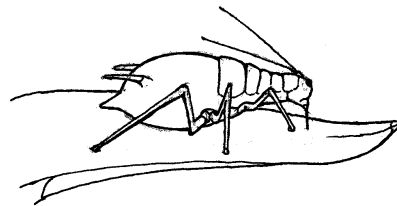


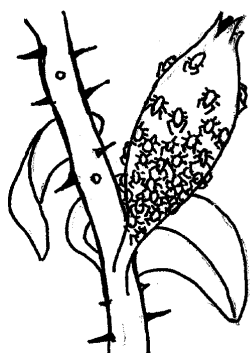
Aphids

Reading #1

Aphids are small, pear-shaped insects that suck the juices from plants. Aphids can be green, red or brown depending on their age, the aphid species, and the color of the plant juices they consume. Aphids can be wingless or have two pairs of wings.



Aphids have a mouthpiece called a proboscis that works like a straw. The aphids inject their proboscises into the plant phloem (a special channel that transports sugars and other nutrients throughout the plant) and suck the plant juices up into their mouths. The aphids take food that plants have made for themselves and use it as their own food.

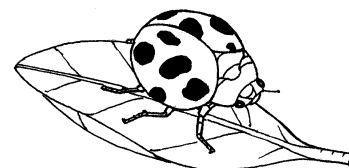


Aphids produce a sweet secretion called “honeydew” as they feed on plant sap. Ants like eating this honeydew. Ants will protect aphids as if they were tiny dairy cattle. They keep other insects from attacking the aphids. The ants “milk” the aphids by stroking them with their antennae. The sticky honeydew is annoying to people.

Even though aphids are very small (3-4 millimeters long) they cause lots of damage to many young crops and household gardens because they feed together in large groups. Aphids not only weaken young plants by removing their sap, but they sometimes carry and transmit viruses as they feed from plant to plant.

There are many ways to control aphids:

- A simple way to reduce the number of aphids is to spray the infected plants with soapy water. This solution makes some aphids slide off the plants while other aphids suffocate. This method of control does not always work well for all aphids and does not kill harmful viruses. The soap must be used frequently to keep the number of aphids to a minimum. Special insecticidal soaps, soaps containing aphid killing chemicals, are used to control aphids on strawberries and ornamental flowers.
- Another interesting way to control aphids is to release beneficial insects into aphid-infested gardens or fields. The larval and adult forms of ladybugs and green lacewings eat aphids. Ladybugs and lacewings are sometimes raised by people and sold to farmers and home gardeners.



Aphids *(continued)*

Reading # I

- An unusual way of controlling aphids is by exposing them to a special tiny wasp. These speck-sized wasps inject their eggs into the bodies of aphids. When the wasp eggs hatch into larvae, the larvae eat the aphids from the inside. The larvae change into adults which emerge from the dead aphids and repeat the cycle. These wasps are parasites—which means they harm others while benefiting themselves. If you examine an aphid population in your garden, you may be able to see some brown aphid mummies.
- Some farmers use insecticides, special chemicals that kill insects, to get rid of aphids quickly. These chemicals may also kill other insects at the same time.

Generally, it is preferred to reduce an aphid population in a particular area rather than completely eliminate the aphids. Although aphids are considered a pest by many, it is important to remember that aphids are a food source for many insects and spiders. They are important in many ecosystems.

Farmers and home gardeners should consider all methods of aphid control and pick the methods which are best suited for their particular situations. People should consider the methods that will be most effective on pest control while minimizing the impact to the environment. This is called Integrated Pest Management or IPM.

Glassy-winged Sharpshooter

Reading #2

Perhaps you have heard about the glassy-winged sharpshooter on the television news or in the newspaper. This insect is being talked about by many because it has the potential of spreading diseases, including Pierce's disease, to more than one hundred kinds of plants. The biggest threat is to grapes in California, but other crops and our environment can be affected too.



