schedules will vary considerably from one garden to another. Low water use shrubs and trees should be irrigated when the accumulated evapotranspiration loss (crop coefficient x ET rate) exceeds 2-3 inches. This can take 1-8 weeks or longer depending on location and the crop coefficient. For example, it would take 8-9 weeks for a low water use tree in a coastal environment to accumulate 2 inches of needed irrigation. Here are some examples of how to water specific plant species in various locations in Southern California.

Cool Season Grasses in a South Coastal Environment

Cool season grasses such as a tall fescue have a crop coefficient of 80%. Coastal areas historically have evapotranspiration rates of 0.75 inches per week in spring and fall and 1.5 inches per week in the summer. A tall fescue growing in Santa Monica would need 0.6 inches of water (80% of 0.75 inches) per week in spring/fall and 1.2 inches of water (80% of 1.5 inches) per week in summer. If the grass is growing in a clay soil, the application frequency could be once a week in spring and fall and twice a week in summer. If the grass was growing in a sandy soil, the application frequency could be twice a week in spring and fall and three times a week in summer. When applying water more than once a week, divide the total amount of water needed per week by the number of applications per week to determine how many inches to apply during each irrigation.

Warm Season Grasses in a South Coastal Environment

Warm season grasses such as Bermuda have a crop coefficient of 60%. Coastal areas historically have evapotranspiration rates of 0.75 inches per week in spring and fall and 1.5 inches per week in the summer. Bermuda grass growing in Santa Monica would need 0.45 inches per week (60% of 0.75 inches) in spring/fall and 0.90 inches per week (60% of 1.5 inches) in summer. If the grass is growing in a clay soil, the application frequency could be once a week in spring and fall and twice a week in summer. If the grass was in a sandy soil, it should be watered twice a week in spring and fall and three times a week in summer. When applying water more than once a week, divide the total amount of water needed per week by the number of applications per week to determine how many inches to apply during each irrigation.

¹⁴ BKI and Green Gardens Group, *The Drought Tolerant Garden, Los Angeles County Handbook*, http://planning.lacounty.gov/assets/upl/project/green_drought-tolerant-garden.pdf

Cool Season Grasses in a Hot Inland Valley

Cool season grasses such as a tall fescue have a crop coefficient of 80%. Hot inland valleys historically have evapotranspiration rates of 1 inch per week in spring and fall and 2 inches per week in the summer. A tall fescue growing in Pasadena would need 0.8 inches of water (80% of 1 inch) per week in spring/fall and 1.6 inches of water (80% of 2 inches) per week in summer. If the grass is growing in a clay soil, the application frequency could be once a week in spring and fall and twice a week in summer. If the grass was growing in a sandy soil, the application frequency could be twice a week in spring and fall and three times a week in summer. When applying water more than once a week, divide the total amount of water needed per week by the number of applications per week to determine how many inches to apply during each irrigation.

Warm Season Grasses in a Hot Inland Valley

Warm season grasses such as Bermuda have a crop coefficient of 60%. Hot inland valleys historically have evapotranspiration rates of 1 inch per week in spring and fall and 2 inches per week in the summer. A Bermuda grass lawn growing in Pasadena would need 0.6 inches per week (60% of 1 inch) in spring/fall and 1.2 inches per week (60% of 2 inches) in summer. If the grass is growing in a clay soil, the application frequency could be once a week in spring and fall and twice a week in summer. The same grass in a sandy soil may need to be watered twice a week in spring and fall and three times a week in summer. When applying water more than once a week, divide the total amount of water needed per week by the number of applications per week to determine how many inches to apply during each irrigation.

Shrubs and Trees in a South Coastal Environment

Shrubs and trees vary greatly in their drought tolerance and crop coefficients. Juniper species have crop coefficients that are low, between 10% and 30% of ET. Bush roses have moderate crop coefficients in the range of 40%-60% of ET. Sword ferns have a moderate crop coefficient in the range of 40% to 60% of ET in southern coastal environments, but have a high crop coefficient in the range of 70% to 90% of ET in hot inland valleys.

Shrubs with low crop coefficients such as Juniper growing along the coast would need 0.225 inches per week (30% of 0.75 inches) in spring/fall and 0.4 inches per week (30% of 1.5 inches) in the summer. It will take 8 weeks in the spring to accumulate 1.8 inches of needed irrigation during the spring (8 weeks x 0.225 inches per week). A Juniper growing in Santa Monica should be watered 1.8 inches every other month in spring/fall and 1.8 inches once a month in summer.

Large trees with moderate water use requirements (40% to 60% of ET) such as Magnolia (*Magnolia grandiflora*) would need 0.45 inches per week (60% of 0.75 inches) in spring/fall and 0.9 inches per week (60% of 1.5 inches) per week in summer. Large trees have deep roots and should be water once every 4-8 weeks. A Magnolia grandiflora growing in Santa Monica should be watered 2.7 inches at 6 week intervals in spring/fall and 3.8 inches once a month in summer.

Olive trees have low water use requirements along the coast and in hot inland valleys (10% to 30% of ET). An Olive tree growing in Santa Monica needs 0.225 inches per week (30% of 0.75 inches) in spring/fall and 0.4 inches per week (30% of 1.5 inches) in the summer. An Olive tree should be watered 1.8 inches every other month in

spring/fall and 1.8 inches once a month in summer based on the crop coefficient and ET rate for coastal areas in Southern California. In this case the 1.8 inches applied would not be enough to irrigate the entire root zone and should be increased to at least two inches or even three inches to fully irrigate the root zone.

Shrubs and Trees in a Hot Inland Valley

The historical evapotranspiration rates for hot inland valleys are 1 inch per week in spring and fall and two inches per week in summer. Using the same trees from above, a Magnolia grandiflora growing in Pasadena would need 0.6 inches per week (60% of 1 inch) in spring/fall and 1.2 inches per week (60% of 2 inches) per week in summer. The schedule would be to apply 2.4 inches once a month in spring/fall and 2.4 inches every two weeks in summer. Since 2.4 inches is less than what is needed to fully irrigate the root zone it would be best to increase the amount of water to 3 inches to fully irrigate the root zone.

An Olive tree in Pasadena would require 0.3 inches per week (30% of 1 inch) in spring/fall and 0.6 inches per week (30% of 2 inches) in summer. The schedule would be to apply 2.4 every other month in spring/fall and 2.4 inches once a month in summer. As 2.4 inches is not enough to fully irrigate the root zone it should be increased to 3 inches to fully irrigate the root zone.

Adjusting Irrigation to Meet Local Conditions

Using historical evapotranspiration rates and crop coefficients provides close approximations as to how much water a tree, shrub or lawn needs. The amounts of irrigation determined using evapotranspiration rates and crop coefficients should be adjusted to take into account locale conditions. For example, lawns that receive morning sun but are shaded in the afternoon will use less water than lawns that receive full sun all day. A lawn that gets sun all day may need to be watered 0.5 inches three times a week, whereas a lawn that gets shaded in the afternoon may only need 0.5 inches twice a week. The same is true for shrubs that are shaded in the afternoon versus those that are in the full sun all day.

Evapotranspiration rates and crop coefficients provide guidelines for landscape irrigation. Every garden or landscape will use slightly different amounts of water at different intervals depending on site specific conditions. These are guidelines for landscape managers and homeowners to use to avoid either wasting water by applying too much too often or damaging landscapes through drought stress by applying too little water and not often enough.

PART 2 - SAFE AND EFFECTIVE USE OF PESTICIDES AND FERTILIZERS

Section 8 contains a discussion of options that should always be considered before a pesticide is applied. If, after careful consideration and use of the pre-application checklist¹⁵, it is determined that a pesticide application is necessary to achieve a tolerable damage threshold, the guidelines provided in this section should be followed to ensure a safe and effective application.

¹⁵ See Appendix F

14.0 PESTICIDE USE GENERAL STANDARDS OF CARE/BEST MANAGEMENT PRACTICES

Minimizing the Impact of Pesticides/ Protection of Surface Water

Nearly every drain in landscaping flows to a gutter and ultimately a storm drain providing a direct conduit for pesticides, fertilizers, and other contaminants to enter surface water. Recent studies conducted in Southern California have detected significant levels of certain insecticides, most notably pyrethroids and fipronil. Whenever any pesticide is used outdoors at a facility, the limitations, standards of care, and best management practices outlined below should be observed to minimize the impact on the environment and prevent accidental contamination of surface water. A red arrow signifies a State requirement (law) for the application of a pyrethroid insecticide containing one of the active ingredients listed in the sidebar on page 50 (except aerosol and bait station applications).

The products on the left are a few examples containing the pyrethroid, *bifenthrin* as an active ingredient. The products shown on the right contain the active ingredient *fipronil*. Bifenthrin, fipronil and other insecticides are being detected in southern California urban runoff. Careful adherence to the BMPs established in this document will reduce the impact of pesticides in surface water.



- fi Where feasible, landscaping should be designed (or redesigned) to break the direct contact between areas needing treatment and pathways to waterways
- fi No applications of pesticides (or fertilizers) should be made when two or more consecutive days with greater than 50% chance of rainfall are predicted by NOAA¹⁶ or within 48 hours of a ½-inch rain event (Does not apply to aquatic pesticides or pre-emergent herbicides requiring water for activation)
- fi Regularly inspect irrigation for broken sprinklers and over-watering
- fi Drip irrigation is better than overhead watering
- fi Minimize or eliminate drift to hard surfaces
- fi An ACWM Biologist should review potential RFPs/RFBs for landscaping contractors if pest control will be part of the resulting contract (Statement of Work, proper licensing, etc.)
- fi Use native, drought-tolerant plants that require less water and fertilizer
- ➡ Granular products should be swept up off of impervious surfaces like sidewalks and driveways and onto the treatment area

¹⁶ www.srh.noaa.gov/forecast

- fi Avoid broad-spectrum pesticides
- fi Spot treatments are preferred over broadcast treatments
- fi Extra care should be exercised when treating slopes due to the additional potential for runoff
- fi Mark and/or cover storm drains or other water paths and avoid treating in those areas

➤ No applications shall be made:

- ◆ To any site during rain or with standing water, including puddles
- ◆ To plants, shrubs, or trees where there is standing water in the dripline or perimeter of the plants, shrubs, or trees
- ◆ To a sewer, storm drain, or curbside gutter
- ◆ To the following components of a constructed drainage system that drains to a sewer or storm drain, curbside gutter, or aquatic habitat:
 - Visible drainage grate connected to a drain pipe
 - Visible French drain, or a landscaped dry riverbed, swale or trench filled with gravel or rock
- ◆ To the soil surface or horizontal impervious surfaces within 25 feet of aquatic habitat located downgradient from the application
- ◆ To a preconstruction termiticide site within 10 feet of a storm drain located downgradient from the application

➤ Applications to the soil surface, mulch, gravel, lawn, turf, or groundcover must only be made using the methods described below:

- ◆ Spot treatments
- ◆ Pin stream treatment of one inch or less
- ◆ Perimeter band treatment of three feet wide or less from the base of a building outward

➤ Applications to vertical structural surfaces, such as walls, foundations, and fencing, must be made using only the methods described below:

- ◆ Spot treatments
- ◆ Crack and crevice treatment

Pyrethroids are a group of synthetic insecticides which are similar in action to the botanical insecticide *pyrethrin*. How do you know if the insecticide you are using is a pyrethroid? Common pyrethroid active ingredients often end in “-thrin”. Refer to the list below for more information.

