Pest Factsheets for Structures

The Argentine Ant (*Linepithema humile*)

The goal of ant management is to prevent the ants from becoming a nuisance to people working in a building. It is impossible to eliminate ants outdoors.

Biology and Life Cycle

Argentine Ant Colonies

- Colonies are linked by tunnels; workers and queens move freely from nest to nest; each colony has many queens that live in harmony. Perhaps it is more accurate to think of Argentine ants as living in huge colonies over large areas of land with 1000's of entrances.
- Because of these huge "supercolonies," the concept of finding and killing "the" nest is not always valid.
- The energy that most other ant species use in defending the colony is used instead for reproduction.

Feeding Behavior

- Worker ants (all females) feed and care for the young, but also feed each other and the queens. This is the way baits are spread throughout a colony
- On average at any one time, a very small proportion of a colony is out foraging, so killing these ants with a pesticide spray will not eliminate the colony.
- Adult ants can swallow only liquids, but they collect solid food to feed to the young, which digest the solid food and regurgitate liquids for the adults to feed on.
- Argentine ants feed on just about anything, from dead animals (including insects) to all kinds of human and pet food, to vomit, feces, and even human sputum.
- A favorite food is the honeydew produced by insects like aphids, mealybugs, scales, and whiteflies. Argentine ants protect these insects from their natural enemies.
    - Plants that harbor these pests and are growing near a structure will attract ants to the building.
    - If ants are excluded from plants with honeydew-producing insects, natural enemies will often eliminate the plant pests
    - Removing these plants will greatly help with ant management.
- Liquid baits that use sugar as an attractant are a very effective method for managing ants in the landscape because adult Argentine ants will feed on liquid sugary baits all year around.
- Baits with a protein attractant may only be useful when the colony is expanding and adult ants are feeding a large number of young (late winter/early spring).
- For details on baiting, see Baiting Tips for Ants, below.

Nesting sites

- Argentine ants move their colonies within hours to take advantage of a food source or to escape inhospitable conditions. In winter they look for places that are warmer and drier, and in summer they seek cooler and moister sites.
- Their shallow nests are primarily in the ground, and they are not marked by significant soil mounds. They prefer moist, well-drained soil.

  Outside, some places to find nests are

  - near irrigated turf and other landscaping,
  - in planters and potted plants,
  - in the ground under trees, especially trees with honeydew producing insects,

- near faucets and irrigation valves,
- under sidewalks, stones, and patios,
- in soil or decomposing leaves accumulated in the corners of a roof.

Inside, nests can be found

- in potted plants,
- inside cupboards and drawers,
- under tiles on kitchen counters, behind wall tile and brick veneer,
- in the insulation in dishwashers, washing machines, and refrigerators,
- in wall voids, in moist basements, and in vehicles,
- in unusual places including inside metal curtain rods and inside bathroom sinks in the void that allows overflowing water to escape down the drain.

Seasonal Colony Development and Feeding Behavior

Winter (November thru January): many adults die, colony essentially stops breeding and ant population is small.

Liquid sugar baits are accepted better than other baits, and less is needed because of the low population.

Late winter/early spring: breeding increases and adult workers seek honeydew producing insects (aphids, scales) and protein to feed developing larvae.

Both solid protein and liquid sugar baits are accepted.

Summer: honeydew producers decline (beginning in July/August) and ants start to look elsewhere for food, often in nearby buildings. In early summer, solid protein baits are still accepted. Liquid sugar baits are readily accepted all summer.

Fall: the ant population has reached its maximum, honeydew food sources have declined and foraging pressure results in more nearby building invasions. Liquid sugar baits are readily accepted.

Argentine ants accessing a commercial bait station

Ant Management

To limit availability of food and water

- Discuss the importance of not feeding wildlife, including feral cats, with those who may want to do so, or implement *and* enforce a policy prohibiting the feeding of feral animals. Pet food, both wet and dry, is very attractive to ants.
- Discuss the importance of sanitation in relation to ant invasions with the appropriate people.
- Thoroughly rinse recyclables that will be stored. It is preferable to store them outdoors if at all possible. If they must be stored indoors, special care must be taken during times of ant invasions to make sure the recyclables are clean and dry.
- Remove garbage containing food wastes from the building before nightfall or, if this is not possible and rats are not a problem, tie a knot in the plastic liner.
- Store garbage, especially garbage containing food wastes, in garbage cans or dumpsters outside the building. These receptacles must have tight-fitting lids that are kept closed.
- Thoroughly clean food preparation and eating areas daily.
- Regularly steam clean large appliances in commercial kitchens.

- Store food in the refrigerator, freezer, or cooler, or in ant-proof containers such Tupperware or screw-top jars (screw-top jars are not ant-proof unless the lid has a rubber gasket).
- Discourage people from storing food in desks or lockers. Insist that food in personal spaces is stored in ant-proof containers.
- Use plastic liners in wastebaskets and garbage cans.
- If food garbage is a continual problem, you can set small garbage cans on ant-proof stands such as the Antser® (platform with soapy water moat underneath).
- Treat honeydew-producing insects on vegetation near the structure by washing with plain water or with insecticidal soap and water. Aphids, scales, mealybugs, whiteflies, and psyllids are examples of honeydew-producing insects.
- Or, remove and/or replace plants that regularly have large populations of honeydew-producing insects.

  Some plants that are highly attractive to honeydew-producing insects are:

  - Citrus
  - Bottlebrush bush
  - Chinese elm
  - Conifers (pines, redwoods)
  - Eugenia
  - Figs
  - London Plane tree (sycamore)
  - Pittosporum
  - Roses
  - Tulip magnolia

To limit availability of shelter/habitat

- Reduce excessive moisture and irrigation leaks near structures.
- Reduce areas covered with black plastic and decorative rock, especially next to the foundation.
- Reduce or eliminate bark mulch within at least 6" of a building.
- Cut back or eliminate ground covers next to the structure. This will also allow better access to the foundation to observe ant activity.
- Manage potted plants with ant infestations:
  - Move to the outdoors any potted plant with an ant nest, water the plant, and then set the pot in a container of water. Provide a bridge (a pencil or stick) from the potted plant to the edge of the water container, and wait for the ants to leave the pot.
  - Place potted plants on ant-proof stands such as the Antser® (platform with soapy water moat underneath).
  - Place potted plants in a moat of soapy water: place the pot on a small overturned saucer inside a larger saucer; add water to the larger saucer along with several drops of liquid detergent. The water should come to just below the overturned saucer so the plant is not sitting in soapy water.

To limit access to the structure

- Trim branches that touch the building to prevent ants from using them as highways into the building.
- Whenever you find an ant trail inside a structure, try to find the spot where they are getting into the room. If you routinely caulk these little entrance points, you will eventually close up most of the easy entrances into the building without having to caulk every square inch. Over time you can also close up holes around wires and pipes that go into the building.

- Insert foam insulator sheets behind electrical face plates to seal off ant access and reduce infiltration of hot or cold air.
- Blow low-toxic insecticidal dusts, such as silica gel or diatomaceous earth, into cracks and wall voids

Ways to remove ants from an area

- Vacuum up ant trails.
- Pick up ants with a sticky lint roller
- Clean up ant trails with soap and water

Chemical Controls (Insecticides)

Baiting is the preferred chemical control method for Argentine ants.

Why use baits?

- Baiting may take longer to kill ants, but will have a much greater impact on the colony as a whole because ants take bait back to feed to their nest mates. Sprays kill only a small fraction of the ants that are out foraging, and the foragers only represent a very small fraction of the total colony.
- Spraying pesticides around the outside of a structure can lead to run-off that contaminates creeks, rivers, and the Bay. This is especially true if pesticides are sprayed on impervious surfaces. Rain or irrigation can move the pesticide residues into storm drains that drain to creeks and the Bay.

Note: Do not spray pesticide on or near ant bait stations because the pesticide will repel the ants.

