

VERTEBRATE PEST MANAGEMENT

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California ground squirrels, pocket gophers, meadow voles, birds and jackrabbits may be significant pests in pistachio orchards. They cause damage by feeding on nuts, tree roots and bark, and can stunt tree growth or even kill young trees. Burrows and mounds created by ground squirrels and pocket gophers interfere with orchard maintenance and harvesting operations. In addition, rodents and rabbits gnaw on drip irrigation lines.

The rodent and rabbit pest problems in a given orchard are determined in large part by the orchard's location. Problems are often worse in orchards that are adjacent to rangeland, water ways or unmanaged areas where pest populations are not controlled. Orchard management activities also have some effect; for example, flood irrigation and orchard floor cultivation may discourage meadow mouse populations.

The most successful approach to dealing with rodent and rabbit problems is one that aims to manage their populations at levels where significant damage never occurs. This preventative approach is of particular importance in organic orchards where the options for reducing high density damaging populations are limited to labor intensive techniques such as shooting or trapping.

Management programs for vertebrate pests involve 4 basic steps:

- Correctly identify the species causing the problem. Signs such as tracks, feces, plant damage and burrows may be used to identify which species is responsible for damage.
- Alter the habitat where feasible to make the area less favorable to the pest species
- Take early action and use the control methods appropriate for the orchard and time of year, with due consideration for the environment and nontarget species

- Establish a monitoring system to detect reinfestation so that you can determine when additional corrective measures or controls are necessary

Regular monitoring of vertebrate pests in and around orchards should form the basis of a management program. Historical records of pest population levels, control measures implemented, and the effect of the method, can be used to help determine the best management approach. For most pests, more than one control method is usually available, although their relative effectiveness may vary.

Vertebrate control equipment and supplies (baits, fumigants etc) are available at local retail outlets such as farm supply and hardware stores. In addition, many Agricultural Commissioners sell some control materials. For further information on sources of control materials, consult your local University of California (UC) Farm Advisor or Agricultural Commissioner.

Biological Control

Vertebrate populations are affected most by availability of food and cover, while diseases and predators play a relatively minor role. A number of predators such as hawks, owls, foxes, coyotes and snakes feed on some of the vertebrate pest species. However, natural enemies seldom keep vertebrate pests from reaching damaging levels. So, they should not be relied on to prevent vertebrates from causing economic damage to crops. Factors that limit the role of predators in rodent control include:

- the tendency of predators to modify their diet according to the relative abundance of prey species;
- the high reproductive rate of small rodents that allows rodent populations to compensate for loss to predation;

- predator-avoidance strategies developed by prey species.

In some instances, predators may actually be detrimental to production. For example, coyotes frequently chew on and damage drip lines. If their presence poses no hazard, however, predators might be considered a small component of an integrated management program. Growers in favorable settings can enhance the orchard habitat (via installation of nest boxes, raptor perches etc.) to increase the probability that these predators will prey on rodents in the orchard. However, growers should be aware that there is little or no data to suggest that the installation of nest boxes or raptor perches will have any measurable effect on damage reduction. One study showed that despite quick acceptance of perches and an increase in raptors in the areas, rodent numbers did not change.

Research into the development of new control methods, and studies to satisfy EPA's data requirements to maintain current pesticide registrations for vertebrate pests in California is supported by the bait surcharge program of the California Department of Food and Agriculture.

There are many innovative control methods that have been proposed as being more environmentally-friendly than some of the traditional approaches. When considering one of these alternative approaches, you should remember that testimonials aren't necessarily proof of effectiveness. Check with your local Farm Advisor's office to determine if the technique has proven to be successful in controlled scientific tests. For example, burrow-exploding devices (eg. Rodentorch, Rodex 4000) are gaining popularity in California. These devices deliver and ignite a mixture of propane and oxygen into a burrow system. Burrowing rodents supposedly die as a result of concussion. Research has shown that these devices, at best, reduce burrowing rodent populations by about 50%. Because of the rapid rate at which pest populations can repopulate an area, 50% control is not sufficient to provide any economic benefit. Additionally, these devices are labor intensive and carry a high fire and worker safety risk.