The glassy-winged sharpshooter, almost $\frac{1}{2}$ inch long, got its name because it has large transparent wings with reddish veins. This dark brown insect is easy to spot not only because of its size, but also because of the watery substance it excretes. The glassy-winged sharpshooter pushes its straw-like proboscis into a plant and sucks fluid from the plant and uses it for food. It has a voracious appetite and travels quickly from one plant to another. As it feeds, it excretes a large droplet of a watery substance every three seconds. This "leafhopper rain" turns to a white powdery substance when dry. The word "leafhopper" is given to insects, like the glassy-winged sharpshooter, that move quickly from one plant to another.

During feeding, the glassy-winged sharpshooter can spread harmful bacteria into the plant. One such bacterium is called *Xylella fastidiosa*. These bacteria attack the xylem of plants. The xylem is the tissue which transports water and nutrients. The bacteria continue to grow and eventually choke the plants' water and nutrient transport system and cause the plant to die. If infected by Pierce's disease, grapevines will die within three years. Currently, there is not a remedy for Pierce's disease. The only way to prevent plants from getting the disease is to prevent the plants from being exposed to it. That means, not allowing the glassy-winged sharpshooter to feed on plants.

Xylella fastidiosa can harm and eventually kill other plants too. There is a strain that affects almonds. The leaves of the almond tree get brown, and the almonds do not get large enough to harvest. Another strain of *Xylella fastidiosa* can make the leaves of citrus trees yellow. This is a problem because the plant cannot make enough food for itself and therefore the fruit is too small. The bacterium acts the same way with all of the plants it infests. It chokes the xylem which prevents water from flowing freely through the plant.

As you read this, researchers throughout the state are trying to find a way to control the glassy-winged sharpshooter and prevent Pierce's disease. They are working on finding ways to destroy these insects, which are not native to California. One such research project is proving useful. There is a tiny, stingless wasp that eats sharpshooter eggs. Facilities in Southern California are reproducing these beneficial insects and releasing them as fast as they can.



Glassy-winged Sharpshooter

(continued)

Reading #2

Another method of control that seems hopeful is the use of biotechnology—using biological methods to make the plants resistant to Pierce’s disease. The California Department of Food and Agriculture has put quite a bit of money into the research of the glassy-winged sharpshooter and Pierce’s disease. That money came from an emergency senate bill that passed on May 16, 2000. Research takes a while, but scientists are hopeful that a solution to this challenge will be found.

Do you have an idea on how this challenge can be overcome?

Red Imported Fire Ants

Reading #3

Ants can be found almost anywhere—sidewalks, gardens, fields, school playgrounds, and in the woods. Sometimes we find them where we would rather not see them, like in the kitchen!

Ants belong to a class of animals called insects. All insects have three parts—a head, a thorax, and an abdomen. They also have two eyes, two mouth parts called mandibles, two antennae, and six legs.



Red Imported Fire Ants are one of many kinds of ants. The ants got their name because they are: reddish brown (RED), they are not originally from the United States (IMPORTED), and they can give a burning sting from the stinger on their abdomen (FIRE). Scientists believe that Red Imported Fire Ants came to the United States on ships from South America in the early 1930s. Since that time, these ants have become common in the southeastern United States. Only recently have the ants appeared in California.

Red Imported Fire Ants are difficult to distinguish from other California ants. They are very small, ranging from 1/16-1/4 inch and are reddish brown. They are most often identified by the unusual mounds they form. These mounds do not really look like mounds at all. Rather, they look more like flat patches of soil. Red Imported Fire Ants build nests just about anywhere they can find moisture, such as lawns, gardens, woodpiles, fields, golf courses, and parks. They frequently infest electrical equipment, chew on wire insulation and can cause short circuits. This could be very bad if the equipment they infest are things such as traffic signal boxes, pool pumps, air conditioners, and heaters.

Red Imported Fire Ants are a threat to people including agricultural workers, compete with beneficial insects, and destroy crops such as citrus, strawberries, and corn. The ants also attack and kill wildlife such as quail, lizards, squirrels, and baby deer. When disturbed, the worker ants “boil out” of the mound and sting the animal that bothered them.