Baiting Tips for Ants

- Outdoors, baiting can be used to draw ants out of a structure or to prevent them from going in.
- Inside, baits should be left only long enough to stop the trail of ants entering the building. At that point the bait stations should be removed in order not to attract more ants into the building.
- Liquid baits that use sugar as an attractant are a very effective method for managing ants in the landscape because adult foraging ants will feed on liquid sugary baits all year around. Use liquid baits that contain boric acid (orthoboric acid) or borax (sodium tetraborate decahydrate) as the poison. It is preferable to use baits that contain only 1% to 2% of either boric acid or borax because the lower percentage allows more foraging ants to take bait back to the nest to feed to nest mates, instead of succumbing to the poison on the way home. Place bait stations along ant trails, at the base of the affected plant, or near the nest, if you can locate it. (Note that there may be a number of nests.)
- You can also experiment with commercially available bait stations with active ingredients such as indoxacarb or hydramethylnon. Ants can change their food preferences frequently, so having several different kinds of bait stations on hand can be useful.
- If ant populations are high, or invasions persist and placing a bait station at the exterior perimeter of the building is not feasible, an insecticidal dust, such as diatomaceous earth, can be applied to cracks, crevices, wall voids, electrical boxes, conduits, etc. If necessary, insecticidal dusts can be used to spot-treat under the edge of carpets and behind baseboards. Step up sanitation measures and seal all cracks and holes where ants are entering.

Bed bugs

Bed bugs should be handled by a professional, but municipal staff should be aware of their existence.

Municipalities need to have a plan in place for handling a bed bug infestation in municipal buildings and a plan for handling bed bug complaints from citizens.

Worldwide, bed bug populations are on the rise, and the reasons for this resurgence are unclear. Many areas of the U.S. are severely affected, and as bed bugs become more numerous, the threat to public facilities becomes greater. Bed bugs are small and are easily moved from one place to another on furniture, luggage, backpacks, purses, and other human belongings. Bed bugs have infested buses, taxis, trains, police cars, fire stations, theaters, hospitals, libraries, and public waiting rooms, not to mention homes, apartment buildings, and five star hotels.

Bed bugs have not been found to transmit diseases to humans, but their presence, their bites, and the stigma attached to having bed bugs can take a serious psychological toll. Bed bugs can be very expensive to treat, and lawsuits about who is responsible for that treatment are raging across the country.

Bed bugs are not caused by being poor, "being dirty", or by keeping a "dirty" home; however, the more clutter in dwelling, the harder it can be to find and treat bed bugs. Bed bugs are a "pest of exposure," which means that if you are exposed to bed bugs, you run the risk of taking them home (or to the office). It is the responsibility of municipal and county staff to help dispel the stigma attached to bed bugs and promote awareness by educating the general public, since scientists agree that the problem is only going to get worse. Municipalities will most likely be called on to help citizens whose homes are infested but whose landlords refuse to provide treatment.

For more information on bed bug identification, biology, and treatment, see Contra Costa County's IPM website:

www.cchealth.org/ipm

Cockroaches

Biology and Life Cycle

There are a number of different cockroach species that are considered pests. In Contra Costa County, the species that are most likely to be found in buildings are the German cockroach (*Blatella germanica*) and the Oriental cockroach (*Blatta orientalis*).

- The German cockroach is the most common indoor species and is typically found in warm, humid environments near food and water, most often in kitchens and bathrooms.
- The oriental cockroach primarily lives outdoors in dark, damp environments, such as water meter boxes and decaying organic matter, and invades the ground floors of buildings only periodically.
- The American cockroach (*Periplaneta americana*) prefers warm, humid environments and lives in places like sewers, steam tunnels, and masonry storm drains. It may occasionally invade the ground floor of a building because of a break in a sewer pipe, or for other reasons.

Food preferences

Cockroaches feed on a wide variety of substances found in buildings that humans inhabit:

- Starch, sweets, grease, and meat products
- Cheese, beer, leather, glue
- Hair, flakes of dried skin, dead animals, and plant material

Behavior that impacts management

- Cockroaches are mainly active at night, but they may be seen in the day, especially in a large infestation.
- During the day, cockroaches primarily hide in cracks and crevices.
- Most cockroaches originated in tropical or sub-tropical environments and therefore prefer warm, moist habitats.
- Immature German cockroaches will feed on cockroach droppings in their harborage, which makes them susceptible to secondary poisoning from baits used to control cockroaches in the vicinity.

Life cycle

- Cockroaches mature through three stages: egg to nymph to adult. The nymphs resemble the adults but are smaller, do not have wings or wing pads, and are not sexually mature.
- Mated adult females produce an egg case that is called an ootheca, which contains two rows of eggs.
- The amount of time it takes for a cockroach to go from egg to adult varies among the species and varies within species depending on the temperature, humidity, the quality of their diet, and other environmental factors.

For photographs, drawings, and more detailed descriptions of each pest cockroach species, see http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7467.html

Cockroach Management

To limit availability of food and water

- Discuss the importance of sanitation in relation to cockroaches with the appropriate people.
- Food preparation and eating areas should be thoroughly cleaned daily. Drain sinks and remove all food debris. Do not leave food prep and eating areas wet or dirty overnight.
- Store food in the refrigerator, freezer, or cooler, or in roach-proof containers such as Tupperware or screw-top jars (screw-top jars are not roach-proof unless the lid has a rubber gasket).
- Discourage people from storing food in desks or lockers. Insist that food in personal spaces is stored in roach-proof containers.
- Limit areas where food can be eaten and make sure to clean those areas after holiday, birthday, or other kinds of parties. Regularly steam clean large appliances in commercial kitchens.
- Periodically give all food preparation areas a deep cleaning focusing on drains, vents, deep fat fryers, ovens, and stoves. Steam clean drains and infested appliances. Use a vacuum cleaner to capture cockroaches driven out by the steam.
- Use plastic liners in waste receptacles.
- Thoroughly rinse recyclables that will be stored. It is preferable to store them outdoors, if at all possible. If they must be stored indoors, special care must be taken to make sure the recyclables are clean and dry.
- Remove garbage containing food wastes from the building before nightfall or, if this is not possible and rats are not a problem, tie a knot in the plastic liner.
- Store garbage, especially garbage containing food wastes, in garbage cans or dumpsters outside the building. These receptacles must have tight-fitting lids that are kept closed.
- Keep waste receptacles and dumpsters clean.
- Fix all leaking faucets and pipes.
- Drain and/or ventilate moist areas.
- Keep food preparation areas dry when not in use, especially overnight.

To limit availability of shelter/harborage

- As much as possible, eliminate clutter
- Break down corrugated cardboard boxes and store them away from vending machines and food storage and preparation areas, preferably in a cool or cold spot. The corrugations provide perfect habitat for cockroaches. Cockroaches routinely hitchhike into buildings in cardboard boxes.
- Keep storage closets and other storage areas well-organized and clean.
- Cockroaches hide in cracks and crevices. Caulk or otherwise seal cracks and crevices, first in areas where cockroach populations are highest. As time and money allow, work on other areas that provide good cockroach harborage.
- If gaps cannot be sealed, they can sometimes be widened to make them unattractive to cockroaches. For instance, the space between free-standing shelves and adjacent walls can be widened by moving the shelves one inch away from the walls.

To limit access to the structure

- Sealing gaps in walls around plumbing and electrical conduit is very important to keep cockroaches from moving along these "roach highways" from one room to another.
- Foam gaskets inserted behind electrical face plates will seal off cockroach access and reduce infiltration of hot or cold air.
- Screening and weather-stripping windows and doors can prevent Oriental cockroaches from entering the building, and German Cockroaches from infesting different locations in the same building.

- Filling deep cracks and crevices around the foundation of the structure will reduce Oriental cockroach harborage areas and their access into the building.

Removing and trapping cockroaches

- Vacuuming has an immediate impact on the cockroach population and reduces the level of allergens produced by cockroaches.
- Sticky insect monitors and "roach motels" are very effective in capturing cockroaches, but they usually cannot solve a cockroach problem by themselves. They are excellent tools for monitoring for cockroach problems.