Legal aspects of vertebrate pest management

Under the California Fish and Game Code, if California ground squirrels, meadow voles, pocket gophers or black-tailed jackrabbits are causing or about to cause a crop depredation, they may be lethally removed at any time by the owner or tenant of a property.

Only pesticides that are registered with EPA's Department of Pesticide Regulation (DPR) can legally be used for vertebrate pest control. Registered materials are listed in DPR's database that is available online at <http://www.cdpr.ca.gov/>. You may also contact your Agricultural Commissioner for information on registered materials. In areas where endangered species are present, there may be restrictions on some vertebrate pest control measures. Use restrictions in endangered species habitats are outlined in County Bulletins that are available through DPR's web site or from your Agricultural Commissioner.

Live traps are sometimes used for managing vertebrate pests. Under the California Fish and Game Code, it is illegal to trap and relocate an animal. Live-trapped pest animals should be euthanized humanely. Methods considered humane by the American Veterinary Medical Association include: gassing with carbon dioxide, shooting, or a sharp blow to the head. Drowning is not an approved method of euthanasia.

Rodents and Rabbits

CALIFORNIA GROUND SQUIRREL (*Spermophilus beecheyi*)

California ground squirrels feed on nuts and damage trees by chewing bark off limbs or tree trunks. Burrow systems in the orchard may interfere with orchard management activities and divert irrigation water. Problems also result when ground squirrels chew on and damage drip lines.

The adult ground squirrel has a head and body 9 to 11 inches long and a slightly bushy tail. The fur is mottled dark and light brown or gray. Ground squirrels dig burrows along ditches and fencerows, around buildings and

within and bordering many agricultural crops. They tend to avoid thick chaparral, dense woods, very moist areas and lands that are under complete and frequent cultivation. They will travel 100 yards or more to feed in adjacent crops. In orchards, they often dig the entrances to their burrow systems near the bases of trees. Ground squirrels live in colonies that may grow very large if left uncontrolled. They are active only during the day with peak activity occurring in the morning and late afternoon.

Ground squirrels hibernate during the winter, emerging in late January or February. Some squirrels (usually the young of the year) will be active year-round. Many adults go into a temporary dormant state called aestivation during the hottest parts of the year. Females have one litter averaging 8 young, in the spring. The young emerge from the burrow after about 6 weeks.

Ground squirrels are primarily herbivorous. In spring, ground squirrels consume a variety of green grasses and forbs. When these begin to dry and produce seed in early summer, the squirrels switch to seeds, grains and nuts.

Management Guidelines

Ground squirrel activity should be monitored periodically both inside and on the perimeter of the orchard in spring, summer and fall when squirrels are active. Mid morning is usually the best time of day to observe squirrel activity. Controls should be implemented as soon as activity is first observed, to keep numbers from increasing. Ground squirrels are extremely adaptable so habitat modification only has limited benefit in a management program. Burrow fumigants, poison baits and traps currently are the most effective control methods. Where ground squirrels are a major problem, keep annual records of the dates that squirrels emerge from hibernation and when the first young are seen above the ground; changes in the general number of squirrels; and the controls used, dates of use, and their effect. Use these records as the basis for future management decisions.

Habitat Modification – Removing brush piles, stumps, and debris in and around the orchard may help limit buildup of squirrel

populations to some extent, and will make it easier to monitor squirrel activity. Squirrels may quickly reinvade abandoned burrow systems. On orchard perimeters, deep plowing, where practical, to destroy burrow entrances will help slow down the rate of invasion.

Trapping – Trapping is an effective control method although is quite labor intensive so is most practical for small infestations. Trapping can be undertaken at any time of the year when squirrels are active, but it is most effective in spring before reproduction increases the population. The most commonly used traps are kill traps such as the Conibear trap or box traps.

Conibear traps are placed unbaited over the burrow entrance and trap squirrels as they leave the burrows. Within the range of the San Joaquin kit fox, the trap must be placed in a covered box with an entrance no larger than 3-inches wide to exclude foxes. Box traps are also effective for ground squirrels and are baited with walnuts, almonds, oats, barley, or melon rinds. The bait is placed inside the trap, either behind or tied to the trigger. For several days bait the traps but do not set them so that squirrels become accustomed to them. After the squirrels are taking the bait, rebait and set the trap. As with all traps, take precautions to minimize trapping of nontarget wildlife or pets.