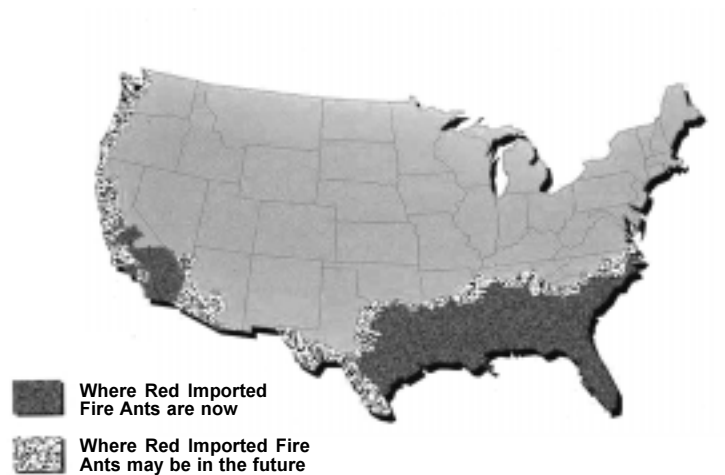
Right now, the ants have been spotted in Southern California. It is best to stay away from ant mounds and to show an adult if you see a lot of ant mounds or a large ant mound in a grassy area, like a park or school field.

Since Red Imported Fire Ants are not natural parts of California ecosystems, the current goal of the California Department of Food and Agriculture is to completely rid of all Red Imported Fire Ants from California. This is called eradication. The current process includes the use of two types of chemicals. One interrupts the growth of the insects and the other affects their metabolism—how they use the energy from their food. Both chemicals are

Red Imported Fire Ants *(continued)*

Reading #3

mixed with ground corncobs and soybean oil, a combination that is used to attract Red Imported Fire Ants. Working together, these chemicals may eradicate an entire colony in several weeks. The slow-acting characteristics of these chemicals are preferred because Red Imported Fire Ants are able to take the bait into the nest and distribute them to other workers and the queen before they die. If these methods work, California will not have the problems southern states have with the insect.



Rodents

Reading #4

Rodents are small mammals which have long chisel-shaped incisor teeth that are adapted for gnawing. In fact, rodents have incisors that continually grow; therefore, they must continually gnaw. If they don't, their teeth could get so long they could grow into another part of their own body! Some examples of rodents are rats, mice, beavers, squirrels, gophers, voles, and moles.

Rodents can be continuous pests because they are able to reproduce very quickly and have many young at one time. Also, rodents are very hearty animals. They can tolerate severe weather conditions and can survive on very little food, if necessary.



Rodents are common pests around homes. Mice often get into household foods intended for humans. Rodents are hazards to people because they have the potential of spreading dangerous diseases. They can carry fleas, which may carry a specific bacterium that causes high fever, rashes, and sometimes death.

Farmers do not like rodents in their fields. A group of ground squirrels can destroy nut, corn, rice, and other crops very quickly. If rodents, such as rats get into grain storage containers called silos, the food can no longer be used to feed people or to feed animals (such as cattle) that will be fed to people.

Rodents are controlled in various ways:

- In most cases, traps are set to kill the rodents that are bothering homeowners or farmers.
- Predators, such as owls and other raptors (birds of prey), can also control rodents. Farmers sometimes place owl boxes and raptor perches in their orchards to encourage more raptors that eat rodents.
- Rodenticides, chemicals that kill rodents (such as D-Con), are often placed in homes. People who use rodenticides must be careful not to place the poisons around children or pets that might accidentally eat or play with the poison. Another danger with rodenticides is that the chemicals may still be present in the rodent after it dies. When a cat, dog, turkey vulture, or other animal eats the dead rodent, it may be harmed by the chemicals inside the rodent's body.