Chemical Controls

- **Silica gel and diatomaceous earth** work by adsorbing the outer waxy coating on an insect's body which allows water to leak out of the insect and causes death by dehydration. These dusts can be used in wall voids, cracks and crevices, and under appliances.
- **Insect growth regulators** (IGRs) are biorational insecticides that mimic hormones occurring naturally in cockroaches and other insects. They help to manage cockroaches by inhibiting reproduction and preventing young cockroaches from growing into adults. They also work synergistically with insecticidal baits as they increase the cockroaches' appetite and bait consumption. Examples are Gentrol® Point Source and Gentrol® IGR Concentrate.
- **Cockroach baits** work best where sanitation is good so that the bait is not competing with freely available cockroach food. Using baits reduces the amount of pesticide in the environment because small amounts of bait, containing minute amounts of pesticide, are placed only in areas where cockroaches are likely to feed.

Filth-Breeding Flies

Biology and Life Cycle

There are a number of fly species that breed in animal manure of all kinds, animal carcasses, food garbage, and other decaying organic matter. These include house flies, little house flies, flesh flies, and blow flies (see http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7457.html for more detail about their biology).

Vinegar flies (fruit flies) are most common in decaying fruits and vegetables, but can breed in drains and in wet mops (see http://ohioline.osu.edu/hyg-fact/2000/2109.html and http://ento.psu.edu/extension/factsheets/vinegar-flies for more information).

Phorid flies also breed in decaying organic matter, both animal and vegetable. Broken drains and broken garbage disposals can produce huge numbers of phorid flies (see http://www.clemson.edu/cafls/departments/esps/factsheets/household_structural/humpedback_flies_hs24.html and http://www.pctonline.com/pct0613-phorids-control-inspection.aspx for more information about biology and control).

Drain (moth) flies breed in decaying organic matter, especially in and around drains and sewers (see http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn74167.html for more detail about their biology).

Flies mature from egg to larva (maggot) to pupa (or cocoon) to adult. Although adult flies may seem to be the most bothersome stage, it is important to concentrate on where the maggots are living to eliminate a problem. Sanitation and exclusion are the most important aspects of fly management.

House Fly Management

The keys to managing filth-breeding flies are sanitation and exclusion.

To limit availability of food

- Discuss the importance of not feeding wildlife, including feral cats, with those who may want to do so. Wet pet food and dry pet food moistened by irrigation, rain, or spilled water that is intended for feral animals provide food for adult flies and for maggots.
- Pet droppings and animal manure will also breed flies.
- Flies can breed in piles of grass clippings when temperature and moisture content are right.
- Discuss the importance of sanitation in relation to flies with the appropriate people.
- Drain food wastes before placing in a plastic bag for disposal in a waste receptacle or dumpster.
- Use plastic liners in all waste receptacles that might collect food garbage; seal the plastic liners before placing in outside dumpsters or garbage cans.
- Remove garbage containing food wastes from the building before nightfall or if rats are not a problem, tie a knot in the plastic liner.
- Store garbage in closed, rodent-proof dumpsters or garbage cans outside the building and away from doors.
- Keep waste receptacles and dumpsters clean; use a high-pressure stream of water or a brush and soapy water. Rinsing with a mild solution of borax or baking soda and water will eliminate odors.
- Flies can breed in soil soaked with water used to clean garbage cans and dumpsters. Check these areas regularly and scrape up any maggots along with the soil, and dispose of the material in a sealed plastic bag.
- Promptly fix drains that allow food waste to accumulate under sinks or floors or electric garbage disposal units that leak. This food waste will attract many different kinds of flies, and once they start breeding in the food waste, you will have a difficult time figuring out where they are coming from.

- If drains or garbage disposal units do leak food waste, remove all the food waste and clean the area *thoroughly*.
- Store food in the refrigerator, freezer, or cooler, or in insect-proof containers such as Tupperware or screw-top jars (screw-top jars are not insect-proof unless the lid has a rubber gasket).
- Limit areas where food can be eaten and make sure to clean those areas after holiday, birthday, or other kinds of parties.
- Outdoors, pick up and remove fallen fruit as soon as possible.
- Remove pet feces as soon as possible, place in a sealed plastic bag, and then into a waste receptacle or dumpster.
- Maintain compost piles properly, otherwise they can produce large numbers of flies.

To limit attractive odors:

Flies are strongly attracted to odors that come from materials that might provide them food or a place to lay eggs, and they can detect these odors over long distances.

- Place dumpsters, garbage cans, and recycling containers away from outside doors to the building.
- Keep dumpsters and garbage cans clean to eliminate odors (see above)
- Empty dumpsters and garbage frequently, at least once a week; consider twice-weekly garbage pickup during warm weather if the fly problem is severe.
- Store food waste in sealed plastic bags.
- Remove pet feces as soon as possible, place them in a sealed plastic bag, and then into a waste receptacle or dumpster.
- Decomposing food left for feral cats can provide many attractive smells.
- The brown- to cream-colored fly specks found on walls and other surfaces where house flies have been resting have a strong fly-attracting odor. They should be frequently cleaned off of surfaces with an odor eliminating cleaner (a mild solution of borax or baking soda and water is effective).

To limit access to the structure

- Tightly screen all windows and doors.
- Weather-strip all windows and doors.
- Seal gaps around windows and doors.
- Screen air intake and exhaust vents.
- Equip doors with self-closing devices to prevent them from being left open inadvertently.
- Install air curtains on doors that must remain open and cannot be screened. The air stream must have a velocity of 1,600 feet per second to be effective.

Trapping flies

- **Indoors**
  - Sticky fly tape and/or fly swatters can eliminate a small number of flies indoors; however, fly paper may be considered unsightly.
  - Ultra-violet light traps can be effective indoors as a supplement to other measures. They must be used in areas where they are not competing with natural light. Follow the manufacturer's instructions carefully.
- **Outside,** cone-type fly traps with strong-smelling bait can be extremely effective in helping to control serious fly populations.

Note that *Fannia* spp. ("little house flies") are not attracted to the same baits or traps as the house fly. *Fannia* is very difficult to distinguish from the house fly. In the Bay Area, these flies are often associated with dog droppings early in the year, and male *Fannia* can be seen circling in a room, outside in the

shade, or under the protection of a porch. They circle for long periods of time and seldom rest. This phenomenon is generally a short lived nuisance in early spring. Females rarely enter buildings. A fan directed at circling *Fannia* will make the area less attractive to them because strong air currents disperse them.

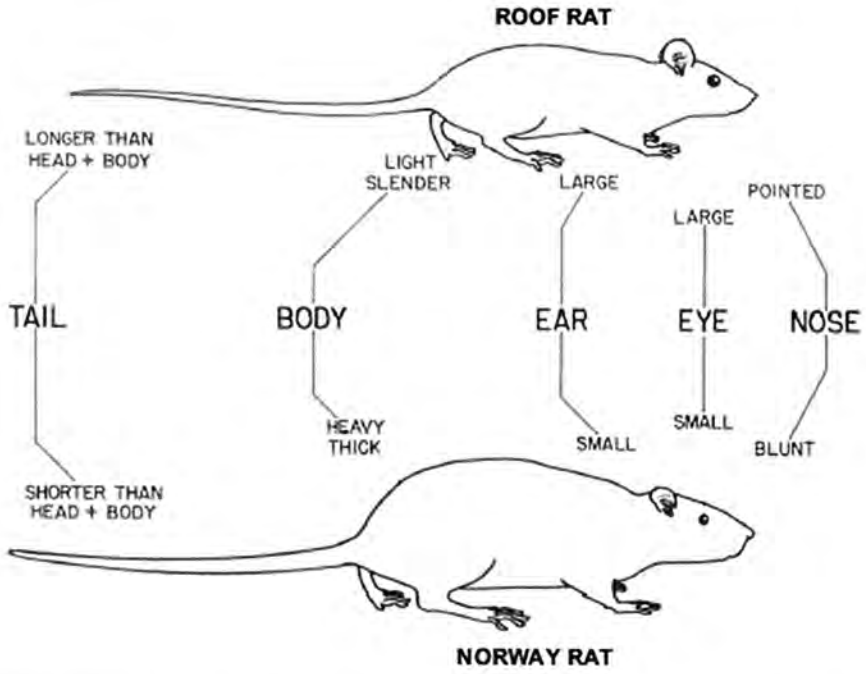
Chemical Controls

Chemical controls are not effective and are not recommended for fly control.