Fumigants. Fumigation can be very effective against ground squirrel populations and can be used prior to squirrels reproducing and during times when poison baits are relatively ineffective. The best time to fumigate burrows is in the late winter or early spring after the squirrels have emerged from hibernation, and prior to breeding. Fumigation is not effective when squirrels are hibernating or aestivating because during those times, squirrels seal themselves within their nesting chambers. It is important that the soil is moist so that the gases are retained in high concentrations within the burrow. When using a fumigant, be sure to treat all active burrow systems in and around the orchard. Re-check all areas a few days after fumigation and retreat any burrows that have been reopened. Do not use fumigants in burrows that extend beneath occupied buildings and carefully follow the label directions for their use. Gas cartridges,

aluminum phosphide, and acrolein (Magnacide “H”) are currently registered for ground squirrel control.

Poison baits. Poison baits are usually the most cost-effective way of controlling ground squirrels, especially large populations and over large areas. Bait consists of grain or pellets treated with a poison registered for ground squirrel control. To be effective, the bait must be used at a time of year when ground squirrels are active and feeding on seeds (usually late spring, early summer and fall). Before using baits, place small amounts of untreated grain near burrows to see if the squirrels will take it. If the grain is taken, proceed with baiting, otherwise wait for several days or a week and try again.

Poison baits registered for ground squirrel control include the acute poison, zinc phosphide (a restricted use material), and the anticoagulant baits diphacinone and chlorphacinone. Zinc phosphide can be applied as spot-treatments to control ground squirrels during the nonbearing season or outside of orchards. The bait is scattered over a 2- to 3-square-foot area around each burrow opening. Low effectiveness of baiting programs using zinc phosphide is often due to bait shyness that occurs when a squirrel gets a sublethal dose, only becomes sick and learns to avoid the bait. Pre-baiting the area with untreated grain 2 to 3 days prior to the application of zinc phosphide may reduce the chances of this happening and therefore improve the effectiveness of the baiting program. Control is usually achieved within 48 hours of the bait application.

With anticoagulant rodenticides, squirrels must ingest several doses of bait over a period of several days. Control is slower but there is less chance of squirrels becoming ‘bait-shy’. Another advantage is that there is an antidote (Vitamin K₁) in the event of an accidental poisoning. Anticoagulants can be applied in bait stations or as spot treatments near burrows, or broadcast over larger areas. Be sure to follow the label directions carefully to determine what application method you may use.

Bait stations are designed to let squirrels in but to exclude larger animals. Openings should

be 3 or 4 inches in diameter. Within the range of the San Joaquin kit fox, entrances to bait stations must not be greater than 3-inches wide. Special types of bait stations must be used within the ranges of endangered kangaroo rat species to ensure that these species are excluded. See your local Agricultural Commissioner or Farm Advisor for bait station specifications.

Spot treatments and broadcast applications are only permissible in orchards during the dormant season. Spot treatments are most economical and effective for small populations. Scatter one handful of bait (ten handfuls to the pound) evenly over 40 to 50 square feet near active burrows. Reapply every 3 or 4 days for a total of 4 or 5 applications to make sure squirrels are exposed to a continual supply of bait. Scattering takes advantage of the ground squirrels’ natural foraging behavior and minimizes the risk to nontarget species. Bait may also be applied using a mechanical broadcaster such as a seed spreader mounted on the back of an ATV. Usually, squirrels retreat back to burrows when sick, and will die there. Dispose of any visible carcasses to prevent poisoning of any predators or scavengers.

POCKET GOPHERS (*Thomomys* spp.)

Pocket gophers are potentially serious orchard pests, especially in young orchards. They feed on the bark of tree crowns and roots, girdling and killing young trees and reducing the vigor of older trees. Gophers may also damage drip irrigation lines. Mounds of soil associated with burrows can interfere with mowing or other orchard management activities.