PYRETHROID INSECTICIDE ACTIVE INGREDIENTS

- bifenthrin
- bioallethrin
- S-bioallethrin
- cyfluthrin
- beta-cyfluthrin
- gamma-cyhalothrin
- lambda-cyhalothrin
- cypermethrin
- deltamethrin
- esfenvalerate
- fenpropathrin
- tau-fluvalinate
- permethrin
- phenothrin
- prallethrin
- resmethrin
- tetramethrin

- ◆ Pin stream treatment of one inch or less
- ◆ Perimeter band treatment up to a maximum height of two feet above the grade level

Pre-Application Site Review and “Walk Around”

Before a County employee applies a pesticide, a pre-application review or “walk-around” of the site is to be conducted. The review should be performed by the Certified Applicator discussed in the Certification subsection on the following page or a responsible person designated by him or her. The review will include completion of the pre-application checklist and verification that no rain is predicted within 48 hours following the application. The walk-around will also include a check for places to avoid such as standing water, areas adjacent to drains, impervious surfaces and any slopes, swales or drainages where significant runoff is likely. The review/walk-around shall be discussed with the person conducting the application unless the same person who conducted the review/walk-around will also apply the pesticide.

The following is a summary of the pesticide use requirements established in this Countywide IPM Program NOT including vendor licensing (See Appendix A for a more complete listing of pesticide use requirements)

FOR ALL PESTICIDES USED OUTDOORS AT A COUNTY FACILITY

- Designation of a Certified Applicator (page 51 [Section 15])
- Pre-application checklist (page 7 [Section 8])
- Lowest risk product selected (page 53 [Section 15])
- Pre-application site review/walk-around (page 49 [Section 14])
- Verification that the employee has received training (page 49 [Section 15])

OTHER PESTICIDE USE REQUIREMENTS WHEN APPLICABLE

- ZAPUR-NET review (page 57 [Section 17])
- Written recommendation (page 51 [Section 15])
- Restricted Materials Permit (page 52 [Section 15])
- Notice of Intent filed (page 52 [Section 15])

15.0 WORKER PROTECTION and OTHER REQUIREMENTS for APPLYING PESTICIDES

Pesticide Safety Training

Any County or contractor employee who applies pesticides shall receive documented training before applying pesticides and then annually thereafter¹⁷. The training must cover the minimum topics outlined in Appendix B for each pesticide or chemically similar group of pesticides to be used. This section is not required if the employee is currently certified by the California Department of Pesticide Regulation as a Qualified Applicator¹⁸ in the appropriate categories. County departments whose employees handle pesticides shall have a written disciplinary program for any employee who fails to adhere to the requirements contained in the training program including use of Personal Protective Equipment. This Program contains information designed to help county employees and vendors manage pests with minimum impact to the

¹⁷ Except use of consumer products, packaged for consumer use, at amounts not greater than typical consumer amounts.

¹⁸ Qualified Applicator Certificate (QAC) or Qualified Applicator License (QAL)

environment, especially surface water. Familiarity with the Program does not constitute the safety training required by state law.

Certification

In addition to the safety training described in the previous section and outlined in Appendix B, it is required that any pesticide application performed by a County employee must be done by or under the direct supervision of a Qualified Applicator certified by the State of California, Department of Pesticide Regulation (CDPR) in the appropriate category(ies). The following is a brief description of the relevant categories, each of which allows the certificate holder to apply or supervise the application of restricted (except Category Q) or general pesticides, substances, methods or devices to control pests in designated areas/situations:

- ▶ **Category A (Residential, Industrial, and Institutional)**
 - Residential areas and around households and immediate environments
 - Industrial establishments, such as packing houses, food manufacturing and processing plants, warehouse, grain elevators and factories
 - Institutions such as, schools, hospitals, libraries, auditoriums, and office buildings
 - Landscaping of walkways, parking lots, and other areas adjacent to these buildings
 - Non-landscaped outside areas, such as storage yards, tank farms or electrical substations that are directly related to the operation of buildings or facilities
 - Treatment of cooling towers and evaporative condensers
 - Sanitizing institutional potable lines
- ▶ **Category B (Landscape Maintenance)**
 - Natural or planted ornamental and turf landscaped areas and other outside areas around buildings
 - Recreation areas, schoolyards, vacant lots, storage yards, greenbelts, golf courses, cemeteries, parks, landscaped street medians, sidewalk areas and walkways, and parking lots directly related to landscaped areas
 - Landscaped areas in enclosed shopping malls and indoor plants
- ▶ **Category C (Right-of-way)**
 - Maintenance of roads, highways, power lines, telephone lines, pipelines, canals, railroads, and similar sites
 - Landscaped right-of-way areas
- ▶ **Category E (Forest)**
 - Forest, forest nurseries, and forest seed-producing areas
 - Site preparations for tree planting, conifer release, brush control projects, and stump treatment in forestry management
- ▶ **Category F (Aquatic)**
 - Standing or running water
- ▶ **Category I (Animal Agriculture)**
 - Animals and the facilities in which animals are confined
- ▶ **Category K (Health Related)**
 - Official programs for the management and control of pests having medical and public health importance, such as mosquito abatement and plague vector suppression

- ▶ **Category N (Sewer Line Root)**
 - Roots in sewer lines
- ▶ **Category P (Microbial Pest Control)**
 - Disinfect potable water systems
 - Industrial cooling towers and evaporative condensers
- ▶ **Category Q (Maintenance Gardener)**
 - Outdoor ornamental and garden areas surrounding public structures, such as buildings, brick walls, fountains, fences, and statues
 - Outdoor ornamental and garden areas surrounding commercial parks, such as offices, restaurants, warehouses, factories, stores, shopping centers, malls
 - Parks, golf course, cemeteries, but only on ornamental or turf plantings near buildings that are distinct and separate from the plantings that constitute open space landscaping in a park, golf course, or cemetery itself

Written Recommendations

The use of pesticides in certain sites is considered a non-production agricultural use of the pesticide. Examples of non-production agricultural use sites are shown in Table 3 below. For most uses within any of these sites, a written pest control recommendation must be prepared in advance of the pesticide application and a copy given to the property operator.

Table 3 Examples of non-production agricultural pesticide use sites

▪Cemeteries	▪Highway medians	▪Recreation areas
▪Ditches and ditch banks	▪Irrigation systems	▪Reservoirs
▪Farm roads	▪Lakes, rivers and streams	▪Roadsides
▪Field borders	▪Parks	▪Rights-of-way
▪Ground water recharge ponds	▪Railroad shoulders	▪Uncultivated agricultural land

According to state law, written recommendations may **only** be prepared by a CDPR licensed Pest Control Advisor or by designated employees within ACWM. Each recommendation shall be signed and dated, and include the following:

- The name and dosage of each pesticide to be used
- The identity of each pest to be controlled
- Criteria used for determining the need for the recommended treatment
- Certification that alternatives and mitigation measures that would substantially lessen any significant adverse impact on the environment have been considered and, if feasible, adopted
- The owner or operator, location of, and acreage to be treated
- Concentration and volume per acre or other units
- The suggested schedule, time, or conditions for the pesticide application or other control method
- A warning of the possibility of damages by the pesticide application that reasonably should have been known by the agricultural pest control adviser to exist
- The signature and address of the person making the recommendation, the date, and the name of the business such person represents (unless prepared by ACWM)

Recommendations prepared by an ACWM biologist contain the following additional environmental protection safeguards:

- A determination if the proposed treatment is in a State-designated groundwater protection area, and, if so, any mitigation measures necessary to prevent leaching or runoff
- A ZAPUR-NET (see Section 17) search for any Endangered, Threatened, or Rare species, or designated California red-legged frog critical habitat within the proposed treatment area and, if any are present, mitigation measures necessary to protect them

A written recommendation is not required for Structural or some Industrial/Institutional uses in certain sub-areas within a non-production agricultural use site. See Section 20 for more information or contact ACWM for guidance.

Permits

Certain pesticides require a Restricted Materials Permit issued by ACWM before they can be used in one of the non-production agricultural use sites listed in Table 3 above. This includes rodenticides with strychnine, zinc phosphide, aluminum phosphide, and certain anticoagulants as active ingredients as well as any herbicide listed by CDPR as having been detected in groundwater. The complete listing of materials requiring a Restricted Materials Permit is found in Section 6400 of the California Code of Regulations. It is a good idea to check with ACWM before applying a pesticide in any non-production agricultural use site to ensure compliance with permits and other pesticide-use requirements.

Pre-Application Notice Requirements

Before applying any pesticide which requires a Restricted Materials Permit referenced above, applicators must file a NOTICE OF INTENT TO APPLY A RESTRICTED MATERIAL to ACWM at least 24 hours before the scheduled application.

Pesticide Use Records and Reporting

Registered Structural Pest Control companies and any person who uses a pesticide for an agricultural use (including on one of the non-production agriculture use sites listed in Table 3) must maintain records of the pesticides they have used in Los Angeles County. The records shall include the following information for each pest control operation:

- Date of application
- Name of the operator of the property treated
- Location of the property treated
- Site treated
- Total acreage or units treated at the site
- The pesticide(s) used including the US EPA Registration Number or State registration number which is on the label, and the amount used.

Each of the persons required to maintain records shall report a summary of the monthly use in Los Angeles County to ACWM by the 10th day of the following month. If no pesticides are used during a month, a report stating this fact (Negative Pesticide Use Report) must be submitted to ACWM. Appendix C has an example of the required

pesticide use reporting form. The ACWM Pesticide Regulatory Division is available to answer any questions about pesticide use reporting. At the moment, these forms can still be submitted by mail or fax; however, it is strongly suggested that they be submitted electronically using the CalAgPermit System. By contacting ACWM's Pesticide Regulatory Division, you will be issued a password and be instructed on how to set up an electronic filing account.

Going Low! (Lowest Risk and Lowest Rates)

Whenever a pesticide is used, the selection from among the range of effective products should be made based on the lowest risk to people, water, natural insect predators, and pollinators. Reducing the risk to water, natural predators and pollinators is discussed elsewhere in this document. For people's safety, the lowest risk will almost always mean selection of a pesticide in Category 3 with the Signal Word CAUTION. Signal Words are required to be on the front of every pesticide label and Service Container. They give a one or two word indication of how hazardous the material is to people. Pesticide products with the Signal Word CAUTION are the lowest risk. A WARNING Signal Word means the product is considered moderately toxic and a DANGER or DANGER POISON Signal Word means the product could seriously harm or even kill a person if not handled properly.

Pesticides come in ready-to-use formulations or as concentrates that require mixing with water or some other diluent/carrier. Concentrates almost always have a range of dilution rates. The highest dilution rate (lowest concentration) of the product that will still be effective should be selected. Under no circumstances shall the maximum concentration on the label be exceeded. Be aware that some common pesticide products have limitations on the number of times they can be used within a specified time period, or, they have a cap on the amount of Active Ingredient that can be used within a one year period. Restrictions on the amount/timing established on a pesticide label should never be exceeded.

If a pesticide application, or more critically, if a series of pesticide applications don't appear to be working, something is wrong and additional applications should be discontinued until the situation can be reviewed by a qualified person. The failure may be related to incorrect pest identification, incorrect product selection, inappropriate timing (wrong time of year), life stage of the pest, or improper application.

16.0 USING FERTILIZERS

One of the more challenging aspects of facilities management is the prevention of surface water runoff contamination from fertilizers. These very common landscape supplements are not regulated in the same way as are pesticides and are generally not part of established Best Management Practices (BMP) routines. What follows will be a brief general discussion of fertilizers and then some management suggestions to help eliminate some of the problems associated with fertilizers including the possibility of their entering into surface water runoff.