Mice, Roof and Norway Rats

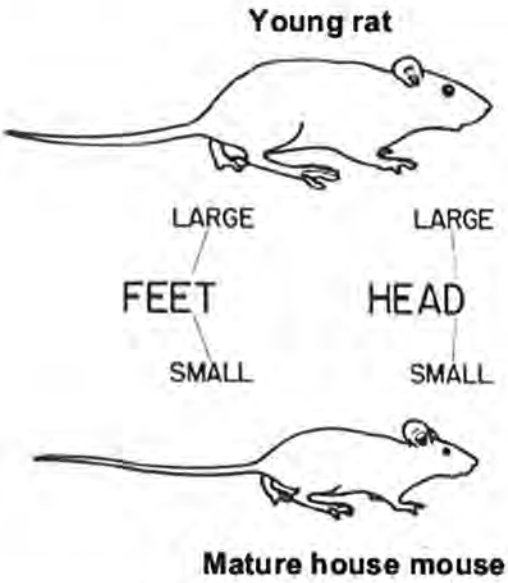
Identification

Key characteristics of the Norway (*Rattus norvegicus*) **and roof rat** (*Rattus rattus*).



From Bjornson, B. F., and C. V. Wright. 1960 (revised). *Control of Domestic Rats and Mice*. Center for Disease Control, USDHEW, Public Health Service Pub. 563.

Key differences between a young rat and the house mouse (*Mus musculus*).



From Bjornson, B. F., and C. V. Wright. 1960 (revised). Control of Domestic Rats and Mice. Center for Disease Control, USDHEW, Public Health Service Pub. 563.

Biology and Life Cycle

Food Preferences

- Mice are omnivorous and will eat almost any food that is readily available. If cereal grains are available, they will be taken regularly.
- Norway rats eat a wide variety of foods, but they are more likely to eat garbage than roof rats. They prefer foods that are high in protein and carbohydrates such as meat, fish, cereal grains, nuts, and pet food.
- Roof rats also eat a wide variety of foods, but prefer fresh plant material such as nuts, fruit (especially avocados and citrus), vegetables, and tree bark. They are fond of snails and slugs.
- A house mouse can obtain all its water from the food it eats, but rats need free water to drink.

Nesting Habits

- Outdoors, Norway rats nest in the ground and in sewers and storm drains.
- Indoors, Norway rats usually prefers to nest on the lower floors of buildings in wall voids, storage areas, and any cluttered area that is little used, but if their population is large or preferred sites are scarce, they will nest on upper floors or in ceilings.
- Outdoors, roof rats usually nest above ground and their nests can be in trees, especially untrimmed palm trees; in dense, overgrown vegetation, especially Algerian ivy (*Hedera canariensis*); in vines clinging to fences or the sides of buildings; in piles of wood and/or debris; and in the ground if there are no other suitable sites.
- Indoors, roof rats usually nest in the upper parts of the building in the attic and in attic and ceiling voids. They can also nest on the lower floors of the structure.
- Outdoors, mice can nest in fields, in weeds and shrubbery around a building, in storage sheds, and in crawl spaces.

- Indoors, mice nest near their food supply in wall, ceiling, and cabinet voids; within large appliances; in wall voids; in storage boxes, drawers, and desks; and in upholstered furniture.

Behavior that impacts management

- Mice can enter a structure through holes as small as ¼" in diameter. Rats can enter a structure through a ½" diameter hole, but they can gnaw on a small hole until it is large enough for them to squeeze through.
- Rats tend to be extremely wary (though temporarily) of new objects in their environment.
- Mice explore and re-explore their home territory daily, investigating changes and new objects.
- Rats and mice are active at night, but will adjust their habits to the availability of food; rodents seen in the day can also indicate a very large population.
- Rats and mice have a keen sense of hearing, smell, taste, and touch.
- Both are prolific breeders.
- Rats can swim through sewers and enter a building through a toilet or a broken drain.
- Construction and weed management in empty lots can disrupt living space for mice and Norway rats and drive them into nearby buildings.
- Mice and rats prefer to travel along edges, such as next to a wall or a foundation. They will also travel along rafters, pipes, and wires.

Life Cycle

- Rats are capable of breeding throughout the year.
- The rat population normally peaks in spring and autumn.
- The number of pups per litter and the number of litters per year is dependent on the food supply and the availability of habitat.
- Rats live less than one year in the wild.
- Mice live less than 1 year in the wild; perhaps 2 year under excellent conditions.

Rodent Management

Prevention is the key to managing rats and mice. This must be done in-house.

To limit availability of food and water

- Discuss the importance of not feeding wildlife, including feral cats, with those who may want to do so, or implement *and* enforce a policy prohibiting the feeding of feral animals. Pet food, both wet and dry is very attractive to rats (and raccoons, possums, other creatures).
- Discuss the importance of sanitation in relation to rodents with the appropriate people.
- Limit areas for eating and storing food and enforce these rules. The fewer designated areas, the easier it will be to limit pests.
- Store food properly: in the refrigerator or in metal, glass, or heavy plastic containers with tight fitting lids.
- Store bags of pet food, bird seed, and grass seed in rodent-proof containers, or at the very least, inspect them often for any signs of gnawing.
- Do not leave food or food waste out overnight.
- Remove all garbage from the building at the end of the day. If this is not possible and rats or mice are a problem, then it is imperative to remove at least the food waste from the building at the end of every day.
- Store garbage, especially garbage containing food wastes, in garbage cans or dumpsters outside the building. These receptacles must have tight-fitting lids that are kept closed.
- Wash all garbage cans that contact food wastes with soap and water at least every 2 weeks.
- Require your refuse company to clean the dumpster or replace it with a clean one frequently.
- Never store extra garbage outside the dumpster or garbage cans, even if it is in cardboard boxes or plastic bags.
- Pick up fallen fruit and nuts from trees daily.
- Pick up cat and dog droppings daily.
- Fix leaky plumbing and eliminate any unnecessary standing water.

- Avoid planting date palms because rats can both feed on and nest in these trees.

To limit availability of shelter/harborage

- Reduce clutter and debris by using proper storage techniques. Items such as cloth, paper, cardboard, and insulation make good nesting material for rodents, so store these carefully as well.
- Remove rock and wood piles and construction debris.
- In warehouses and commercial storage areas, store items on pallets 12 inches off the floor in rows 6 feet wide or less, at least 18 inches from any wall, and with space to walk between the rows. This creates aisles for inspection and cleaning.
- Trim trees, vines, bushes, grass, and weeds at least 2 feet from all buildings to decrease cover for rodent runways along the edges of buildings, to prevent hidden access to buildings, and to make inspections easier.
- Eliminate dense plantings or break them up with pathways, stretches of lawn, or very low groundcover.
- Avoid large expanses of low groundcover that could allow rats to run for long distances without being seen.
- Wherever possible, eliminate plantings of Algerian ivy (*Hedera canariensis*) because rats can live in and feed on this ivy. If you cannot eliminate these plantings, work toward that goal. And in the meantime, mow or shear the ivy very close to the ground.

To limit access to structures

- Make general building repairs and seal large and small holes and gaps in structures both inside and out. If a pencil can fit in the hole, it should be sealed. Use appropriate, permanent materials. Foam sealant is not rodent proof. Copper wool and caulk can fill small holes and copper wool will not rust.
- Cover vents with ¼ inch hardware cloth.
- Seal gaps where pipes and wiring enter the structure.
- Weather-strip doors and windows.
- Use doorsweeps, metal kick plates or raised metal doorsills to prevent rodent entry.
- Equip doors with self-closing devices to prevent their being left open inadvertently. Mice often gain entry to a building through an open door.
- Make sure air conditioning units are well sealed, especially those on the roof.
- Repair broken sewer pipes.
- Install threaded caps on drains.

Tolerance levels for rats and mice

- Inside of occupied buildings, the tolerance for rats and mice is zero.
- Outdoors, the tolerance level should be zero for Norway rat burrows within 500 ft of an occupied structure on municipal property. There should be a zero tolerance for the sighting of a roof rat during the day on municipal property. The tolerance level for mice outdoors is undetermined.