Rodents *(continued)*

Reading #4

- Perhaps one of the most effective ways to control rodents is to eliminate their favorite habitats. Removal of brush, lumber, trash, and other potential nesting places often removes the presence of rodents.
- California ground squirrels, pocket gophers, meadow mice, moles, and voles are some rodent pests responsible for damaging many California fields. In some areas, ground squirrels and voles can reduce alfalfa yields so drastically that farmers can lose millions of dollars each year. That means higher prices to the consumer—you! One control for ground squirrels and other rodents is to use bait traps. These bait traps capture and kill the rodents. Another way to eliminate small infestations of rodents is to fumigate rodent burrows before planting. This kills the existing rodents before crops are planted.

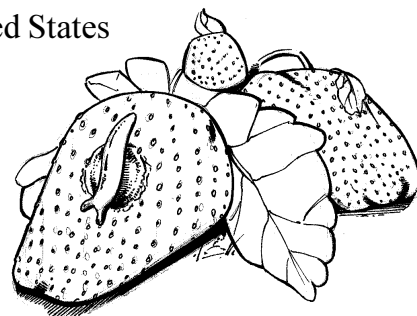
People should consider the most appropriate forms of rodent control for each particular situation. One or more methods may be used. Using a combination of pest management strategies that best controls the pest with minimal impact to the environment is called Integrated Pest Management or IPM. Researchers are constantly developing new ways of controlling rodents. Have you heard of other ways that people control rodents?

Snails, Slugs, and Other Mollusks

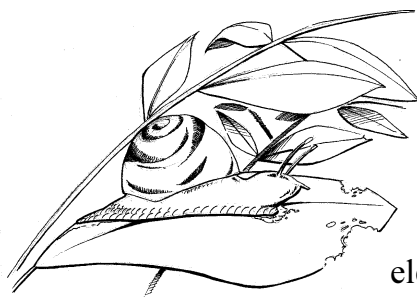
Reading #5

If you go out in your garden or yard at night with a flashlight, you may find snails or slugs feeding on the tender leaves of your plants. Snails and slugs are mollusks and are common to farms as well as home gardens. If not controlled, young seedlings can be consumed by these mollusks in one evening. Snails and slugs feed mostly at night and hide in moist dark places during the day.

One reason common garden snails are such pests in the United States is that they are not sufficiently controlled by natural enemies such as birds, beetles, snakes, and toads. The first garden snails were brought to the United States from France during the 1950s and were originally raised for “escargot,” a dish considered a delicacy by many. The snails reproduced rapidly, traveled out of gardens in which they were raised, and are now a problem throughout the United States.



There are a variety of ways to control snail and slug populations. These include removing them by hand, clearing away ground cover in cool shady places, creating physical barriers, placing salt directly on the animals, and using slug and snail bait. It is important to consider the side effects of certain snail and slug control methods—Should bait be used in areas where children play or food is grown? Can the salt affect soil quality? It is best if all pest management strategies are considered before making a pest control plan which most likely includes several methods. This is called Integrated Pest Management or IPM.



Snails are a common pest to citrus trees such as lemon, orange, and grapefruit. Farmers put copper rings, ranging from 3” to 12” high, around the tree trunks. The snails will not cross this physical barrier because, if they do, they will receive an electrical shock when their slime reacts with the copper. Humans cannot detect this mild electric charge, but snails and slugs can. One species of snail, called a decollate snail, is a predator of the brown garden snail.

These snails are specifically raised and released in snail-infested orchards and row crops. Scientists got this idea by observing how snails were kept under natural control in European countries. The release of decollate snails is carefully regulated because they eat many types of young mollusks, including some that are endangered.

Another interesting mollusk has found its way into California. The Chinese mitten crab, native to the estuaries of Korea and China, has become established in the San Francisco

Snails, Slugs, and Other Mollusks *(continued)*

Reading #5

Estuary. An estuary is the mouth of a river or stream that has contact with seawater. In the Sacramento-San Joaquin Delta, the crab's burrowing activity weakens levees, which can cause flooding, and competes with another scavenger, the crayfish, which supports the local fisheries. Mitten crabs spawn (lay eggs) in saltwater and spend their juvenile life in fresh water. Mitten crabs have been found many miles north of Sacramento.