Fertilizers 101

Basically, fertilizers provide the "food" for plants to perform normal growth functions. Ideally, landscapes, when managed properly, can thrive in a more or less sustainable

fashion, requiring little additional plant nutrition supplementation provided that the natural system for nutrition replenishment is maintained – allowing fallen leaves to remain, grass clippings to decompose, the use of mulch in flower beds, etc.

Plants absorb fertilizers from the roots and are transported throughout the plant where they are incorporated into the nutritional needs of the plant. The amount of fertilizer required by the plant is determined by the state of the soil surrounding it. Soils rich in organic matter and with the proper soil moisture can provide for the nutritional needs of the surrounding plants with little additional need for supplementation in most situations.

Plant Selection

Proper plant selection can go a long way to reduce or eliminate the need for fertilizers in the first place. In established landscapes, unfortunately, the facilities manager frequently inherits the choices of his or her predecessor. However, often times it may be possible over time to replace poor plant choices or a revitalization of a landscape takes place that would allow the facilities manager to make more “informed” plant choices to replace the existing landscape.

Many tropical plants commonly found in commercial landscapes are poor choices not just because of their nutritional and irrigation needs, but they are also attractive to plant insect pests, diseases or rodents.

In Appendix D, you will find a number of resources for suggested plant choices that are better suited to the southern California environment and meet the requirements discussed here. Certainly, the use of native plants and the use of xeriscaping (plants that require little water) should be considered as well.

Weeds and Fertilization

Turf areas that have low soil fertility can be attractive to many weed species that can thrive in those situations. Many of the invasive clovers can be seen thriving in otherwise healthy looking turf due to poor or inconsistent fertilization practices and are an indication of low soil fertility.

Irrigation and Fertilizers

Plants and turf that are water stressed or over watered can have a significant effect on plant health. This can often be mistaken for lack of fertilization. This topic is discussed in greater detail in the MANAGING WATER section elsewhere in this document. Fertilization will not overcome the problems associated with improper watering or other cultural practices such as poor soil drainage.

When to Fertilize

Fertilizer applications are best determined after closely examining the plants themselves. As long as woody plants appear healthy and show normal leaf size, color, and desired growth, they probably don't need fertilizer. Soil testing for the concentrations of existing nutrients can be helpful in determining the need for fertilization and is suggested. If they are needed, fertilizers are usually applied at times of the year that coincide with traditional plant growth cycles which in most cases is the early spring in southern California. It is also recommended that fertilization take place as the growing season winds down in the fall. Because of the high use demands made

on the plants, turf maintained for sports activity requires a much more intense fertilization regimen. Landscape trees should only be fertilized if outward symptoms are observed to warrant such a treatment. Advice on issues with trees in the landscape can be given by certified arborists or by contacting the County Plant Pathologist who can provide a determination on whether the symptoms displayed by trees (or other plants) are caused by nutrient deficiency or some other casual factor.

What Fertilizer Should I Use?

What you should use, or, more likely, what you should ask your landscape vendor to use, would seem to be a very basic question. Since one of the concerns about fertilizers is potential surface contamination of runoff due to rain or irrigation, it is very important to use nutrition supplements that are not going to lend themselves to be easily moved offsite via runoff. In general, slow release organic fertilizers are less likely to enter stormwater. However, many organic fertilizers are very bulky due to their low concentration of nutrients and can have other drawbacks such as unpleasant odors or salts associated with them. Slow release chemical fertilizers allow nitrogen to become available over longer periods of time, so they don't need to be applied as often and are often the best choice to prevent surface water contamination.

Fertilizer Do's and Don'ts

Okay, so we've decided to make a fertilizer application or have a vendor do so. Here are some good practices to incorporate into our work plan to prevent the fertilizers from moving offsite:

DO:

- Fertilize only as needed and only after problems have been eliminated as the cause of poor growth
- Use a soil fertility test or some other acceptable method for verifying soil nutrient deficiencies
- Use a slow release, organic fertilizer
- Make sure that the application is made so that routine irrigation will not create runoff
- Read and observe pesticide label precautions about storing with fertilizers
- Dispose of unwanted or unused fertilizers properly
- Minimize storage of fertilizers by buying only what is needed

DO NOT:

- Apply fertilizer based simply on a calendar schedule
- Apply fertilizers within 24 hours of anticipated rain or on windy days
- Make applications of fertilizers within 5 feet of pavement, 25 feet of a storm drain inlet, or 50 feet of a water body
- Store pesticides and fertilizers together without checking the pesticide label

17.0 PROTECTING WATER, WILDLIFE, AND POLLINATORS

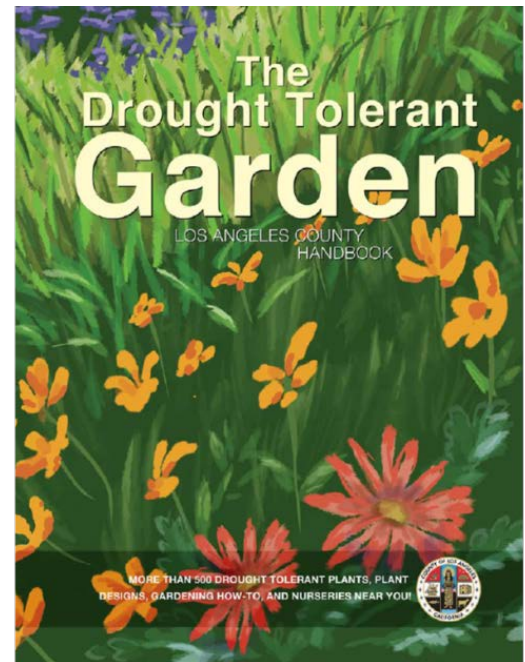
Use Less Pesticides, Water and Fertilizer!

As a guiding principle, facilities managers should always be aware that simply reducing the amount of pesticides, fertilizers, and water used also reduces the likelihood that contaminants will be moved offsite into surface water. This Program contains general

principles as well as policies and procedures crafted with the intent to reduce the use of pesticides, and other contaminants, that can cause impairment of surface waters.

Landscape choices-Less Turf and More Drought Tolerant Plants

Reducing the amount of irrigated turf is a recurring recommendation in this document for a variety of reasons. Among them is the fact that most turf choices require a lot of water. Compounding the problem is that turf is almost always watered by overhead sprinklers which are lined up along an impervious surface. A sheet of water running down a sidewalk as a result of a tweaked or broken sprinkler is not an uncommon sight in Southern California, unfortunately. Planting more drought tolerant plants will also reduce the overall need for water and therefore the potential for runoff. The Appendix section has a series of resources for drought tolerant plants to help with water-wise landscape decisions. Among them is an excellent and easy-to-use guide for how to plant small drought tolerant gardens developed by the Los Angeles County, Department of Regional Planning.



Manage Water Runoff

Where Will the Water Go?

Look around before you apply a pesticide or fertilizer and try to imagine what will happen when it rains or when the sprinklers come on. In some cases, a potential pathway to surface water may become obvious and in other cases it may require a bit of imagination or even a three minute walk down a swale to see where it might end up. If water runs down a drain, it will almost certainly end up in a gutter, the storm drain system and eventually a river or ocean unless the drain has been purposely designed to empty into a landscaped area. If potential pathways to the storm drain system are identified, change the application timing, fix the broken sprinkler, modify the pathway, or do something else to prevent the materials from running off. And remember, applications of pesticides and fertilizers must not be made over standing water, when water is flowing off the application site, when two or consecutive days with a greater than 50% chance of rainfall are predicted by NOAA, or within 48 hours of a ½-inch rain event.¹⁹

A guide to planting small drought tolerant gardens and landscaping developed by the Los Angeles County Department of Regional Planning. See Appendix D for information on how to get a copy.

A World of Concrete and Asphalt (Facility and Landscape Design)

In urban Los Angeles County, miles of interconnected impervious surface (concrete and asphalt roads, driveways, parking lots, etc.) serve as an efficient conduit of water runoff into the storm water management system. From there, most if not all of the water enters its final destination untreated which means anything it collected along the way goes with it. A facility can be designed to help reduce the amount of water runoff from both storm water and irrigation. Integrating the use of porous or *pervious* surfaces for driveways and walkways can allow water to soak into the ground. Examples of pervious surfaces include crushed stone and permeable interlocking pavers. In addition, walkways, driveways and other hard surfaces can be sloped so that water runs off into a landscaped area where it will be more likely to soak into the ground.

¹⁹ The 48 hour rain restriction does not apply to aquatic pesticides or pre-emergent herbicides which require water for activation

Sprinkler Patrol!

Automatic irrigation systems are extremely useful labor-saving devices. Every county department should be using Weather-Based Irrigation Controllers (WBICs). If non-WBICs are used for some reason, the settings must be frequently monitored throughout the year, especially during periods with wide fluctuations in weather. As the weather warms up in the late spring and early summer, the irrigation timing can be increased slowly with the understanding that a week of “low clouds and fog” will almost certainly require a reduction in timing or overwatering and accompanying runoff could occur. Facility managers and other responsible persons should be constantly alert for broken sprinklers and patrol the irrigated areas on an established schedule looking for signs of over or under watering.



This broken sprinkler is not doing its job, wastes precious water and is helping to move any contaminants offsite and into surface water.

Protecting the Environment with ZAPUR-Net

It is unrealistic to expect that any of Los Angeles County’s Endangered, Threatened, or Rare species are using heavily modified (landscaped) areas as habitat to any extent, especially when immediately adjacent to buildings, parking lots, storage areas, etc. However, before a pesticide application is made in or adjacent to a natural area, a review using ZAPUR-NET should be made to ensure any additional restrictions on the use of the proposed pesticide is followed. ZAPUR-NET is a GIS-based, interactive web tool developed as a cooperative effort between the California Department of Pesticide Regulation and the Los Angeles County Departments of Regional Planning and ACWM. Using updated habitat data from the Department of Fish and Game Natural Diversity Database, the U.S. Fish and Wildlife Service and the National Marine Fisheries Service, the potential habitat for every known Endangered, Threatened, or Rare (ETR) species in Los Angeles County can be identified using ZAPUR-NET. A ZAPUR-NET search will also reveal any State-designated Groundwater Protection Areas or critical habitat for the California red-legged frog. Information from ZAPUR-NET is used to see if an area has any special pesticide use restrictions. ZAPUR-NET can be accessed at the ACWM website under the *PROTECTING THE ENVIRONMENT* link.²⁰



Ground Water Protection

Using aerial imagery and data obtained from the California Department of Pesticide Regulation, ACWM has produced detailed maps and an interactive GIS-based web tool (see *ZAPUR-NET*,

²⁰ ZAPUR-NET, Los Angeles County Department of Agricultural Commissioner/Weights and Measures
<http://acwm.co.la.ca.us/template/temp9/main.html>

this Section) showing the exact location of every one of the designated Groundwater Protection Areas (GWPA) within Los Angeles County. No herbicides identified by the California Department of Pesticide Regulation as having been detected in the groundwaters of the State²¹ are to be used in one of the designated GWPAs. In addition, none of these materials should be used in any area of Los Angeles County without a biologist review/recommendation and management approval. All application equipment is to be fitted with an air gap device to prevent backflow to avoid accidental contamination of municipal water, wells, and ground water.