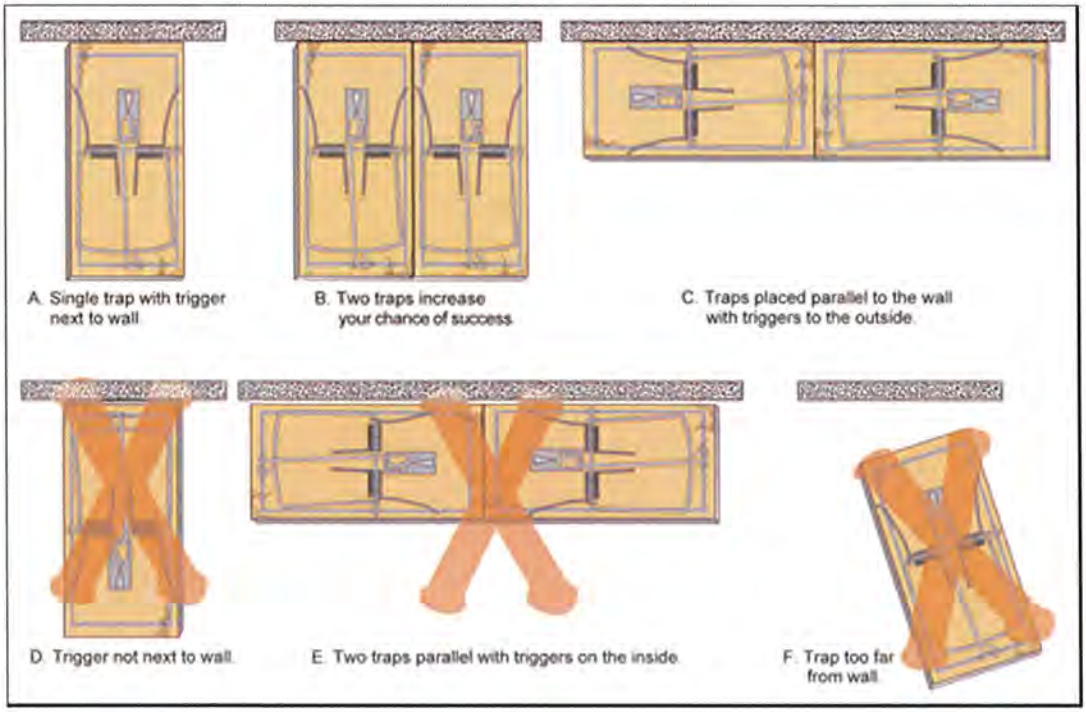
Predators

- Barn owls are excellent rat, mouse, and gopher predators, but alone they cannot control an infestation. Erecting barn owl boxes in the appropriate places will attract more owls to the area so that a municipality can benefit from their services. To purchase barn owl boxes see http://www.wildwingco.com/boxes.html or http://www.hungryowl.org/nesting-boxes.html. To purchase barn owl box plans, see http://www.hungryowl.org/nesting_boxes/boxplans.html. For detailed plans for a barn owl box see www.scvas.org/pdf/cbrp/BuildingBarnOwlBoxes.pdf.
- Cats and dogs will kill rodents but they will not control an infestation.

Trapping

Trapping is the best and safest way to get rid of mice or rats.

- Use snap traps to catch rodents, and record the trap location on your site plan. You don't want to leave dead rodents in a forgotten trap.
- Snap traps with "expanded triggers" are best.
- Always use plenty of traps. It's easy to underestimate the rodent population.
- Indoors, traps should be set along the edges of walls with the traps touching the wall (see the diagram below). For mice, there are multiple catch traps, such as Tin Cat®, that conceal the mice inside a metal box.



- Outdoors, large tamper-resistant bait stations can conceal rat snap traps and prevent children or pets from accidentally encountering the traps. This is the best rat control method for outside of buildings.

Initial Set-up for Using Traps inside of Bait Stations

1. Use T-Rex® rat traps or a similar trap. T-Rex® rat traps work very well inside a bait station; knock-offs and some other traps do not. The trap must be able to spring closed easily within the bait station.
2. Use bait stations such as Protecta Sidewinder® Bait Stations, or any other station that will easily accommodate the trap with its jaws open.
3. Set up and leave the trapping stations around the building. Place the edge of the station touching the building and place the side with the openings closest to the building.
4. Place a non-toxic feeding block, such as Detex Blox®, on the post inside the station.
5. Place a snap trap inside each station, but don't set the trap yet. (Rats are very wary of new things so this process lets them gets used to the station as a safe place to get food.)

Monitoring

6. Return in one week to check for rodent feeding activity on the feeding blocks.
7. If you see no feeding, continue to monitor the stations weekly.

Trapping

8. If you find evidence of rodent feeding, set the traps and place them so that the rat will encounter the open jaw as it tries to get to the feeding block.
9. You can use one of the baits, mentioned below, on the traps as an added enticement for the rats.
10. Come back one week later to check for activity or dead rats. Remove rats, re-set the traps, refresh the bait.
11. Repeat steps 8 through 10.

12. Replace the feeding blocks as necessary. Rats do not like old or rancid bait.

If you cannot inspect the trapping stations every week:

13. Deactivate the traps (but leave them in the stations), and leave the feeding blocks.
14. Return in one month and set the traps again if you see feeding activity.

If you have a large infestation:

1. Use more bait stations with traps.
2. Be sure to inspect your trapping stations every week.
3. Step up your sanitation measures.
4. Make sure you have made the necessary repairs to the structure to prevent rats from getting in.
5. Consider hiring a professional to help with the problem.

Trapping Tips

- Use as bait the food rats or mice are already eating. Or, for roof rats use nuts, dried fruit, apples, bananas, candy, marshmallows, raisins or peanut butter. For Norway rats use pieces of hot dog, cooked hamburger pieces, bacon, liver, peanut butter, or nut meats. For mice use peanut butter or candy.
- Indoors you can move objects around to funnel rodents into traps.
- Monitor traps regularly and frequently, and keep bait fresh. Rodents avoid old or rancid bait.

Chemical Controls (Rodenticides)

In general, chemical controls should be used *only* in emergency situations when public health is threatened. Rodenticides can pose hazards to non target animals, including children and dogs. Poisoned rodents often do not die immediately and can be eaten by birds of prey or other predators that can then suffer secondary poisoning. Poisoned rodents may also die in inaccessible places and cause odor and fly problems.

Exclusion methods and trapping should be favored over any chemical controls.

If a rodenticide becomes necessary, **use a first-generation anticoagulant** (see the chart below) for the following reasons:

1. They are less toxic than second-generation anticoagulants.
2. They are less likely to cause secondary poisoning to predators.
3. Vitamin K is a readily available antidote for anticoagulant poisoning.
4. Second generation anticoagulant rodenticides are considered so hazardous that they are now classified by the State as "restricted materials", which means they can only be purchased and used by a certified private applicator with a restricted use permit from the County Department of Agriculture.

First-generation anticoagulants	
Common name	**Example products (trade names)***
chlorophacinone	J.T. Eaton AC, Rozol
diphacinone	Ramik, Sierra
warfarin	Kaput, Rodex
Second-generation anticoagulants	
Common name	**Example products (trade names)***

brodifacoum	Final, Havoc, Jaguar, Talon
bromadiolone	BootHill, Contrac, Hawk, Maki
difenacoum	Di-Kill
difethialone	Generation, Hombre

* Always check the label for the active ingredient. The same or similar trade names may be used for products with different active ingredients.

Pigeons

Pigeons can transmit a number of diseases to people and can harbor a variety of insects, ticks, and mites that can bite humans. Their droppings deface and accelerate the deterioration of buildings and foul areas where people walk, work, or play. Their droppings and nests can clog drain pipes and air intakes.