An adult pocket gopher is 6- to 8-inches long and has a stout yellowish or grayish brown body, a short tail, and small ears and eyes. External fur-lined cheek pouches open outside the lips on each side of the mouth, and are used for carrying food. Pocket gophers are rarely seen aboveground, spending most of their time in a system of tunnels they construct 6 to 18 inches below the surface. Gophers are antisocial and solitary except during breeding and when the young are being raised. A single burrow system can cover several hundred square feet and consists of main tunnels with lateral branches used for feeding or to push

excavated soil to the surface. The fan-shaped mounds that are formed over the openings of lateral tunnels are the most obvious signs of gopher infestation. Pocket gophers plug burrow openings with soil so that the tunnel system is completely closed and the temperature and humidity in the burrow remain fairly constant. Gophers feed primarily on the roots of herbaceous plants, but may also dig lateral tunnels to feed on aboveground vegetation within a few inches of the tunnel opening. Once they have finished feeding, they plug these holes with soil.

In orchards and other irrigated lands, gophers may breed throughout the year with a breeding peak in late winter or early spring. Females may produce 3 litters per year with litters averaging about 5 young. When the young are mature, they leave the burrow to find a favorable location to establish their own burrow. Some may take over burrow systems that recently have been vacated. Buildup of gopher populations in an orchard is favored by the presence of cover crops, especially those that contain clovers that are a favored food source. When cover crops dry up or are removed, gophers may be forced to feed on the bark of tree roots and crowns. Cover crops also make detection of pocket gophers difficult.

Management guidelines

Pocket gophers are active through the year and if uncontrolled and food is plentiful, a population can increase rapidly. Damage to orchard trees is almost always below ground and usually is not evident until trees show signs of stress such as yellow or brown colored leaves. It is therefore important to control gophers when activity is first detected. The typical fan-shaped mounds are a good indicator of gopher presence. These mounds are produced in greatest numbers in the spring and fall when the soil is moist. Monitor for activity monthly in the spring and pay close attention to orchard perimeters where gophers may move in from adjacent infested areas. Gophers patrol their burrows on a regular basis, so their activity can be determined by “flattening” the mound, and then look for new activity in one or two days. Monitor orchards with ground covers carefully. With persistent effort, pocket

gophers can be controlled and even eliminated from an orchard. The most effective control methods are baiting, trapping and fumigation.

Habitat modification. Pocket gophers should be controlled prior to planting an orchard. The land can be deep-ripped so that most burrow systems are destroyed and many gophers are killed. Poison baits or traps can then be used to eliminate any remaining gophers. In established orchards, clean cultivation of the orchard floor reduces the food supply and may destroy some burrows, making the orchard less favorable for gophers. Clean cultivation also makes it easier to monitor gopher activity. Flood-irrigated orchards may have fewer problems than orchards that are drip- or sprinkler-irrigated. Gophers should be controlled in adjacent areas to prevent orchards from being invaded.

Trapping. Traps are effective in controlling small infestations of pocket gophers but are labor-intensive. Either pincer or box-type traps may be used. To place traps, you need to use a probe near a fresh mound to locate the main tunnel. The main tunnel is usually 8 to 12 inches below the surface, and the probe will drop quickly about 2 inches when you find it. Two traps, one facing each direction should be set. Wire the pair of traps to a stake and cover the hole. If the trap is not visited within 48 hours, move it to a new location.

Fumigants. Most fumigants are not effective against pocket gophers. In extensive burrow systems, it is difficult to maintain a lethal concentration of the fumigant in the system, and pocket gophers quickly seal off their system when they detect poison gas. However, aluminum phosphide can be effective. It should be used in late winter or early spring when soil moisture is high and prior to the gophers' breeding period. Follow label instructions and follow all the safety precautions given. To use aluminum phosphide, probe to find the main tunnel, then drop 2 to 4 tablets into the burrow and seal off the hole. As with any control method, you need to keep monitoring for signs of renewed gopher activity. Re-treat the area if you find any new mounds.

Poison baits. Baits may be applied by hand or with a mechanical applicator.

Strychnine and zinc phosphide (single-feed poisons) or anticoagulants (diphacinone and chlorophacinone) are currently registered for pocket gopher control. Follow bait label directions for application methods and amounts carefully.