Protection/Conservation of Pollinators

Many plant species depend on animals (domestic honey bees, native wild bees, butterflies, moths, wasps, beetles, birds and even bats in some areas) for pollination. In recent decades, several pollinating animals have suffered a decline for a variety of reasons including loss of habitat, pesticide misuse, diseases, parasites, and introduced invasive plant and animal species. The decline in population of pollinators may pose a serious threat to biodiversity, global food sources and to human welfare.

Most pesticides are not toxic to bees and other important insect pollinators, but many *insecticides* are. Bees can be killed directly as they are out foraging or they can return to the hive carrying with them insecticide-contaminated pollen which can contribute to chronic health effects in the colony. Following the principles outlined below will help reduce the impact of insecticides to Los Angeles County's important insect pollinators:

- Before applying any pesticide, follow the Pre-application Checklist discussed in Section 8 which will help avoid unnecessary and ineffective pesticide use
- Read and carefully follow all environmental protection safety precautions on the pesticide label
- Watch for new EPA regulations that require some pesticide labels to have a PROTECTION OF POLLINATORS statement (Bee Advisory Box)
- Do not apply insecticides on or near plants when they are in bloom and bees are foraging
- Delay applying a systemic insecticide until after plants have flowered



Look for US EPA's Bee Hazard Icon on insecticide labels.

The following are some ways bees and other insect pollinators can be helped or augmented:

- Cultivating plants that provide foraging habitat for collecting nectar and pollen
- Consider bees and other insect pollinators when designing landscaping by ensuring several bee-supporting plants will be in bloom throughout the year
- Convert turf areas into flowerbeds
- Controlling soil erosion will help protect native wild bees many of which nest in the ground

²¹ California Code of Regulations, Division 6, Title 3, Chapter 4, Subchapter 1, Article 1, section 6800(a)

18.0 SAFE AND PROPER STORAGE OF PESTICIDES AND FERTILIZERS AND DISPOSAL OF USED PESTICIDE CONTAINERS

Storage

Every pesticide label is required by federal law to contain information on how to properly store the product. Each person responsible for pesticides is expected to read, understand, and comply with the storage requirements which almost always require the product to be stored in its original container away from food (including

pet food), feed, seeds, and sometimes fertilizers.

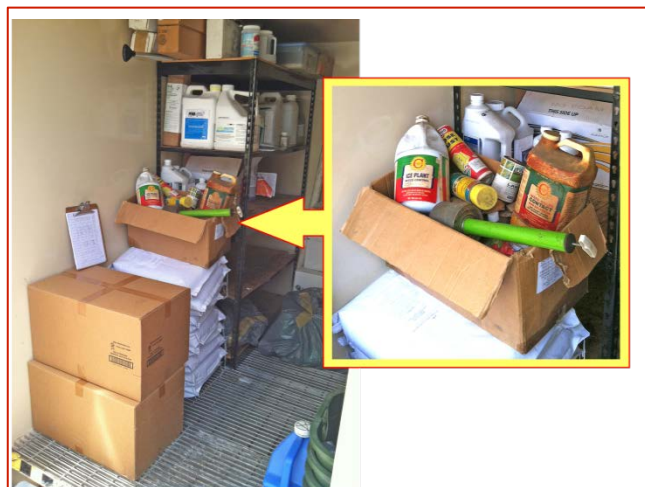
State law prohibits storage of PPE (Personal Protective Equipment) with pesticides and requires that all storage areas that hold, or have held, pesticides labeled with the Signal Words "Warning" or "Danger" to be posted with signs visible from any direction of probable approach. If required, the signs must be readable at a distance of 25 feet and be worded substantially as follows:

**DANGER
POISON STORAGE AREA
ALL UNAUTHORIZED
PERSONS KEEP OUT
KEEP DOOR LOCKED WHEN
NOT IN USE**

All pesticide containers shall be locked up or under the personal control of a responsible person which in most cases means the person shall have them in his or her sight. If a pesticide is being transported to another facility, it must be delivered into a locked enclosure or directly to a responsible person. In NO CASE shall a pesticide be placed or kept in a container commonly used for food or drink.



The two jars with blue caps contain a pesticide. The other containers are full of apple juice or a sports drink. Can you see why it might not be a good idea to put a pesticide in any container commonly used for food or drink? (It is also illegal)



This image shows an otherwise well-organized pesticide storage area that was compromised by allowing employees to store their own pesticides in it.



These two 30 gallon containers of herbicide at the ACWM Malibu Field Office are stored on a secondary containment system designed to prevent any spills or leaks from going very far.

With a few exceptions, every County department should attempt to minimize the quantities of pesticides stored. This can be accomplished by careful review of past usage and anticipated needs. For some commonly used products, the County may have a Master Agreement with product vendors which would allow departments to buy smaller quantities while still getting the large quantity purchase advantage. Departments are encouraged to check with ISD or ACWM to see if the product(s) they would like to purchase are available on a Master Agreement.

DO NOT accept “free” pesticides from another agency without consulting with ACWM first! Experience has also shown that it is never a good idea to allow employees to store personal items, including their own pesticides, in a County storage area.

Pesticides and fertilizers are to be stored indoors or under cover on a paved surface. If there is even a slight chance of container leakage or spillage from handling, secondary containment is to be used. Pesticide and fertilizer storage areas are to be inspected at least monthly. The inspection should include:

- ∨ Verification that it is kept locked
- ∨ Check for Leaking containers
- ∨ Containers are labeled
- ∨ Unauthorized or non-compatible materials
- ∨ Sign Posting (if required)

Used Pesticide Container Disposal

As with pesticide storage, federal law requires each pesticide label to have specific directions on the proper disposal of the pesticide and its container. State law also requires that, except for containers to be returned to the registrant, each emptied container that has held less than 28 gallons of a liquid pesticide that is diluted for use shall be rinsed and drained at the time of use as follows:

1. Less than 5 gallons use 1/4 container volume of rinse water
2. 5 gallons or over use 1/5 container volume of rinse water
3. Using the amount or rinse water from 1 or 2 above:
 - ∨ Place required minimum amount of rinse water in the container, replace closure securely, and agitate
 - ∨ Drain rinse solution from container into tank mix. Allow container to drain 30 seconds after normal emptying
 - ∨ Repeat a minimum of two times so as to provide a total of three rinses

After being used and rinsed, if required, containers may be discarded or offered for recycle as allowed by the label. They should not be kept and used to store something else. Even though pesticide labels are required to include information on disposal of the actual pesticide, it shall

be the goal of every county department to ensure there is almost never a “leftover” pesticide requiring disposal at a landfill. If this seems like it might be the only option, ACWM should be contacted for a review of the proposed disposal.

PART 3 – TRAINING, CONTRACTING, AND RECORDKEEPING

19.0 PROGRAM TRAINING

County Employees

County employees whose duties include any of the following shall have training in this Program appropriate to their duties, level of responsibility, and authority:

- Applying, or have the potential to apply, pesticides or fertilizers
- Supervising employees applying pesticides or fertilizers
- Making decisions about the use of pesticides or fertilizers
- Acting as the designated Certified Applicator
- Managing a park, recreational facility, or landscaping
- Having input into the design of the outdoor areas of a facility
- Contracting where the services involve, or may involve, applications of pesticides or fertilizers

Contractor Employees

Contractors are expected to adhere to the applicable requirements in the Countywide IPM Program and must ensure and certify that their employees are appropriately trained. The training must be documented, and include:

- The potential for pesticide-related surface water toxicity
- Proper use, handling, and disposal of pesticides
- Least toxic methods of pest prevention and control, including IPM
- Reduction of pesticide use

County contract monitors shall be alert for any direct violations of the Program or anything else that suggests a weakness in the contractors’ training. Training for County employees and contract vendors shall be performed annually, as appropriate, before June 30th of each year. Contact vendors can self-certify, provided they certify they have received all of the applicable training listed above, and have documentation to that effect. The Program training discussed in this Section does not constitute the pesticide safety training required by state law. For more information on pesticide safety training requirements, refer to Section 15.0 WORKER PROTECTION and OTHER REQUIREMENTS for HANDLING PESTICIDES.

20.0 CONTRACTORS, CONTRACTING, and BUYING PESTICIDES

Contractor Licensing

Anytime a contractor applies a pesticide outdoors as part of his or her paid service to the County, the contractor must be licensed. This is the case even if the pesticide is only applied occasionally or as part of the routine maintenance of landscaping with only

one exception²². The type of license(s) required depends on the purpose of the application, pests being controlled, proximity to a structure, and other variables. For some types of work, one or more permits may also be required. Appendix A has a summary of the requirements for any vendor or County employee who applies pesticides.

Most of the pesticide applications applied on property owned or managed by the County will fall under one of three use categories which are: Structural, Industrial/Institutional, and Non-production Agricultural. The following is a brief explanation of each category and the accompanying licensing requirements for contractors.

Structural Pesticide Use

Structural Pesticide Use means the use of pesticides for eliminating, exterminating, controlling, or preventing pests which may invade households or other structures. Examples of some very common pests controlled by a structural use of a pesticide include things like termites, Argentine ants, and cockroaches. State law has divided the practice of structural pest control into three “Branches”.²³ The purpose of this is to limit a pest control operator to only those pest control activities for which the operator is specifically qualified. These “Branches” are:

Branch 1 (Fumigation) – Control of household and wood-destroying pests (usually termites) by fumigation with a poisonous or lethal gas. Household pests are defined as those pests other than wood destroying pests (termites), which invade households and other structures including rodents, ants, cockroaches and pantry pests.

Branch 2 (General Pests) - Control of household pests excluding fumigation with poisonous or lethal gases.

Branch 3 (Termites) - Control of wood-destroying pests by the use of insecticides or structural repairs and corrections, excluding fumigation with poisonous or lethal gases.

Before engaging in any structural pest control work, including advertising or soliciting for work, making inspections for the purpose of identifying infestations or infections, providing an inspection report, recommendation, or estimate, the company must first be registered with the California Department of Consumer Affairs, Structural Pest Control Board (SPCB), and the County through ACWM. The registered company must have a designated Qualifying Manager who is licensed by the SPCB as an Operator. The Designated Manager/Operator must be licensed in the Branch or Branches of pest control performed by the registered company.

Registered structural pest control companies may also utilize the services of a licensed Field Representative and/or licensed Applicator. Field Representatives may secure structural pest control work, identify infestations or infections, make inspections, apply pesticides, submit bids for or otherwise contract on behalf of a registered company. A pest control field representative may not contract for pest control work or perform pest

²² Persons doing pest control incidental to new construction including construction work in establishing new landscapes

²³ California Business and Professions Code, section 8560

control work on his or her own behalf. An Applicator is licensed in **Branch 2** and **Branch 3** and can only perform work while working for a registered structural pest control company.

Industrial/Institutional Pesticide Use:

Industrial/institutional pesticide use is performed on property necessary for the operation of warehouses, factories, and buildings like schools, hospitals, offices, etc. When controlling household pests near buildings, there is some overlap with certain types of work performed pursuant to a Branch 2, Structural License. As a general rule, a company licensed only for structural pest control should not be attempting to control non-household pests and a contractor providing industrial/institutional pest control should not be attempting to control pests inside of structures. Industrial/institutional also includes pesticide applications in landscaping to a degree, but not in large, open spaces like parks, golf courses, and recreation areas. The following table lists examples of locations that are considered industrial or institutional use.