For more information on pigeons and many different vertebrate pests visit the University of Nebraska's Digital Commons: http://digitalcommons.unl.edu/icwdmhandbook/

Biology and Life Cycle

- In urban areas, pigeons tend to move in flocks of sometimes hundreds of birds, and may fly up to five miles from feeding to nesting sites.
- They are very dependent on humans to provide them with food, water, and nesting and roosting sites. Pigeons can survive without food for several days but must have water daily.
- Pigeons are primarily grain and seed eaters, but they will also eat garbage, insects, and food provided intentionally or unintentionally by humans.
- For nesting and roosting, pigeons use roofs, ledges, drainpipes, attics, and architectural decorations.
- Nests are sticks, twigs and grasses that are clumped together to form a crude platform. Pigeons often rely on parts of the structure to provide additional protection for a nest.
- Pigeons have one mate at a time. The male protects the female and the nest. Eight to 12 days after mating the female lays one or two eggs, and about 18 days later the eggs hatch. The young, called squabs, leave the nest in about four to six weeks.
- Breeding can occur all year around, but peaks in spring and again in fall.

To limit food and water availability

- Discuss the importance of not feeding pigeons with those who may want to do so.
- Reduce the number of temporary water sources such as puddles, leaks, or any open container of water.
- Properly discard garbage and food items in and around the infested area; place in a container which inhibits bird access.

To limit shelter/harborage availability

Structural modifications to reduce nesting, roosting, and loafing sites:

- Seal gaps that allow pigeons access to roosting and nesting sites.
- Change ledge angles to at least 45° so pigeons cannot loaf, roost, or nest on them.
- Install plastic bird netting to prevent access to nesting or roosting sites.
- Use repellants such as plastic or metal spines, monofilament or steel lines, or gels or pastes.

Trapping

- Trapping and releasing pigeons elsewhere is not an option due to their homing abilities. Pigeons will usually return to the same place where they were trapped and continue to cause problems.

Chemical controls

Lethal controls are usually unsuccessful because the dead birds are rapidly replaced by juvenile birds, and the flock may become larger than it was initially. The best tactics for managing pigeons are to prevent feeding and limit habitat with structural modifications.

Spiders

Spiders provide superior insect control and should therefore be left alone as much as possible.

A note on spider bites

Throughout the United States, spiders are blamed by both the public and physicians for bites to the skin and for many other dermatological wounds. Note that it is impossible for a physician, or anyone else, to distinguish one kind of bite from another by just looking at the bite because people's reactions to bites are so varied. The vast majority of the time, a spider would have no reason to bite a human. True spider bites (which are rare events) occur when a spider is trapped inside clothing or when someone puts a hand or other body part in a spider habitat without looking, or slaps at a spider that is crawling on them.

Black widow spider

Black widows are very shy and will bite only when seriously provoked. Sticky traps can be placed where they will be effective in catching black widows as they migrate into a sensitive area. Black widows can also be removed with a vacuum. If black widows are common in your area, train staff and building occupants to refrain from sticking ungloved hands into dark holes or crevices, and remove clutter and debris both inside and outside.

Brown recluse spider

There are no populations of brown recluse spiders living in California. Necrotic lesions, similar to those caused by the bites of a brown recluse, can be the result of a bacterial, viral, or fungal infection or any number of other medical conditions.

Other spiders

Spiders and their webs should be removed with a vacuum or Webber (web removing tool that is a brush with a long handle). Sticky traps can be placed under furniture and in areas prone to crawling spiders. Changing outdoor lighting, either by moving the lights or changing the bulbs to yellow "bug lights" so that insects are not attracted near doorways, can reduce the number of spiders and webs in places where they are not wanted.

For more information on spiders, go to http://spiders.ucr.edu/.

Wasps and Bees

Yellowjackets and Paper Wasps

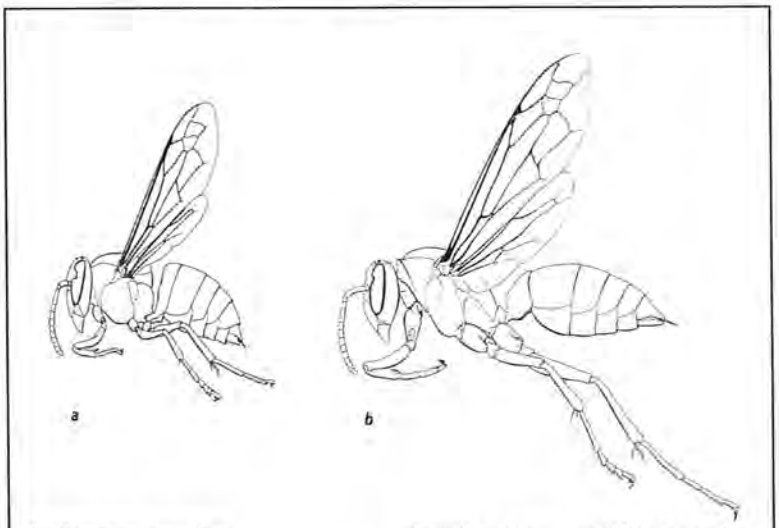
Yellowjackets are one of the pests that should be handled by a professional. Yellowjackets are scavengers and are excellent insect predators. They should be left alone if they are not a threat to passersby.

In Contra Costa County the Contra Costa Mosquito and Vector Control District will remove ground nests for you. You must find and mark the location of the yellowjacket nest before you call them.

Contra Costa Mosquito and Vector Control District
155 Mason Cir
Concord, CA 94520
(925) 685-9301
To submit an online service request: http://contracostamosquito.com/service_request.htm

Yellowjackets are sometimes confused with paper wasps. Yellowjackets are fierce defenders of their nests, and will sometimes attack a person simply walking near the nest. Paper wasps are far less aggressive in defending their nests, which may not have to be removed unless they are in the line of traffic into a building. Paper wasps are also valuable insect predators.

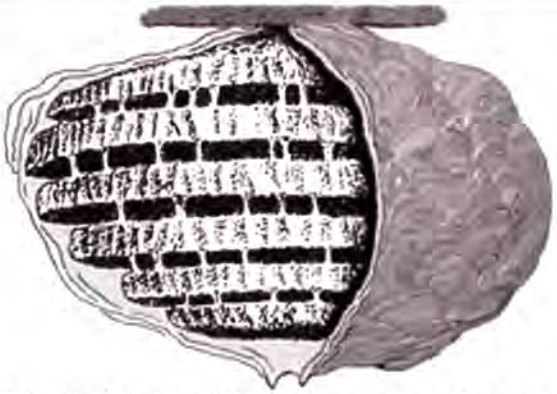
Yellowjackets are stocky and have relatively short legs compared to the long dangling legs of the slender paper wasp (see the illustration below).



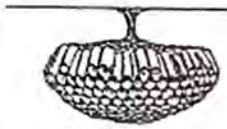
Yellowjacket worker — Female paper wasp (*Polistes* sp.)

from: Agriculture Handbook 552, The Yellowjackets of America North of Mexico

Yellowjacket nests are enclosed in a papery substance made from chewed vegetation and have a single opening at the bottom (below left). They can be constructed underground in a hole or animal burrow, or they can be found hanging from eaves or lodged in bushes. Paper wasp nests (below right) are small, rarely more than 6 to 8 inches in diameter and open, without the papery enclosure of a yellowjacket nest. They are hung from horizontal surfaces such as eaves, window sills, and branches.



Yellowjacket nest with cutaway section to show interior comb structure.



Paper Wasp Nest

Control options vary depending on the proximity to the public and perceived hazard. Ideally treatment should be carried out either at dawn or dusk. Caution tape can be installed around a nest to temporarily warn passersby. The pest control technician must be equipped with an appropriate bee suit to remove a nest.

Yellowjacket nests can be removed with little or no pesticide use, so discuss this option with the pest control company you hire.