With hand baiting, locate the main tunnel of the burrow system by probing near fresh activity. Then enlarge the probe opening and place a small amount of bait in the burrow. This should be repeated 2 or 3 times for each burrow system. Hand-operated mechanical bait dispensers have a bait reservoir and bait release mechanism and permit probing and bait dispensing in one operation. These devices are substantially faster than hand baiting. Mechanical bait applicators or burrow builders are tractor drawn and are an efficient way of controlling gophers over large areas. The device constructs an artificial burrow beneath the soil and deposits poison grain bait (strychnine and zinc phosphide only) within it at preset intervals and quantities. The artificial burrows should be made to intercept some of the pocket gophers natural burrows so that gophers will explore them and consume the bait. When using the mechanical burrow builder, periodically check to see that the artificial burrows are being formed properly. Soil moisture must be right to produce a well-formed, smooth, artificial burrow. After you've used a mechanical burrow builder, follow-up with a program of trapping or hand baiting to maintain control. Burrow builders should not be used in areas with a small or localized gopher population. Otherwise, creating burrows throughout the orchard creates a new tunnel system for easier infestation.

MEADOW VOLES (*Microtus californicus*)

Meadow voles (meadow mice or field mice) can cause serious damage to trees by feeding on the bark at the base of the tree. Small trees are most susceptible to being completely girdled or killed by voles, but even large trees can suffer significant damage. Vole populations often develop in areas where grass or other permanent vegetative cover remains year-round. Voles are most likely to cause problems in orchards with year-round cover

crops or where vegetation is allowed to build up around the bases of trees.

Meadow voles are small stocky rodents with small ears and eyes, short legs and short tails. Their coarse fur is usually dark brown or grayish brown. Adults are larger than a house mouse but smaller than a rat. They are active year-round and during the day and night. Females produce several litters per year with peaks in reproduction in spring and fall. Because voles mature rapidly and can produce many litters annually, their populations can increase rapidly. Populations cycle, peaking every 4 to 7 years and then rapidly declining. Vole infestations are indicated by the presence of narrow runways in grass or other ground cover and numerous shallow burrows with openings about 1.5 inches in diameter. Voles seldom travel far from their burrows and runways.

Management guidelines

In mid-winter, begin to monitor monthly for active runways in cover crops or weedy areas in and around orchards. Look for fresh vole droppings and short pieces of clipped vegetation in runways. Look for burrow openings around the bases of trees. Where burrow openings are present, check for tree damage. Characteristic damage is complete or partial girdling of tree trunks from just below the surface to as high as they can reach on the trunk (usually not more than 5 inches). In some situations voles climb higher on young trees. Young trees are most susceptible to being damaged by voles.

Vegetation management and the proper use of trunk guards on young trees are usually the most effective means of controlling meadow voles. In some situations, it may be necessary to use poison bait to bring a population under control.

Habitat modification. Vegetative cover provides food and cover so habitat modification is an effective method of meadow vole control. Because voles do not travel more than a few feet from their burrows to obtain food, any significant destruction of their food and cover causes them to die or abandon their burrows. Eliminating vegetative cover in adjacent areas or providing a 30- to 40- foot

wide buffer between it reduces the number of voles invading the orchard. Clean cultivation or weed control within 3 feet of the trunks of trees makes the habitat unsuitable for voles. If you maintain ground cover in the row middles, keep it mowed fairly short.

Trunk guards. Cylindrical wire or plastic trunk guards can protect young trees from voles. Trunk guards must extend at least 6 inches below the soil surface but even then the voles may burrow beneath them. Meadow voles rarely climb over guards. Trunk guards may increase problems by allowing voles to work beneath them where damage goes undetected.

Poison baits. Poison grain baits are very effective in reducing meadow vole populations but application within an orchard is restricted to during the nonbearing season. For most effective control, apply bait in the voles' runways where most feeding occurs. Spot bait or broadcast bait over the entire infested area. Application rates vary depending on the estimated density of voles and the type of toxicant. Both zinc phosphide and anticoagulants are registered for meadow vole control. Consult the product label for application rates and methods.