The next time you see a mollusk in your garden, think about how it impacts your garden. It is food for birds, yet eats your plants. Snails and slugs decompose plant material so nutrients can be returned to the soil. As you can see, the interactions between living things are complex. It is no wonder the area of pest management is unique, challenging, and often times confusing.



Weeds

Reading #6

Weeds! They spring up almost everywhere—crowding, strangling, shading, and competing for nutrients and water. Weeds are plants that are a nuisance in gardens, agricultural fields, rangelands, recreational areas, and even waterways.

A weed is “a plant growing in a place where it is not wanted.” Plants can be weeds at certain times and in certain places, but can be beneficial at other times and places. For example, the milkweed plant is the essential food for monarch butterfly caterpillars; without it, the monarch cannot survive. Milkweed plants contain digitoxin.



Digitoxin is used to produce a human heart medicine called “digitalis.” Milkweed, however, can also be a pest in home gardens, in fields, and in orchards. It makes the areas look unattractive as well as takes nutrients that the desired plants need. Sheep ranchers walk their rangelands and remove milkweed by hand because lambs will get sick and may even die if they eat it. The digitoxin inside the plant is harmful to livestock.

If you like hiking, biking, or horse riding, chances are you are very familiar with yellow starthistle. This spiny, yellow flowered thistle is a member of the sunflower family and was accidentally imported as a contaminant in alfalfa seed. It quickly takes over areas of rangeland because it does not have natural enemies in California. It is poisonous to horses causing an illness called “chewing disease.”

California agriculture currently depends on the movement of water from one place to another through rivers, irrigation canals, and aqueducts. These waterways can become clogged by particular waterweeds. One such waterweed is called hydrilla. This weed looks similar to the elodea people use in home aquariums. But instead of smooth leaves, hydrilla has rough leaves with sawtooth edges and small potato-like, peanut-sized tubers on the roots.

Weeds are controlled in many ways:

- The most common weed control techniques are cultivation with tractors, hoeing, mowing, and physically pulling weeds out by hand.
- Some farmers and home gardeners cover soil with dark plastic to prevent weeds from sprouting.
- Herbicides (chemicals that kill weeds) are sometimes used to



kill weeds. There are different kinds of herbicides for different kinds of weeds.

- Another form of weed control is called crop rotation. An example of this is when densely growing crops, such as wheat or rye grasses, are planted in the soil where row crops, like tomatoes or pumpkins, once grew. The wheat or rye crowds out the weeds by taking the nutrients and water that the weeds once had. They also shade the area, preventing the weeds from getting the sunlight they need to grow.
- Sometimes a fire is purposely set in rangeland full of starthistle. These prescribed fires (or burns) kill the starthistle and allow the native plants to begin growing again. One year after burning, poppies, lupines and other native plants can be seen in the area. After burning areas three years in a row, scientists have found that most of the starthistle seeds are destroyed and an area is restored. You can imagine though, how carefully monitored these burns must be.
- A method of control called biological control is also used to kill starthistle. Since the 1980s two type of flies and two types of weevils (beetles with long snouts), have been introduced into starthistle infested areas. Some of these insects eat starthistle only. Others feed on the flower of the plants, reducing the number of seeds produced each year.
- In some residential areas, goats are used to eat weeds. This practice is becoming popular in residential areas that have large open grasslands nearby. The goats are raised for their hair and consume any vegetation they are around. Oakland, Sacramento, and Los Angeles are three large cities using goats now.

Successful home gardeners and farmers look at each weed situation individually and use a combination of pest management techniques to control the weeds. Farmers depend on specialists called Pest Control Advisors to help them make important decisions that will keep the crops growing while not harming the environment. This pest management approach is called Integrated Pest Management or IPM.