Category 3: Ornamental and Turf Pest Control

IF YOU WISH TO APPLY PESTICIDES TO PUBLIC PROPERTIES YOU MUST NOW BE A LICENSED GOVERNMENT APPLICATOR.

Ornamental and Turf Pest Control Learning Objectives

After studying this section, you should be able to:

✓ Describe the principles of Integrated Pest Management for Ornamentals and Turf.
✓ Describe the factors affecting pesticide application effectiveness.
✓ Describe the most common ornamental and turf insect pests and methods to control them.
✓ Describe the most common ornamental and turf diseases and methods to control them.
✓ Describe the different control methods available for weed management in ornamentals plantings and turf areas.
✓ Describe the most common vertebrate pests that impact ornamentals and turf, and control strategies for each.

Category 3, Ornamental and Turf Pest Control

Recent changes in Nevada’s legislation limit ornamental and turf certified applicators to the following: residential landscapers, homeowners, commercial establishments with their own pest control staff (hotels, casinos, resorts, restaurants, etc.), home owner association (HOA) employees, private golf courses or clubs with their own pest control staff, Nevada mine staff and Tribes.

As of July 1, 2017, pesticide applications at public buildings, public schools, all Federal (BLM, USFS, etc.), State, County, City or other municipality
properties, including County or State owned golf courses and City, County or State Parks, must be made by a Licensed Government Applicator or a licensed pest control company. The new requirements are detailed in the Pesticides and the Law chapter of this manual. Additional information can be found at http://agri.nv.gov/Pest-Control/.

Landscapers must become licensed if they are doing any off the following:

- Using anything other than “CAUTION” pesticides.
- Advertising pest control or soliciting for pesticide applications, including bidding for maintenance contracts that involve pesticide applications.
- Using powered equipment to apply pesticides.
- Operating as a commercial (for hire) pest control company.
- Conducting any pesticide applications on non-residential properties (includes commercial and public properties).
- Applying pesticides to sites other than homeowner’s lawns and gardens.

For further information or clarification go to Nevada Department of Agriculture Pest Control Website, http://agri.nv.gov/Pest-Control/.

Ornamental and turf pests occur in landscaping found around commercial establishments (hotels, casinos, resorts, restaurants), industrial parks, private golf courses and residential properties (private homes, apartments, condos).

Plants in these locations are often chosen for their aesthetic qualities, not for their pest resistance. Some of these areas are also used by and under scrutiny from the general public. Thoughtful planning and implementation of pest control measures is required to maintain public health and a visually pleasing landscape.

The single most important factor in ornamental and turf pest control, as for all pest control, is to identify the pest. Before considering control measures, pest managers must also understand the pest’s life cycle.

**Ornamental and Turf Integrated Pest Management (IPM)**

The principles of Integrated Pest Management can be applied to controlling insect pests, weeds, diseases and vertebrate pests of ornamentals and turf.

- Pests, their hosts and beneficial organisms must be positively identified. The pest problem and associated plant species must be correctly identified. If you can’t identify the pest, collect samples and submit them to the University of Nevada Cooperative Extension or the Nevada Department of Agriculture for identification. Once the pest is identified, determine the pest’s life cycle, growth cycle and reproductive
habits. Pest managers should also be able to identify all life stages of beneficial organisms, such as the lady bird beetle, a beneficial insect predator.

- **Establish monitoring guidelines for each pest species.** Routine monitoring of both pests and natural enemies (beneficial species) is a critical part of IPM. Methods of monitoring include visual inspection, pheromone and sticky traps, and sweep nets. Document and track both pest and beneficial organism population numbers. The ratio of natural enemies (usually insects) to pests should be taken into account before a pesticide is applied.

- **Establish an action threshold for the pest.** A fundamental concept of IPM is that a certain number of individual pests can and should be tolerated. **Consider: What will happen if no action is taken?** Will the pest cause unacceptable damage to the value of the lawn or landscape? Sometimes the action threshold is based on economics. The **economic threshold** is defined as the pest population level that produces damage equal to the cost of preventing damage by controlling the pest. The threshold is the pest density, or population level, at which a control application should be made.

Urban landscapes are judged on their appearance and whether or not the presence of a pest presents a health or safety issue. The aesthetics and healthful condition of an individual plant or a whole landscape may be affected by pests. The presence of pests and their damage, though not serious, may be intolerable or annoying to some, yet readily accepted by others. Ornamental and turf IPM strategies are developed with emphasis on aesthetic thresholds. It is often the appearance of a pest or the damage it causes that triggers control actions. This is called the **aesthetic threshold**. The aesthetic threshold varies from person to person, making it difficult to establish control criteria for most landscape pests.

Sometimes, the action threshold is based solely on the emotions of the property owner. This is referred to as an **emotional threshold**. For many people, a single mouse, cockroach or spider is unacceptable. Many people fear pests and this triggers their need to implement control actions.

- **Evaluate and implement control tactics.** Select tactics that will be most effective, most economical and have least impact on non-target species and the environment. Select controls that will impact beneficial organisms as little as possible while suppressing the pest. If a pesticide is
Use the correct pesticide, one that is labeled for use on the plant and/or site, and one that will be effective on the identified pest.

one of the selected management tools, beneficial enemies (usually insects) will likely also be killed.

- **Monitor, evaluate and document the results.** This allows you to make adjustments to improve the effectiveness of future pest control strategies.