Yellowjacket Management Chart

Adapted from a chart created by Mike Merchant and Dale Pollet, Texas A&M University

Locations/ Situations	Nonchemical Control	Preferred Chemical Treatment(s)
Foraging wasps around outdoor eating areas.	Use yellowjacket traps placed at least 20 feet from areas of high human activity to reduce the chance of human/wasp contact.	Not practical
Foraging wasps near dumpsters and garbage receptacles.	Ensure lids and doors of receptacles are present and close easily. Keep doors and lids clean and free of food debris, especially when yellowjackets are in the area. If yellowjackets are a serious problem, consider installing receptacles with automatically closing lids or doors, increasing waste pickup and installing informational warning signs to alert the public.	None
Nest in the ground.	Professionals can excavate a ground nest and remove the wasps by vacuum.	If you can find and mark the next, the Contra Costa Mosquito and Vector Control will exterminate the nest. Call 925-685-9301 or make an online request at http://www.contracostamosquito.com/service_request.htm
Nest in a structural void, in a tree, bush, etc.	Professionals can remove nests using vacuums and/or steam.	Very small quantities of pyrethroid insecticides work well and should pose no significant environmental or health risks when applied directly to yellowjacket nests. A trained technician can also use

Locations/ Situations	Nonchemical Control	Preferred Chemical Treatment(s)
		insecticidal soap or pesticides derived from plant oils. Nest elimination should be done during the evening or very early morning hours to prevent risks to the applicator.

Yellowjacket Trapping

Trapping works by killing foraging wasps and drawing foragers away from areas of high human activity.

Traps designed especially for yellowjacket wasps are available from a variety of sources.

While traps may have some benefit in reducing numbers of foraging wasps, they are not generally effective in eliminating entire yellowjacket wasp colonies.

Wasp and Bee Stings

- Yellowjackets and paper wasps can sting multiple times, while honey bees can only sting once.
- A honey bee stinger has a tiny barb, which locks the stinger in the skin after the bee pulls away.
    - Immediately after the sting, the stinger needs to be removed.
    - Attached to the stinger is a poison sac that continues to pump venom into the sting site for several minutes.
    - This stinger should not be pulled out; rather, it should be scraped off. A stiff sheet of paper or a credit card works well for this.
- **A wasp sting does not require scraping.**
- After you have identified the offending organism and, if necessary, removed the stinger, be sure to observe the person for any signs of allergic reaction.
- Treatment for stings
    - If the person has a history of allergic reactions, shows signs of severe swelling or has trouble breathing, call 911.
    - If the person shows no signs of distress, the sting area can be soothed by applying an over-the-counter insect bite and sting product. An oral antihistamine can relieve the itching caused by the sting.

Sting Prevention

- Keep sweet items, especially sodas and juices, covered. Bees and wasps are attracted to sweets.
- Keep recycling bins and outdoor garbage cans clean and sealed, especially when they contain soda cans or cups, and food scraps. Ideally, all outside garbage cans should have self-closing lids.
- Don't walk barefoot on playgrounds or playing fields. Bees and wasps are nectar collectors, so they are often close to the ground.
- When in close proximity to bees or wasps move slowly and fluidly. Quick, jerky motions will increase the likelihood of provoking the insects.

If a bee or wasp lands on your body, don't panic. Gently brush it away, or wait for it to leave by itself.

Bee Swarms and Nests

If the location of the swarm or nest poses a danger to the public, rope off the area and post warning signs. Bees in swarms are docile and are unlikely to sting. Swarms normally move out of the area after 8 to 12 hours.

The municipality should contract with a bee handler such as the Mt. Diablo Beekeeper's Association at (925) 458-3900 (http://www.diablobees.org/swarmlist/) for removal and relocation. If the nest is in the wall of the structure, the entire honeycomb should be removed to prevent damage to the structure.

Appendix C: Lose Your Lawn: The Bay-Friendly Way

Lose Your Lawn: the Bay-Friendly Way

Sheet mulching is an easy way to replace your lawn

www.LoseYourLawn.org

Now is a great time to transform your conventional lawn into a Bay-Friendly garden. Sheet mulching is a technique of laying cardboard or newspaper over an existing lawn and then topping it off with layers of compost and wood mulch. The layers suppress weed growth and break down naturally – creating a vibrant ecosystem that gives you healthier soil and plants.

Sheet mulching can be done all at once or a little bit at a time. It doesn't require the use of heavy equipment or pesticides. Sheet mulching can be completed in one day, depending on the size of the area you are covering. The best time to sheet mulch is in the fall to take advantage of the rains, but it can be done any time of year. There are many different ways to sheet mulch. The following is a simple method recommended by the Bay-Friendly program:

❶ PREPARE THE SITE

- **Mow or knock down tall weeds** so they lie flat.
- **Remove woody, bulky and invasive plants** such as blackberries, oxalis, horsetail, kikuyu and Bermuda grass.
- **Flag your sprinkler heads** if you plan to retrofit your sprinkler heads for drip irrigation.

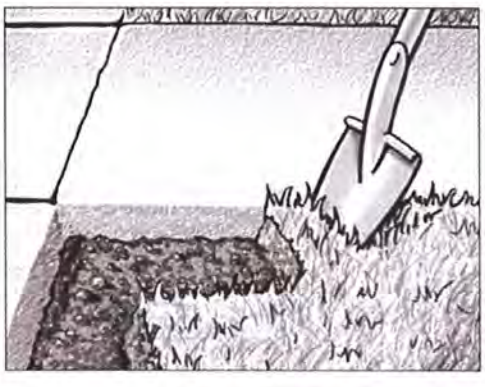
Knock down weeds.

Soak the area.

Soak the area with water to start the natural process of decomposition

❷ EDGING & MOUNDING FOR EROSION CONTROL

- **Edge the lawn** to avoid run-off and keep mulch from spilling onto paving. Use a flat-edged shovel to cut the lawn 8-12 inches away from the edge of the concrete. The soil should be at least 3 inches below the top of the concrete.



- **Create mounds** using the leftover soil and sod from edging, or simply sheet mulch in place. Just flip the edges over so the roots and soil face up. Don't worry if you encounter the plastic netting that came with your sod, just throw away the pieces that you see. Mounds can create visual interest in the garden by adding height and depth. Many native plants like well drained soil and thrive on mounds.

❸ PLANT LARGE PLANTS

- **Install 5-gallon or larger plants** once the area has been prepared.

❹ ADD A WEED BARRIER

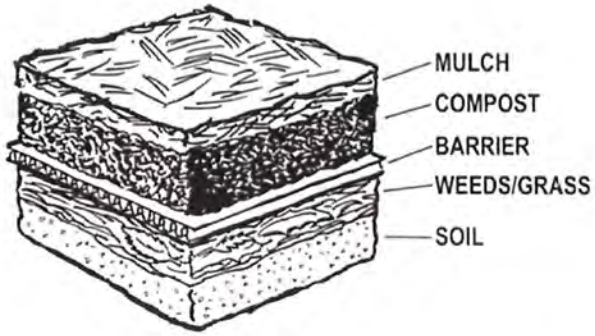
- **Add a weed barrier** that is permeable to water and air, such as cardboard, newspaper or burlap. Recycled cardboard boxes can be found at appliance stores or bike shops. You can also buy recycled cardboard rolls. Do not use plastic or types of weed cloth which will not degrade.

CONTINUED ON OTHER SIDE....

- **Overlap the pieces by 6-8 inches** so the sun won't get through. Any lawn showing at the end of the project will come right back.
- **Wet down the cardboard as you go** to keep it in place and to shape it around obstacles.
- **Work around existing plants** by ripping and folding the cardboard. It's easier to rip once wet.
- **Completely cover the ground** with the cardboard except where there are plants that you plan to keep.

❺ LAYER WITH COMPOST AND MULCH

- **Add compost and mulch on top of the cardboard.** Spread compost directly over the cardboard and then cover it with bulky materials like wood chips to optimize water conservation and weed control. Adding 1-2 inches of compost will help build soil and provide a planting medium for 4-inch or smaller plants. However, if your main goal is weed suppression just add the mulch.



- **The compost/mulch layer should be a total of 3 to 5 inches deep.** The top layer of mulch mimics the newly fallen organic matter of a forest. Good materials for the top layer include chipped plant debris, tree prunings, leaves or even straw. You will need a lot of mulch. To determine the amount of mulch and/or compost needed, please see the calculators on LoseYourLawn.org.

❻ PLANT

- **Punch or cut holes in the cardboard** and place your larger plants in the soil under the mulch. In cooler climates, smaller plants (4-inch pots) can be planted right into the mulch/compost layer on top of the cardboard. Add compost around the root ball if compost was not included in the previous layer.