Table 4 – List of some industrial/institutional pesticide-use sites

▪Airports	▪Libraries	▪Restaurants
▪Amusement parks	▪Lumber yards	▪Schools
▪Clubhouse landscape	▪Nursery schools	▪Sewage treatment plants
▪Construction sites	▪Office complex (around outside)	▪Sewer lines
▪Food manufacturing plants	▪Office parking lots	▪Shipyards
▪Grain elevators	▪Oil wells	▪Swimming Pools
▪Homeowner Association	▪Paper mills	▪Water treatment plants
▪Hospitals	▪Ports	▪Zoos

For a contractor to apply pesticides for hire in an industrial/institutional setting, the company must have one of the following licenses issued by CDPR:

1. *Pest Control Business License:* This license allows a company to apply pesticides in an industrial/institutional setting except inside structures. The company must also have a designated Qualified Person in a supervisory position holding a valid Qualified Applicator License (QAL) issued by CDPR in the category of pest control performed by the company. Section 14 has a general explanation of the license categories. Many companies also have employees that possess a CDPR issued Qualified Applicator Certificate (QAC), but this is not a legal requirement unless applications of a Restricted-Use pesticide are planned.
2. *Maintenance Gardener Pest Control Business License:* This license is required for companies providing maintenance gardening service who occasionally apply pesticides in support of their primary business. This license allows application of pesticides in outdoor ornamental, garden and turf areas near buildings, commercial parks, brick walls, fountains, fences, statues, etc. It does not include large open space areas such as in parks, golf courses or cemeteries. The company must also have at least one designated person in a supervisory

position that holds a valid QAC with a category Q (*Maintenance Gardener*) or B (*Landscape Maintenance*).

Non-Production Agricultural Pesticide Use:

An outdoor application of a pesticide at any of the use sites listed in Table 3 is considered a non-production agricultural use of the pesticide. There may be sub-areas within the sites where a pesticide application is allowed under a Structural or Maintenance Gardener Pest Control Business license. Refer to the previous sections to see where this may be the case.

For a contractor to apply pesticides for hire in a non-production agricultural setting, the company must have a Pest Control Business License and a Qualified Person in a supervisory role. The Qualified Person must have a QAL in the category of pest control performed by the company.

In addition to the above, the company must provide a **Written Recommendation** covering the proposed pesticide use. The Recommendation must be furnished to the operator of the property prior to the application. Written Recommendations are required by law to contain certain information and they can only be written by a licensed Pest Control Advisor or designated individuals from ACWM. Section 15 has more information on the required Written Recommendations.

Questions about Contractor's Licensing?

Determining what types of licenses and/or permits are required for a contractor who may apply a pesticide can be challenging. In ACWM's role as the principal regulatory agency in the County for pesticide-use, it is ACWM's experience that in many cases the contractors themselves may not always know. For this reason, County departments are strongly encouraged to have someone in ACWM's Pesticide Regulatory Division review proposed solicitations (IFB, RFP, RFSQ), including the Minimum Requirements and Statement of Work, for any solicitation for services where the application of a pesticide is a possibility.

Approval of County and Contractor Pesticides

The ACWM Pesticide Regulatory Division shall review and approve all pesticides used by contractors or purchased by County departments to ensure no banned or unregistered products are stored or applied. The approval shall also include a general evaluation of the anticipated use sites and target pests to see if the proposed use is legal and appropriate. In any solicitation for services at a County facility where the outdoor application of a pesticide is part of the services, the solicitation documents (RFB, RFP, and RFSQ) shall list the pesticides the contractor will be authorized to use or shall require bidders/proposers to submit a list of pesticides they intend to use as part of the Required Forms. ACWM must approve the pesticides before the RFB/RFP/RFSQ is released. ACWM approval is not required for purchases of consumer products, packaged for consumer use at projected use amounts not greater than typical consumer amounts.

Quantifying Contractor Pesticide Use

In addition to the monthly pesticide use reporting required by State law (see Section 15), contractors must provide to the contracting department an annual summary of the pesticides used outdoors. For each pesticide, the summary shall include:

- Product trade name
- Active ingredient
- EPA Registration Number
- Total amount used

The units reported may be appropriate to the product (gallons, ounces, pounds, etc.). The contracting County department shall report contractor use of pesticides annually to the ACWM IPM Division (see Section 22).

Attestation of Adherence to the County's Countywide IPM Program

Language attesting adherence to the Countywide IPM Program must be included in all County solicitations (IFB, RFP, and RFSQ) where the outdoor application of a pesticide is or may be part of the services being requested. The attestation shall include all applicable principles of IPM summarized in sub-sections I, III and IV of Section 21.0 RESPONSIBILITIES and EXPECTATIONS (below).

21.0 RESPONSIBILITIES and EXPECTATIONS

This Section serves as a summary of the expectations for County employees' adherence to the principles and policies contained in this document, which are, to the extent practicable and as appropriate to job duties, responsibilities, authority, ability, and resources, County departments and their employees are expected to:

I. Understand and follow the IPM principles established in this Program including:

- ∨ Selecting landscape plants that are drought tolerant and adapted to the local conditions
- ∨ Designing and managing landscapes and building perimeters with the goal of preventing pests from getting inside
- ∨ Protecting and conserving natural insect predators
- ∨ Using pest prevention and exclusion as well as cultural and physical methods to control pests
- ∨ Applying pesticides only after monitoring confirms:
 - An actual pest is identified as causing the problem or damage
 - The number of pests and the amount of damage they are causing is intolerable
 - A pesticide application would be effective
 - The conditions that caused the pest activity are not likely to stay the same leading to a bigger problem
 - There are no viable nonchemical methods that can be used to manage the pest or change the environment to prevent pest problems in the future

II. Manage water wisely and protect Los Angeles County surface water by:

- ∨ Using sustainable irrigation practices
- ∨ Limiting overhead irrigation
- ∨ Using weather-based irrigation controllers
- ∨ Performing routine checks of irrigation and sprinklers
- ∨ Planting native or drought tolerant plants when practicable

- ∨ Reducing turf where appropriate
- ∨ Designing landscape areas to minimize or eliminate offsite water runoff
- ∨ Using fertilizers responsibly and only when needed

III. Use/store pesticides and fertilizers safely and responsibly by:

- ∨ Conducting a pre-application site review
- ∨ Using the required pre-application Checklist
- ∨ Ensuring all County employees are trained prior to using or handling pesticides
- ∨ Ensuring any permits or Written Recommendations are obtained
- ∨ Ensuring the application is conducted under the supervision of a Certified Applicator
- ∨ Using the lowest risk product at the lowest effective rate
- ∨ Not applying or allowing pesticides to drift on impervious surfaces
- ∨ Never applying pesticides or fertilizers:
 - ▶ over standing water
 - ▶ when water is flowing off the application area
 - ▶ when two or more consecutive days with greater than 50% chance of rainfall are predicted by NOAA
 - ▶ when rain is predicted within 48 hours of a ½ inch rain event²⁴
- ∨ Limiting or eliminating the use of broad spectrum insecticides
- ∨ Limiting the amount of pesticides or fertilizers that are stored
- ∨ Routinely inspecting pesticide storage areas
- ∨ Properly rinsing and disposing of used pesticide containers
- ∨ Developing and enforcing a written disciplinary program for County employees for failing to use required Personal Protective Equipment (PPE)

IV. Help protect Los Angeles County pollinators by:

- ∨ Carefully following the PROTECTION OF POLLINATORS statement (if any) on pesticide labels
- ∨ Avoiding applications of insecticides when plants are in bloom

22.0 RECORDKEEPING

In addition to any of the pesticide use reporting requirements established in State law or regulation, each County department shall prepare and annually update an inventory of all pesticides applied outdoors by County staff or contractors on property owned or managed by the County. The inventory shall include the following for each product:

- Product trade name
- Active ingredient
- EPA Registration Number
- Total amount in current storage (County departments only)
- Total amount used

By August 15 of each year, County departments shall provide the pesticide inventory/use information to the ACWM IPM Division. As a follow through to the County's commitment to minimize the use of pesticides that cause impairment of surface waters, ACWM and

²⁴ The 48 hour rain restriction does not apply to aquatic pesticides or pre-emergent herbicides which require water for activation.

DPW shall, at least annually, schedule a review of the County's overall pesticide use records. Trends that appear contrary to the goal of minimizing the use of certain pesticides will be examined. As part of this, County departments should anticipate follow up or clarification questions from ACWM staff.

PART 4 – APPENDICES and GLOSSARY

APPENDIX A-MATRIX OF LOS ANGELES COUNTY OUTDOOR PESTICIDE USE REQUIREMENTS

		Training			Licensing and Certification						Permits/Registration	Reporting				
		Pesticide Safety Training ⁸	Countywide IPM Program Training ⁹	State Qualified Applicator Certificate (QALC) ¹⁰	Structural Pest Control Board License (QAL) ¹¹	Structural Pest Control Board Applicator, Branch 2 ¹¹	Structural Pest Control Board Applicator, Branch 3 ¹¹	Representative, Branch 1 ¹¹	Representative, Branch 2 ¹¹	Representative, Branch 3 ¹¹	State Maintenance Gardener Pest Operator or Field License ¹²	State Pest Control Business License ¹¹	Restricted Materials Permit Issued by L.A. County ¹³	Written Pest Control Recommendation by County Ag. ¹⁴	Pesticide Use Reporting ¹⁵	Notice of Intent to County Ag. ¹⁸
Structural Pesticide Use ¹	Application of pesticides for the control of HOUSEHOLD PESTS ³ <u>excluding fumigation</u>															
	County Employees	X	X	X										X ⁷		
	Contractor Employees	X	X		X		X			X	X			X		
	Application of pesticides for control of WOOD-DESTROYING PESTS ⁴ <u>excluding fumigation</u>															
	County Employees	X	X	X										X ⁷		
	Contractor Employees	X	X		X		X			X	X			X		
Non-structural Pesticide Use ²	Application of pesticides for control of HOUSEHOLD and WOOD-DESTROYING PESTS by <u>fumigation</u>															
	County Employees ⁵															
	Contractor Employees	X			X									X		
	Application of pesticides INCIDENTAL to LANDSCAPING															
	County Employees	X	X	X											X	
	Contractor Employees	X	X						X		X				X	
Non-structural Pesticide Use ²	Application of pesticides for control of pests in INDUSTRIAL and INSTITUTIONAL ⁶ areas															
	County Employees	X	X	X								X		X		
	Contractor Employees	X	X		X						X	X	X	X		
	Application of pesticides for control of pests in NON-PRODUCTION AGRICULTURAL ⁷ areas															
	County Employees	X	X	X								X	X	X	X	
	Contractor Employees	X	X		X						X	X	X	X	X	