BLACK-TAILED JACKRABBIT (*Lepus californicus*)

Jackrabbit damage to nut orchards is almost always limited to orchards fewer than 4 years old. Jackrabbits may debark trees and clip off branches within their reach to eat buds and young foliage. Trunk girdling is usually higher on the trunk than damage caused by meadow voles. The damage appears as vertical lines or groves in the bark. Jackrabbits also may gnaw on drip irrigation lines.

A jackrabbit is actually a hare and is about the size of a large house cat. It has very long ears, short front legs, and long hind legs. They live in the more open areas of the Central Valley, coastal valleys, and foothills. They make depressions underneath bushes or other vegetation where they remain secluded during the day. Young are born fully haired, with open eyes, and become active within a few days. Jackrabbits usually breed, bear young and live outside orchards. They are active all

year but damage trees primarily in winter and early spring when other sources of food are limiting.

Management guidelines

Inspect young trees periodically for damage. If you find damage, look for droppings and tracks that indicate jackrabbits are the cause. Monitor the orchard perimeter in the early morning, late evening or at night using a spotlight to look for jackrabbits, and estimate the number of animals involved. Jackrabbit control in nut orchards includes exclusion, repellents, shooting and poisoning. The choice of method should depend on the urgency of the problem and the situation. Manage problems before severe damage occurs.

Habitat modification. Jackrabbits usually invade orchards from adjacent fields and unless the land is under the grower's direct management, modification of the outlying habitat is usually impractical. The removal of orchard cover crops and weeds that serve as jackrabbit food may reduce the number that visit the orchard. Removing vegetative cover may temporarily increase tree damage because trees are all that are left for jackrabbits to feed on. In any case, cover removal makes jackrabbit detection easier. Habitat modification to reduce damage within the orchard is rarely practical.

Exclusion. Where jackrabbits are a constant and continuing threat to young trees, fencing the entire orchard may be the best management approach. To make an effective barrier, build a fence using 48-inch wide, 1.5-inch gauge woven wire or poultry netting. Bury the mesh 6-inches deep with a 6-inch lip turned out at a 90-degree angle at the bottom to prevent jackrabbits from burrowing underneath. Unless you are already building a fence to exclude deer, the cost of a rabbit fence may be prohibitive for a large orchard when you only need it for a few years.

Individual tree guards may provide a cheaper alternative and offers a practical way to prevent damage to replants in an established orchard. Guards may be solid or made of net or mesh materials such as metal, hardware cloth, plastic, or sturdy fibrous sheets. Make the cylinders at least 2.5-feet high to prevent

jackrabbits from reaching foliage and limbs by standing on their back legs.

Repellents. Chemical repellents may provide temporary relief from jackrabbits. Spray or paint the repellent you choose on the trunks or foliage, following label instructions. Repeat applications may be necessary to renew repellency lost through rain or sprinkler irrigation or to protect new growth.

Shooting. Under certain conditions shooting can be an effective control. Patrol systematically in the early morning or late evening.

Poison baits. Poison baits offer a practical and economical way to control large numbers of jackrabbits in large areas. Only anticoagulant poisons are registered for use against jackrabbits. Baits are placed in open self-dispensing feeders, shallow trays or nursery flats. Position the feeders in areas frequented by jackrabbits such as trails and resting and feeding areas. If jackrabbits fail to feed after a few days, move feeders to where bait is readily accepted. Keep bait available until all feeding ceases, which may be from 1 to 4 weeks.

Place poisoned bait where livestock and humans – especially children – cannot access it. Be aware of all wildlife in the area (such as doves or pheasants) and take precautions to protect them from feeding on the bait. Protect diurnal seed-eating birds by covering or removing the bait during daylight hours.

Birds

Bird management in orchards can be challenging, as bird populations are very mobile, migratory birds are federally protected, few or no poison baits are available, and they are adaptable to existing control measures. The four-point management program for vertebrate pests as outlined on page one of this chapter especially applies to bird control. Pistachios are a more recent crop to the San Joaquin Valley and if acreage increases, so will the bird population that feeds on the crop. It will be critical to correctly identify the specific bird attacking an orchard so as to determine the best control methods. Two of the most common

bird species that attack nut crops in the Valley are crows and blue jays. Other bird species may be attracted to pistachios also.