❼ PROBLEM PREVENTION

- **Your new plants will require water** and attention when they are young, even if they are drought-tolerant.
- **Do not pile materials** up against tree trunks or stems of plants.
- **Small seedlings may need protection** from snails and slugs that like to hide under the mulch, especially in the dry season.
- **Protect young trees from rodents** with physical guards like metal bands that wrap around the base.

For a detailed description and case study of lawn removal with sheet mulch, be sure to check out the *Bay-Friendly Gardening Guide*, download or order online at www.bayfriendlycoalition.org.

For information on lawn conversion rebates, where to find local materials, instructional videos and other resources, visit LoseYourLawn.org.

Appendix D: Pest Control Materials for Municipal and LEED Certified Buildings

Example Pest Control Materials List for Municipal Buildings

The following is an example of a list of pesticides that might be used in a structural IPM program. To help you with choosing less hazardous pesticides appropriate for use in structural pest control, or to update the list below, use the following resources:

- EcoWise Certified Pesticide Criteria with Examples: http://ecowisecertified.org/ecowise_about_who.html (Click on the link marked "Materials Criteria/Examples"
- City of San Francisco Reduced Risk Pesticide List: http://www.sfapproved.org/pest-control-for-city#list

Brand Name	**Active Ingredient and %**	**EPA Reg #**	**Signal Word**	**To be used for** (e.g., ant bait, cockroach control, etc.)	**Method of use** (e.g., as a bait station, in cracks & crevices, etc.)	**Area/building for use** (e.g., in food service areas, around the outside perimeter of the building, etc.)
Advion Ant Bait Arena	Indoxacarb 0.1%	352-664	Caution	Ant bait	Bait station	Inside where needed or outside of buildings at perimeter
Advion Ant Gel	Indoxacarb 0.05%	352-746	Caution	Ant bait	Spot treatment in cracks and crevices	Inside where needed or outside of buildings at perimeter
Advion Cockroach Gel	Indoxacarb 0.06%	352-668	Caution	Cockroach bait	Spot treatment in cracks and crevices	Food service/ break areas inside buildings
Dri Die	Amorphous silica 95%	4816-240	Caution	To prevent bed bugs and other crawling insects	Spot treatment dusted into voids, cracks and crevices	Interior
Gentrol Point Source and Gentrol Concentrate	Hydroprene 90.6% and 9% respectively	2724-469 and 2724-351	Caution	Cockroach, and pantry pest control (insect growth regulator)	Spot treatment in cracks and crevices, or slow release treatment station	Food service/storage areas inside buildings
Mother Earth Granules	Boric Acid 5.0%	499-509	Caution	Ant and cockroach bait, Oriental cockroach	Spot treatment in cracks and crevices	Inside or outside of buildings at perimeter or voids and cracks cockroaches are hiding
Niban Granular Bait	Boric Acid 5.0%	64405-2	Caution	Ant and cockroach bait, Oriental cockroach	Spot treatment in cracks and crevices	Inside or outside of buildings at perimeter or voids and cracks cockroaches are hiding
OhYeah!	Sodium lauryl sulfate 7% and water 93%	Exempt	Caution	Insects such as bed bugs, roaches, ant, yellow jackets, spiders	Spot spray (contact insecticide)	Anywhere detergent and water can be used
Pyganic	Pyrethrins 1%	1021-1871	Caution	Bed bug control, bird or rat mites	Spot treatment in cracks and crevices, voids	In cracks and crevices at perimeter of rooms or attics and crawlspaces

PiGNX	Capsaicin 0.0357%	84418–1	Caution	Pigeon repellent	Spot treatment as caulking	Window ledges, structural fixtures
Advance Liquid Ant Bait	Sodium Tetraborate Decahydrate (Borax) 1.3%	499-491	Caution	Ant bait	Inside a bait station	Outside of buildings at perimeter
Avert cockroach Bait Station	Abamectin 0.05%	499-467	Caution	Cockroach bait	Bait station	Inside buildings near food service, storage and break areas
Avert Cockroach Gel	Abamectin 0.05%	499-406	Caution	Cockroach bait	Spot treatment in cracks and crevices	Inside buildings near food service, storage and break areas
Safer Brand Ant and Crawling Insect Killer, Powder	Diatomaceous Earth	59913-1	Caution	Ants, cockroaches and other crawling insects, mites (prevention/exclusion/control)	Dusted/blown into cracks and crevices, voids	Wall voids, cracks and crevices in walls, floors, ceilings
Cimexa	Amorphous Silica Gel, 100%	73079-12	Caution	Bed bugs, ants, cockroaches and other crawling insects, mites (prevention/exclusion/control)	Dusted/blown into cracks and crevices, voids	Wall voids, cracks and crevices in walls, floors, ceilings
Terro PCO Ant Bait	Borax 5.40%	149-8-64405	Caution	Ant bait	Liquid bait used in a bait station	Outside of buildings at perimeter
Terro PCO Ant Bait Station	Borax 5.40%	149-8-64405	Caution	Ant bait	Bait station	Inside and outside of building at perimeter, outside in voids, cracks or under objects

MSDS and Labels are available in digital format. Hardcopies should be stored at the IPM Coordinator's office, and must be easily available for any staff that uses pesticides.

Your pest control company must alert municipal staff to the placement of bait stations and gel baits and to the location of any other pesticide application. Gel baits and bait stations must be placed so that regular cleaning will not dislodge them.

Example Pest Control Materials List for LEED Certified Buildings

The following materials conform to San Francisco's Tier III (low hazard) pesticide criteria. The list of pesticides that might be used inside a LEED Certified building must be permanently posted in a prominent location in each LEED Certified building. **For San Francisco's approved pesticide list and to update the list below, visit http://www.sfapproved.org/pest-control-for-city#list**

Brand Name	**Active Ingredient**	**EPA Reg #**	**Signal Word**	**To be used for** (e.g., ant bait, cockroach control, etc.)	**Method of use** (e.g., as a bait station, in cracks & crevices, etc.)	**Area/building for use** (e.g., in food service areas, around the outside perimeter of the building, etc.)
Advance Dual Choice Ant bait stations	Sulfluramid	499-459-AA-499	Caution	Ant bait	Bait station	Inside where needed or outside of buildings at perimeter
Advion Ant Bait Arena	Indoxacarb 0.1%	352-664	Caution	Ant bait	Bait station	Inside where needed or outside of buildings at perimeter
Advion Ant Gel	Indoxacarb 0.05%	352-746	Caution	Ant bait	Spot treatment in cracks and crevices	Inside where needed or outside of buildings at perimeter
Advion Cockroach Gel	Indoxacarb 0.06%	352-668	Caution	Cockroach bait	Spot treatment in cracks and crevices	Food service/ break areas inside buildings
EcoPCO AC Contact Insecticide	Eugenol, 2-phenethyl propionate	67425-4	Caution	Various insects	Spot treatment	Inside
Gentrol Point Source and Gentrol Concentrate	Hydroprene 90.6% and 9% respectively	2724-469 and 2724-351	Caution	Cockroach, moth flies, and pantry pest control (insect growth regulator)	Spot treatment in cracks and crevices, or slow release treatment station	Food service/storage areas inside buildings
Orange Guard	d-limonene	61887-1-AA	Caution	Various	Can be used to clean up an ant trail	Inside where needed
PiGNX	Capsaicin 0.0357%	84418–1	Caution	Pigeon repellent	Spot treatment as caulking	Window ledges, structural fixtures
Safer Brand Ant and Crawling Insect Killer, Powder	Diatomaceous Earth	59913-1	Caution	Ant control (exclusion)	Blown into cracks and crevices, voids	Wall voids
Victor Poison Free Wasp/Hornet Killer	Mint oil	Exempt		Killing yellow jackets	Spot treatment for nest removal	Outside where needed, wall voids

MSDS and Labels are available in digital format. Hardcopies should be stored at the IPM Coordinator's Office and must be easily available for any staff that apply pesticides.

Your pest control company must alert municipal staff to the placement of bait stations and gel baits and to the location of any other pesticide application. Gel baits and bait stations must be placed so that regular cleaning will not dislodge them.

The following fact sheets (and many others) can also be found at

http://www.ipm.ucdavis.edu/PMG/menu.homegarden.html