- Structural Pesticide Use** means pesticides used to control household pests or wood destroying organisms which may invade households or other structures.
 - Non-Structural Pesticide Use** means virtually any outdoor use of a pesticide
 - Household Pests** are those pests other than wood destroying pests or organisms, which invade households and other structures, including, but not limited to, rodents, vermin and insects.
 - Wood Destroying Pests** are insects like termites and other organisms such as fungus that can damage structural wood.
 - It is highly unlikely a County employee would perform a fumigation
 - Industrial/institutional** pesticide use is a type of non-agricultural, outdoor application of a pesticide performed on property necessary for the operation of warehouses, factories and buildings like schools, hospitals and offices. Section 20.0- CONTRACTORS, CONTRACTING AND BUYING PESTICIDES has additional information what constitutes an Industrial/Institutional use of a pesticide.
 - Non-production Agricultural** pesticide use refers to outdoor applications of pesticides that are not Industrial/Institutional use, and are not for the production for sale of an agricultural commodity. They include: cemeteries, ditches, golf courses, greenbelts, highway medians, irrigation canals, parks, recreation areas, reservoirs, roadsides, rights-of-way and fallow land.
 - Any employee who applies a pesticide must receive training prior to use and then annually thereafter. Appendix B has a list of the topics the training must address. Employee training is not required for employees handling consumer products packaged for distribution to, and use by, the general public provided that the employee use of the product is not significantly greater than the typical consumer use of the product.
 - Both County and Contractor employees who apply pesticides and/or perform certain other job duties are expected to have training in the Countywide IPM Program to a level appropriate to their job duties and responsibilities. Section 19.0- PROGRAM TRAINING has additional information on training.
 - Any pesticide application performed by a County employee must be done by or under the direct supervision of a State certified Qualified Applicator certified in the appropriate category.
 - See Section 20.0 - CONTRACTORS, CONTRACTING and BUYING PESTICIDES
 - A contractor must possess a **Maintenance Gardener Pest Control Business License** if they are a maintenance gardener who occasionally engages in pest control in support of his/her primary gardening business. A contractor is a maintenance gardener if his/her maintenance gardening activities include mowing lawns, performing general yard clean up, and taking care of ornamental and turf plants in:
 - Outdoor ornamental and garden areas surrounding public structures, such as buildings, brick walls, fountains, fences, statues;
 - Outdoor ornamental and garden areas surrounding commercial parks, such as offices, restaurants, warehouses, factories, stores, shopping centers, malls;
 - Parks, golf courses, cemeteries, but only on ornamental or turf plantings near buildings that are distinct and separate from the plantings that constitute open space landscaping in a park, golf course or cemetery itself.
- Persons performing pest control incidental to new construction are not required a Maintenance Gardener Pest Control Business License. A list of currently valid Maintenance Gardener Pest Control Business Licenses may be viewed at the DPR website at: www.cdpr.ca.gov/docs/license/curric.htm. ACWM can also answer any questions regarding licensing or anything else about safe and legal use of pesticides in Los Angeles County.
- The Pest Control Business must be registered with ACWM to perform work in Los Angeles County.
 - Certain pesticides require a Restricted Materials Permit issued by ACWM before they can be used in one of the non-production agricultural use sites listed in Table 3 on page 53. This includes rodenticides with strychnine, zinc phosphide, aluminum phosphide and anticoagulants as active ingredients as well as any herbicide listed by CDPR as having been detected in groundwater. The complete listing of materials requiring a Restricted Materials Permit is found in Section 6400 of the California Code of Regulations.
 - Most pesticide applications within one of the non-production agricultural use requires a Written Recommendation prepared by a CDPR certified Pest Control Advisor or designated ACWM staff. See PART 2 - SAFE AND EFFECTIVE USE OF PESTICIDES AND FERTILIZERS.
 - Registered structural pest control companies must prepare and submit to ACWM a monthly summary (Report) of all pesticides they have used in Los Angeles County. In addition, any person, including County employees, must submit to ACWM a monthly Report of all pesticides used in one of the non-production agricultural sites listed in Table 3 (Section 14). The Reports are due by the 10th of the following month and pest control businesses are required to submit one even if no pesticides were used during the month (Negative Pesticide Use Report).
Contractors must provide an annual summary of pesticides used directly to the contacting County department on a monthly basis (see Section 20.0)
 - County employees applying pesticides outdoors must report the use annually to the Los Angeles County, Department of Public Works, Watershed Division.
 - Before applying any pesticide requiring a Restricted Materials Permit, applicators must file a *NOTICE OF INTENT TO APPLY A RESTRICTED MATERIAL* to ACWM at least 24 hours before the scheduled application.

APPENDIX B-LIST OF THE REQUIRED TOPICS FOR EMPLOYEE PESTICIDE SAFETY TRAINING²⁵

(Training must be received prior to handling pesticides, additional pesticides, and updated yearly. The training shall be in a manner that the employee understands).

- **Product Labeling:** (review of format and meaning of information, such as precautionary statements, hazards, use rates, limitations, prohibited uses, etc., contained in the product labeling)
- **Hazards of Pesticides:** (review of hazards of pesticides including acute and chronic effects, delayed effects and sensitization as identified in pesticide product labeling, Safety Data Sheets (SDS), Material Safety Data Sheets [MSDS], or Pesticide Safety Information Series [PSIS] leaflets)
- **Routes of Exposure:** (routes by which pesticides can enter the body)
- **Overexposure:** (signs and symptoms of overexposure)
- **First Aid:** (emergency first aid for pesticide overexposure)
- **Medical Care:** (how and where to obtain emergency medical care)
- **Decontamination/Spill Clean Up:** (routine and emergency decontamination procedures, including spill cleanup and the need to thoroughly shower with soap and warm water after the exposure period)
- **Personal Protective Equipment:** (need for, limitations, appropriate use, and sanitation of any required personal protective equipment)
- **Heat Related Illness:** (prevention, recognition, and first aid for heat related illnesses)
- **Transporting, Storing and Disposal:** (safety requirements and procedures, including engineering controls for handling, transporting, storing, and disposing of pesticides)
- **Environmental Concerns:** (drift, runoff, and wildlife hazards)
- **Taking Pesticides Home:** (warning about taking pesticides or pesticide containers home)
- **Laws and Regulations:** (laws and regulations related to pesticide safety, MSDS, or PSIS leaflets)
- **Hazard Communication:** (the location of the written hazard communication information including the PSIS N-8 MSDS's for pesticides used by employees)
- **Employees' Rights:** (the right to personally receive information about pesticides to which an employee may be exposed, for the employee's physician or employee representative to receive this information; to be protected against retaliatory action due to the exercise of any of the employee's rights)

²⁵ California Code of Regulations, Division 6, Article 2, Section 6724(b)

APPENDIX C- PESTICIDE USE REPORTING FORM

The MONTHLY SUMMARY PESTICIDE USE REPORT shown below is the form most likely to be used by a County department to report pesticide use. The reverse side of the form (shown on the following page) has instructions on how to complete the Report. Completed forms are due by the 10th day of the following month. They can be mailed to:

ACWM –Pesticide Use Division
12300 Lower Azusa Road, Arcadia Ca 91006

Or faxed to ACWM: (626) 443-6652

The forms are available at <http://www.cdpr.ca.gov/docs/pur/forms/purforms.htm> ACWM's Pesticide Regulatory Division is available to answer questions about the form. They can be reached at (626) 575-6466.

STATE OF CALIFORNIA				DEPARTMENT OF PESTICIDE REGULATION			
MONTHLY SUMMARY PESTICIDE USE REPORT				ENFORCEMENT BRANCH			
DPR-ENF-000 (REV. 4-12) PAGE 1 OF 2							
INSTRUCTIONS FOR COMPLETING THIS FORM ARE INDICATED BELOW AND ON THE REVERSE SIDE							
OPERATOR (FIRM NAME)		ADDRESS		CITY		ZIP CODE	PHONE NUMBER
OPERATOR ID/PERMIT NUMBER	LICENSE NUMBER	COUNTY WHERE APPLIED		COUNTY NUMBER	MONTH/YEAR OF USE	TOTAL NUMBER OF APPLICATIONS	
<p>1. Complete Columns A, B, C, and D for All Users</p> <p>2. Complete Column E by using one of the following codes:</p> <p>Code 10 - Structural Pest Control.....includes any pest control work performed within or on buildings and other structures.</p> <p>Code 30 - Landscape Maintenance Pest Control.....includes any pest control work performed on landscape plantings around residences or other buildings, golf courses, parks, cemeteries, etc.</p> <p>Code 40 - Right-of-Way Pest Control.....includes any pest control work performed along roadsides, power lines, median strips, ditch banks, and similar sites.</p> <p>Code 50 - Public Health Pest Control.....includes any pest control work performed by or under contract with State or local public health or vector control agencies.</p> <p>Code 80 - Vertebrate Pest Control.....includes any vertebrate pest control work performed by public agencies or work under the supervision of the State or county agricultural commissioner.</p> <p>Code 91 - Commodity Fumigation (Nonfood/Nonfeed).....includes fumigation of nonfood/nonfeed commodities such as pallets, dunnage, furniture, burlap bags, etc.</p> <p>Code 100 - Regulatory Pest Control.....includes any pest control work performed by public employees or contractors in the control of regulated pests.</p> <p>3. Complete Columns F and G, if use does not fit one of the above codes</p>							
A	B	C	D	E	F	G	
MANUFACTURER AND NAME OF PRODUCT APPLIED	EPA/CALIFORNIA REGISTRATION NUMBER FROM LABEL INCLUDE ALPHA CODE	TOTAL PRODUCT USED (Check One Unit of Measure)	NUMBER OF APPLICATIONS	CODE	COMMODITY OR SITE TREATED	ACRES/UNITS TREATED	
		<input type="checkbox"/> LB <input type="checkbox"/> OZ <input type="checkbox"/> PT <input type="checkbox"/> QT <input type="checkbox"/> GA					
		<input type="checkbox"/> LB <input type="checkbox"/> OZ <input type="checkbox"/> PT <input type="checkbox"/> QT <input type="checkbox"/> GA					
		<input type="checkbox"/> LB <input type="checkbox"/> OZ <input type="checkbox"/> PT <input type="checkbox"/> QT <input type="checkbox"/> GA					
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		<input type="checkbox"/> LB <input type="checkbox"/> OZ <input type="checkbox"/> PT <input type="checkbox"/> QT <input type="checkbox"/> GA					
		<input type="checkbox"/> LB <input type="checkbox"/> OZ <input type="checkbox"/> PT <input type="checkbox"/> QT <input type="checkbox"/> GA					
REPORT PREPARED BY _____				DATE _____			
Distribution: CAC - Two copies; Report preparer - One copy				<input type="button" value="Print Form"/>			

GENERAL INFORMATION FOR COMPLETING THE MONTHLY SUMMARY PESTICIDE USE REPORT

(Page 2 of 2)

Reporting Requirements

Reporting of all pesticide applications including spray adjuvants and plant growth regulators, is required by:

1. Landscape maintenance gardener pest control businesses, agricultural pest control businesses performing residential work, and structural pest control businesses.
2. Public agencies, pest control businesses and property operators who apply pesticides for agricultural use other than for the production of an agricultural commodity. These uses include applications for the production of poultry, fish, and apiary. Pest control businesses must report uses for the production of livestock. Also, uses on golf courses, parks, rights-of-way, cemeteries, forests, ditches, fence lines, etc. must be reported.
3. Persons who use restricted materials for uses other than the production of an agricultural commodity.
4. Persons who use a pesticide for industrial post-harvest commodity treatments.
5. Persons who use a Ground Water Protection pesticide, listed in Title 3, California Code of Regulations, section 6800(b) for any outdoor, institutional or industrial use.

Report Filing Deadlines

Submit two (2) copies of this report to the county agricultural commissioner by the 10th of the month, following the month in which the work was performed. Reports may be hand-delivered or mailed, the postmark serving as the date of delivery. Retain a copy for your records.

For each month when no pest control work has been performed, licensed pest control businesses must submit a use report by the 10th day of the following month to the county agricultural commissioner in counties where they are registered. The use report must indicate that no pest control work was performed.

SPECIFIC INSTRUCTIONS FOR COMPLETING THE FACE PAGE

The operator/firm information should be filled out completely, including the address, ZIP code, and telephone number.

Identify the Operator Identification/Restricted Material Permit Number, if applicable.

Enter the name of the county where the pesticide(s) was applied.

Indicate the county number where the product(s) was applied. The county number is available from the county agricultural commissioner's office. A separate report must be filed for each county where pesticides were applied.