With any bird species, it is critical to identify the type of bird, and thus its legal status and if a depredation permit is required. No permit or depredation order is required (CDFG Code section 3801) for English house sparrows, and Starlings (except if it is trapped). No permit is required for crow, magpie, grackle, and a few other blackbirds (except if they are trapped) as these birds are covered by a general depredation order.

A depredation permit is required from US Fish and Wildlife Service for all birds covered under the Migratory Bird Treaty Act. The Agricultural Commissioner's office can issue a Migratory Bird Permit for the following birds: horned lark, house finch, golden and white crowned sparrow, and when trapping any bird. When in doubt, contact the Agricultural Commissioner's office for assistance.

AMERICAN CROW (*Corvus brachyrhynchos*)

Crows are established in both the urban and rural areas of California. They are quite intelligent birds and will easily adapt to one control measure and human activities. During summer months, small groups of crows will band together into larger flocks. Crows will fly up to 20 miles from their roost to feeding areas. They have a wide host range, from nut crops and stone fruits to vegetables and even small animals.

Crows may be taken when damaging or the potential exists they may damage ornamental or shade trees, agricultural crops, livestock, or wildlife, or when populations are such that it constitutes a health hazard or other nuisance.

Management Guidelines

Early morning is a desired time to monitor for crow feeding, as it is common for a few scout birds to identify food sources and then alert the flock. If scout birds can be deterred from an orchard, the flock will choose another food source. With almonds, crows will start feeding in early summer before, during and after hull-split occurs. Crows will knock several nuts to the ground and then feed on them.

Control measures include the use of shooting, frightening devices, biosonics, and reflective tape. Shooting can be very effective as crows associate the noise and a person/weapon with danger, and will leave quickly. Unfortunately, they also learn when it is safe to return. It is best to use shooting against the early scout crows, and visit the orchard during the day to reinforce the danger to the crows.

Frightening devices such as shell crackers, bird bombs, and propane exploders, can also be effective temporarily. After a time period, the birds will not be frightened only by the noise, so an additional control measure should be used with the frightening device. Biosonics uses recorded distress calls to control crows and other birds. Initially, the crows are attracted to the sound of a crow in distress as they are social animals. However, it is thought they will disperse after the “distressed bird” can not be located.

Again, this device works best when used with another control method such as shooting. Reflective tape has been used, mostly in small areas with grapes and stone fruit. It is thought that the reflected light and movement will frighten birds. Crows are intelligent enough to adapt to it after a time period, so additional control methods should be used.

SCRUB JAY

(Aphelocoma coerulescens)

Scrub Jays are found near and within the foothills, and in urban areas. They do not migrate or flock like crows, and feed individually. Jays have a wide host range, feeding on nut crops, seeds and grains, and soft orchard fruit such as figs and cherries. Their feeding habits consist of flying back and forth several times a day from a feeding source to a food storage area. Thus, a manager may not

notice the damage as the food source is removed from the orchard. Blue Jays are not deterred by the sighting of humans and will continue to fly into the orchard during the daytime.

For control purposes, Jays are classified as migratory nongame birds according to federal regulations. They can only be controlled under a permit from the USFWS. Shooting is a possible control measure but is very labor intensive. Frightening devices are relatively ineffective. Trapping with rat traps using nuts as bait can be effective for a small number of birds.

In summary, managing vertebrate pests in pistachio can be challenging. Successful efforts will use the four point program that was given at the beginning of the chapter, and the services of the local Agricultural Commissioner’s and Farm Advisor’s offices. Many areas of the southern SJV are impacted by endangered species and must consider control methods to avoid damaging those animals. Bird control may require a permit depending on the species, so seek help if needed. Quality and frequent observations are needed so as to identify smaller populations of vertebrate pests before populations become too large and damaging.

Helpful websites

Endangered Species

<http://www.cdpr.ca.gov/docs/es/index/htm>

Rodents

<http://wfc.ucdavis.edu/www/Faculty/Desley/programs.htm>

<http://www.ipm.ucdavis.edu/PMG/PESTNOTES>