Enter the month and year in which the applications were made.

Enter the total number of applications (i.e., the total of column D below) made during the month.

In Column A, enter both the manufacturer and brand name of the product.

In Column B, enter the "EPA Registration Number" or "California Registration Number" that appears on the pesticide label, including alpha codes, if any (AA, ZA, ZB, etc.). Do not use the "EPA Establishment Number" (Est. No.).

In Column C, indicate the total amount of product used as formulated and packaged by the manufacturer. Do not report the total mixture after dilution. Check only one unit of measure. If necessary, decimals and fractions may be used.

In Column D, indicate the total number of applications for each pesticide used during the reporting month. Each separate site (home, apartment complex, building, right-of-way, grain silo, etc.) should be counted as one application. For tank mixes, each represented pesticide should be credited with one application.

In Column E, if the use of the product is structural, landscape, right-of-way, vertebrate, public health, commodity fumigation (nonfood/nonfeed) or regulatory, enter the appropriate code number. Leave Columns F and G blank.

In Column F, if use of the product is not included in one of the number coded categories that are identified in column E, such as food/feed commodity fumigations, seed treatment, noncrop fenclines or ditch banks, etc., enter the commodity or site treated. Leave Column E blank.

Do not enter vertebrate pest control work in production areas such as orchards or other crop areas. This work should be reported on the Production Agriculture Monthly Pesticide Use Report.

In Column G, if use of the product is not included in one of the number-coded categories that are identified in Column E, enter the amount treated and the appropriate unit of measure (acres, pounds, square feet, tons, etc.). If you have a different measure, describe it fully and enter the amount treated. Leave Column E blank.

Enter the name of the person responsible for completing the information, and date the report. This could be a licensee, a manager, the person who applied the pesticide, a bookkeeper, etc.

APPENDIX D - LIST OF RESOURCES FOR DROUGHT TOLERANT AND/OR NATIVE PLANTS

The following are all lists of drought tolerant plants that can be referenced when contemplating replacing or establishing a new landscape.

LA County Green Building Program - planning.lacounty.gov/green

This site was developed the Los Angeles County Department of Regional Planning and offers several references for drought tolerant plants, including *THE DROUGHT TOLERANT GARDEN – LOS ANGELES COUNTY HANDBOOK*, a water efficient turf list and a list of invasive plants to avoid using in your landscape.

WaterSense® An EPA Partnership Program – www.epa.gov/watersense/outdoor/what_to_plant.html

This site, developed by the US EPA, has a number of plant data bases maintained, including one for southern California. The site also has tips designed with water conservation and efficacy in mind.

Water-Wise Gardening – <http://dpw.lacounty.gov/epd/sg/plants.cfm>

Another useful plant listing produced by Los Angeles County, this time by the Public Works Department, gives tips on water smart gardening, irrigation practices and a short listing of recommended drought tolerant plants.

A California Friendly Guide to Native and Drought Tolerant Plants - <http://www.lvmwd.com/for-customers/conservation/a-california-friendly-guide>

This list has been put together by the Las Virgenes Municipal Water District. It was prepared primarily for use for homeowners in the Santa Monica Mountains; the plants will survive in most other areas of Los Angeles County as well.

Great California Native Plants – www.bewaterwise.com

This site was developed by the Metropolitan Water District and it has a listing of 1,000 native plants that would be suitable for planting in many areas of Los Angeles County. The site also has online water wise gardening classes, tips on irrigation, and other programs related to the conservation of water resources.

Native Plant List – <http://dpw.lacounty.gov/wwd/web/Conservation/NativePlant.aspx>

This list has been developed by the Los Angeles County Department of Public Works – Water Works Division. It has Plant Listings for the Topanga/Malibu area down to Marina Del Rey (District #29) as well as other county geographic areas.

Drought Tolerant Plant List – www.chico.ca.us/document/_library/documents/ldm-droughttolerantplantlist

This list was put together by the City of Chico in northern California for use by their Parks, Public Right of Ways, and other facilities.

APPENDIX E - INSECTARY AND BIOCONTROL LANDSCAPING NOTES

- ⌞ In order to insure year round habitat, you must provide a variety of plants with different bloom and fruiting times.
- ⌞ Some insectary plants can be considered weedy. If you are planting near natural areas, consider restricting your palette to natives only (noted with an asterisk* in the list below).
- ⌞ Many native birds prefer dense shrubby habitat, and require some dead twigs and branches for nesting. Regular hedging or pruning at the wrong time of the year can affect nesting.
- ⌞ If you are looking to promote native bees, leaving some areas of bare soil is important, many of California’s native solitary stingless bees nest in the ground.
- ⌞ Fungal interactions protect plants from diseases, improve heat tolerance, and help them alert insect predators about aphids, and other harmful insects. Try to promote healthy symbiotic fungi by mulching, and reducing herbicide use and soil disturbance. A good rule of thumb to tell good fungi from bad, is if the mushroom is growing on the wood of a live tree or shrub, it is not beneficial. However, mushrooms growing on soil, dead leaves and mulch tend to be indicators of healthy soils and plants.

Plants Beneficial for Insects	Plants Beneficial for Birds	Non-Living Options
<i>Achillea millefolium*</i> <i>Asclepias fascicularis*</i> Aster sp. Calendula California poppy* <i>Ceanothus sp.*</i> <i>Clarkia sp.*</i> <i>Coreopsis</i> <i>Datura sp.*</i> <i>Encelia californica*</i> <i>Eriogonum species*</i> Gaillardia Grindelia* <i>Helianthus annuus*</i> <i>Heteromeles arbutifolia*</i> Lavandula species Monarda Native wildflowers* Oenothera <i>Quercus sp.*</i> <i>Ribes sp.*</i> Rudbeckia Salvia sp. Scabiosa sp. <i>Tanacetum parthenium</i> <i>Tithonia rotundiflora</i> Zinnia	<i>Helianthus annuus*</i> <i>Eriogonum species*</i> <i>Heteromeles arbutifolia*</i> Berberis (Mahonia) <i>aquifolium*</i> Berberis <i>nevinii*</i> <i>Quercus sp.*</i> <i>Rubus ursinus*</i> <i>Rhus ovata*</i> <i>Rhus integrifolia*</i> Penstemon sp. Salvia sp. Salvia sp. (native)* <i>Prunus ilicifolia*</i> <i>Ribes sp.*</i> <i>Ceanothus sp.*</i> <i>Arctostaphylos sp.*</i> <i>Mimulus sp*</i> Salix sp.* Grasses	Rocks (lizards, snakes) Logs (birds, decomposers, predatory beetles) Sticks, dead branches (native bees, praying mantids, birds) Mulch (worms, predatory beetles and other insects, birds)

APPENDIX F

PESTICIDE USE PRE-APPLICATION SURVEY and CHECKLIST

Department: _____ Division: _____
Applicator: _____ QAC/QAL _____
Survey Date: _____ Proposed Application _____
Application Site: _____

Is a pest really causing the problem? *(Briefly describe the problem or damage observed, the location and the identification of the pest)*

Comments: _____

Are the number of pests and the amount of damage they are causing intolerable? *(Briefly explain how the pests and their damage have exceeded an established threshold, and why they can't simply be tolerated)*

Comments: _____

Would a pesticide be effective? *(Are the pests still there and at a life stage where a pesticide would control them; will the pesticide actually reach the pest; is the proposed use allowed by the*

Comments: _____

Are the conditions that caused the pest activity likely to stay the same leading to a bigger problem? *(Some insecticides can harm natural insect predators increasing the chances for more severe outbreaks of the original pest)*

Comments: _____

Are there any nonchemical methods that can be used to manage the pest or change the environment to prevent pest problems in the future? *(Sanitation, exclusion, pruning, sprinkler repair, pest tolerant plants, etc.)*

Comments: _____

APPENDIX G - INFORMATION SOURCES ON COMMON PESTS AND PEST
MANAGEMENT SOLUTIONS

This Appendix will contain website sources for those interested in additional information/resources on common pests, pest solutions, IPM ideas, pest bulletins, images, etc.

**RESERVED FOR
INTERNET VERSION**

lacountyipm.org

This Appendix will contain contact information for resources and support available to County employees including, but not limited to:

1. Information on pesticides

- Pesticide use
- Product registration
- Reporting
- Proper storage
- Use rates
- Product selection
- Endangered species
- Written records
- Interactions

**RESERVED FOR
INTERNET VERSION**

lacountyipm.org

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3. Drought tolerant plants

4. Disease resistant plants

5. Insectary plants

6. Irrigation

APPENDIX I – PEST and DISEASE IDENTIFICATION SERVICES

ACWM operates an entomology and a plant pathology laboratory. The two labs process over 8,000 pest specimens annually for Los Angeles County residents, schools, governmental agencies, growers, nurseries, and pest control operators. Specimens can be taken directly to the labs (call first) or mailed in. Careful handling is required for specimens that are mailed in. The following are guidelines for mailing specimens to help ensure the specimens are intact and fresh enough for an accurate identification or diagnosis.

1. PLANT PATHOLOGY LABORATORY

Submitting specimens for plant disease diagnosis or plant/mushroom identification

To diagnose plant disease(s), the lab needs a sample of the plant parts that are infected or symptomatic (showing the symptoms of a disease). In many cases, a root sample may also be needed. If you are unsure, call the lab. Cut a 6 to 12 inch piece of the infected foliage off of the plant and seal in a zip-lock bag. If necessary, fold the stem in half to fit in the bag.

When submitting roots, collect a small handful of fine feeder roots from 3 to 6 inches below the surface of the soil. Shake the soil from the roots and place the roots in a zip-lock bag.

When submitting mushrooms, collect the entire mushroom by using a trowel to lift the mushroom from the soil (note the stem may extend into the soil). Wrap the mushroom in wax paper and place in a paper bag. Do not place the mushroom in a plastic bag or place a wet paper towel in the sample bag as this will cause the sample to rot quickly. The lab is closed Friday through Sunday, so it is best to mail the sample early in the week to ensure it does not sit over the weekend.

Samples should be sent along with the following information:

1. Property Owner or Collector
2. Street Address, City, and ZIP
3. Daytime Phone Number
4. Date the specimen was collected
5. Date the specimen was sent
6. Host (Plant Name)
7. Plant damage or disease symptoms observed

A downloadable form is available on the ACWM website to assist with proper submission of samples <http://acwm.lacounty.gov/scripts/pestpdf.htm>

Samples along with the complete information should be sent to:

Plant Pathology Laboratory
Los Angeles County Department of
Agricultural Commissioner/Weights & Measures
11012 South Garfield Avenue, South Gate, CA 90280

Questions regarding packaging and submitting specimens can be directed to the Plant Pathology Laboratory at (562) 622-0433.

2. ENTOMOLOGY LABORATORY

Submitting specimens for identification of insects, snails, slugs, spiders, mites, and other invertebrates

Invertebrate specimens should be submitted in crush-proof, non-glass containers to protect them from damage during mail handling. Plastic vials, pill bottles, and film canisters work for this purpose.

Collect multiple specimens of all available life cycles (larvae, pupae, adults). Make sure they are intact (do not send body parts). If the insects are attached to plant material, cut infested sections, wrap them in dry paper towels, and seal them in a plastic zip-lock bag. Please do not submit live specimens.

Containers with samples should be sent in sturdy mailing boxes or padded envelopes. The lab is closed Friday through Sunday, so it is best to mail the sample early in the week to ensure it does not sit over the weekend.

THE ENTOMOLOGY LABORATORY IS NOT EQUIPPED TO HANDLE SPECIMENS OF HUMAN PEST OR DISEASE AGENTS. Contact the Los Angeles County Department of Public Health for guidance on how and where to submit such samples.

The sample should be sent with the following information:

1. Property Owner or Collector
2. Street Address, City and ZIP
3. Daytime Phone Number
4. Date the specimen was collected
5. Date the specimen was sent
6. Host plant name (for landscape & garden pests)
7. Food product name (for pantry and food-storage pests)
8. Location on/in the building (for structural pests)
9. Damage observed

A downloadable form is available on the ACWM website to assist with proper submission of samples <http://acwm.lacounty.gov/scripts/pestpdf.htm>

Samples along with the complete information should be sent to:

Entomology Laboratory
Los Angeles County Department of
Agricultural Commissioner/Weights & Measures
11012 South Garfield Avenue, South Gate, CA 90280

Questions regarding packaging and submitting specimens can be directed to the Entomology Laboratory at (562) 622-0431.

APPENDIX J – WEEDS IN L.A. COUNTY THE AGRICULTURAL COMMISSIONER NEEDS TO KNOW ABOUT

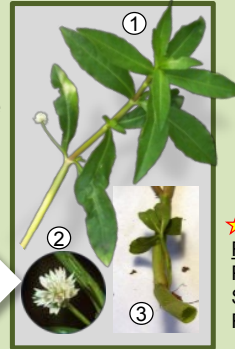
If any of the following four weeds are detected in Los Angeles County, ACWM should be notified



Alligatorweed!

Alligatorweed (*Alternanthera philoxeroides*) is a highly invasive aquatic plant from South America which has the potential to clog waterways, degrade habitat and ruin recreational boating/ fishing

- Key characteristics include:
1. alternating leaves
 2. small white flower
 3. hollow stem



★ Recent detections: Bonelli Park in San Dimas, Rio Hondo Spreading Grounds near Pico Rivera, and...



Dalmatian Toadflax!

Dalmatian toadflax (*Linaria genistifolia*) is an invasive perennial from southern Europe. Dense stands can displace native plants and reduce grazing capacity

- Key characteristics include:
1. bright yellow "snapdragon" like flower with orange tint
 2. heart-shaped leaves that are "clasped" near the stem



★ Recent detections: The Hungry Valley State Off-Road area near Gorman



Halogeton!

Halogeton (*Halogeton glomeratus*) is a poisonous noxious weed from Eurasia. It is highly toxic to both cattle and sheep

- Key characteristics include:
1. reddish purple stems and leaves that resemble little green sausages
 2. Showy, fan-like flowers that cover almost the entire plant



★ Recent detections: In the Antelope Valley along the 14 Freeway near Palmdale



Spotted Knapweed!

Spotted Knapweed (*Centaurea maculosa*) is a range land pest which reduces forage for grazing mammals like deer and elk. It displaces native plants, including grasses, leading to soil erosion

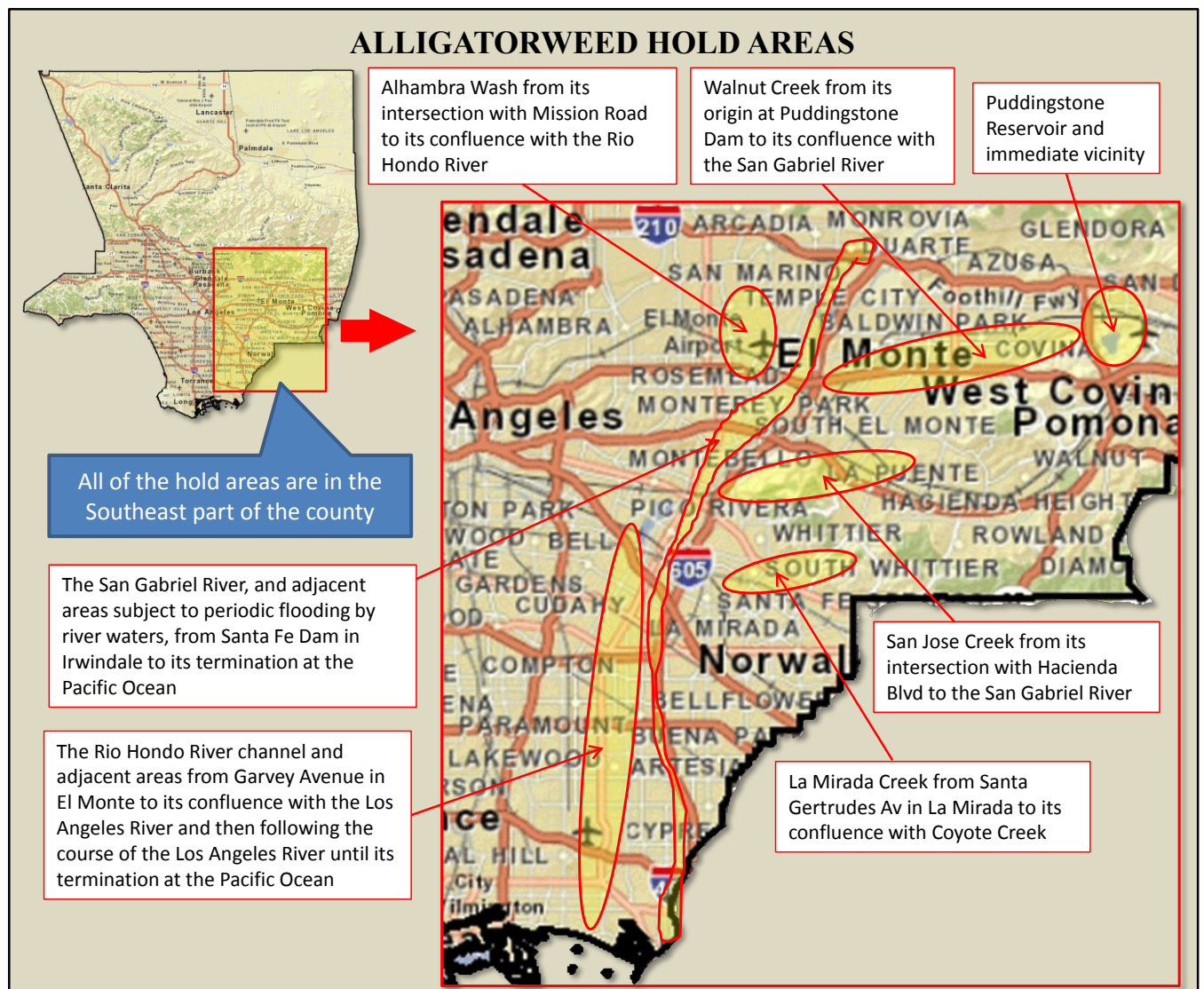
- Key characteristics include:
1. Young plants (rosettes) resemble a dandelion
 2. Flowers with white, pink or purple petals and darkish "spots"



★ Recent detections: The Antelope Valley near Neenach, the Angeles Forest north of San Dimas, and Charmlee Wilderness Park in Malibu

APPENDIX K - INFORMATION ON THE ALLIGATORWEED HOLD AREA IN LOS ANGELES COUNTY

In order to prevent the spread of Alligatorweed, a non-indigenous and highly invasive aquatic plant, the Director of the California Department of Food and Agriculture has designated all of Los Angeles County as an Alligatorweed Eradication Area²⁶. Within the county, the Agricultural Commissioner has imposed a Notice to Hold (Notice) covering areas of the county where Alligatorweed detections continue to be a possibility. In these areas, no plants, soil or other carriers of alligatorweed may be moved except under a permit. This means no vehicles, equipment, grading, construction, repairs, etc., in the area without a permit. If any of these activities are contemplated, ACWM must be contacted first! Violation of the Notice is a misdemeanor punishable by civil penalties of up to \$2,500 for each violation²⁷ or civil liability of up to \$10,000 for each violation²⁸.



²⁶ California Code of Regulations, Title 3, Section 3960

²⁷ Food and Agricultural Code, Section 5311

²⁸ Food and Agricultural Code, Section 5310

APPENDIX L – EFFECTIVE SOLARIZATION FOR WEEDS AND OTHER PESTS

About Solarization

This technique for weed and pathogen control can be very effective if the proper conditions exist for its success. At its most basic, solarization is simply the use of solar radiation trapped as heat under plastic sheeting raising the temperature of the soil to the point that it will kill weeds, weed seeds, plant pathogens, and other pests. Solarization is also a good way to kill unwanted turf without using herbicides!

Timing

Soil solarization is most effective in warm, sunny locations when the days are long, air temperature is high, skies are clear and there is no wind. Solarization is most effective when done during the hottest weeks of the year, generally from June to August.

Soil Preparation

A flat, smooth bed with clods and litter raked away works best for this method as it allows the plastic to lie snugly against the soil surface. Air pockets between the soil surface and the plastic sheeting can greatly reduce soil heating and promote “sailing” of the plastic in the wind.

Irrigate the Soil

Wet soil conducts heat better than dry soil and makes soil organisms more vulnerable to heat. Wet the soil to at least 12 inches deep. In larger areas, it is easiest to do this before laying down the plastic, but in smaller sites it can be done after the sheeting is in place by using a garden or soaker hose or drip tape under the plastic tarp. Otherwise, place the tarp over the area as soon as possible after water has been applied to prevent evaporation. Unless the soil gets dry, do not irrigate again as this will lower the soil temperature and lengthen the time required for successful solarization.

Plastic Tarp Choice

- Thinner is better, but is more prone to tearing from wind or animals (1mil)
- Slightly thicker plastic is better for windy areas (1.5 – 2mils)
- Small areas can use thicker plastic (4 mil)

“Painter’s” plastic works well for larger areas and will generally last the 3 to 5 weeks required for solarization before it begins to breakdown. The plastic sheets should be watched closely so that they can be removed before they deteriorate to the point where removal and disposal are difficult. In cooler climates, a second layer of plastic can be placed over the first, separated by objects like PVC pipe or plastic bottles, as this can raise the soil temperatures from 2 to 10 degrees over temperatures obtained with a single layer.

Sheet or Tarp Placement

The plastic must be held as tightly as possible against the soil. One way to accomplish this is to dig a trench 4 to 6 inches deep around the area to be solarized. Lay the plastic over the area with the edge in the trench. Cover that end with soil to hold it down. Pull the plastic tight from the other side and bury that edge in the corresponding trench. Do the same with the other sides and then walk around the perimeter of the trenched area and pack the soil down around the edges of the plastic. The closer to the soil surface the plastic is, the better the heating.

Solarizing Period

Solarization is both time and temperature dependent. The cooler the soil temperature, the longer the plastic needs to remain in place to raise the temperature to desired levels. In general, 4 to 6 weeks of soil heating during the warmest time of the year is sufficient to control most soil pests. In cooler, windier, or cloudy locations, or if there are pests that are harder to control, the plastic may need to remain in place from 6 to 8 weeks. The goal is to maintain daily maximum temperatures in the upper 6 inches of soil at or above 110 to 125 Degrees F. Use of a soil thermometer or temperature probe can verify these temperatures.

Post – Solarization (Removal of the plastic)

The plastic should be removed, taking care not to disturb the underlying soil, so as to not to bring up any viable seed from deeper soil layers. Alternatively, the plastic can be left in place and holes cut into it to allow for the planting of landscape plants; however over time, the plastic will degrade and fall apart during the growing season. If soil must be cultivated for plantings, the cultivation should be shallow, no more than two inches to avoid bringing up viable weed seed or pathogens to the surface.