## Factors Affecting Pesticide Application Effectiveness

If the decision has been reached to apply a pesticide, there are many factors that affect the success of the application. Early detection can increase success. For example, applying herbicides to annual weed seedlings is far more effective than applying herbicides to mature plants. Mature plants are much larger, require more herbicide and are harder to control. It is important to regularly inspect the areas in your care and look for signs and symptoms of pests.

Correct timing and a thorough application of pesticide are necessary for good control. Pesticide applications should be timed to coincide with the times the pest is most susceptible. This could be the time of day, the time of year or the life cycle stage of the pest, or a combination of these factors. Applying pesticides in the wrong place or at the wrong time is a waste of time and money and has the additional potential to harm the environment.

Use the correct pesticide, one that is labeled for use on the plant and/or site. Make sure the pesticide will be effective on the identified pest. Use the correct amount applied by the correct method using the correct equipment. Take into account the weather, including temperature, wind speed and the potential for precipitation. Most pesticides are not effective below 50 degrees F and many tend to volatilize above 85-90 degrees F. Applying pesticides in windy conditions increases the risk of pesticide drift and reduces the amount of pesticide reaching target plants. Many pesticides require a drying period, so applying them when rain is forecast can be a waste of time and money. All these factors can diminish pesticide effectiveness and increase the potential for drift or other environmental damage.

## Insect Pests

Not all insects are injurious. Most are benign and many are beneficial. Identifying the insect first will reduce the chances of destroying a beneficial insect.

The insect pest and the degree of infestation should be determined before control measures are implemented. What insect is present, and how many
are there? What plant species is affected? It may be more expensive to apply a pesticide than to simply replace the plant(s) with a different type that is less likely to be damaged by insects. In some cases, the easiest and most effective control may be simply spraying water on the plant to remove insect pests. For example, aphids may be removed from plants by spraying them with a strong jet of water. This interrupts their life cycle and can reduce pest numbers significantly. While this method is often used on small or medium sized plants, it would not be as effective on large trees.

Knowing the life cycle of the insect pest helps you to identify when it is most susceptible to a pesticide. Some insects produce one generation per year and others may produce multiple generations each year. If multiple generations are likely, you may have to apply pesticides more than once in a given year. Review the insect section in General Knowledge: General Pest Problems in this manual for more information on insect life cycles.

It is important to consider what would happen if you did nothing at all. During the field inspection, did you identify predators or parasites that will provide biological control for the insect pest? If the infestation is small, it may be managed (but not eradicated) by letting nature take its course.

What are some indications that there may be an insect infestation? For ornamental plants, there are many. The following signs and symptoms may indicate an insect pest problem:

- Webbing, silk shelters or silk enclosures on foliage, indicating mites or caterpillars.
- Insect or mite remains, such as egg shells, shed skins, cocoons, trails of silk or excrement.
- Scale or aphid protective coverings, generally waxy substances.
- Honeydew, a sticky liquid excreted by some insect pests. Black, sooty mold may grow on the honeydew.
- Sawdust, wood chips or pitch balls found either on tree trunks or at the base of the tree trunk, indicating bark beetles or wood borers.
- Decline of the plant.
- Feeding damage.
- Holes in any part of the plant.

For above-ground turf insect pest infestations, damage to grass blades or stems can indicate an infestation. This damage may be due to sod webworms, army worms or cutworms.

Below-ground turf insect pest infestations are more difficult to identify. If you can grab a handful of grass and easily pull it up, it indicates the roots are damaged. Identification of what is damaging the roots is more difficult and
generally requires cutting and pulling up a portion of the sod. If no insects are present, the damage may be caused by one or more poor cultural practices: excess thatch, poor nutrition, inappropriate soil, lack of water, mowing too short or over-fertilizing, causing fertilizer burn. Disease may be the cause, as may dog urine spots and/or pesticide damage.

**Common Invertebrate Pests**

**Mites:** Mites are not insects. They are actually arachnids, related to spiders. They have eight legs, no wings, no antennae and two body parts. They are very small and are usually identified by the presence of fine, delicate webbing on the plant leaves, stems and trunk. Mites often appear under dry conditions. Mite damage often appears as bronzing of the foliage, which can give the foliage a dusty appearance. Severe infestations may lead to leaf drop. Mites can be controlled with insecticidal soaps, horticultural or “dormant” oils, and acaricides. It may be wise to alternate chemical control methods to reduce the chance of developing pesticide resistance in the mites.

**Aphids:** These small, soft-bodied insects are common problems. There are many species of aphids and most are plant or plant-family specific. They have piercing-sucking mouth parts and can be disease vectors. They can be green, black or red in color, and some excrete a white, waxy coating that obscures them from sight. A good portion of the sap they ingest may pass through them undigested and is then excreted on the plants. This liquid, known as honeydew, makes leaves sticky and can also host a black, sooty mold. Some aphids will also cause leaves to pucker, curl or twist. Small infestations may be reduced or controlled by a strong spray of water that knocks the adults off plants and interrupts their life cycle. Large infestations can be controlled with insecticidal soaps, horticultural or “dormant” oils, and many other insecticides. Read and follow label instructions.

**Scales:** These are also small, soft-bodied insects. Scale insects protect themselves by producing a waxy shell. The life cycle of these insects starts after hatching with an immature, crawler stage. The insects then find a likely plant host, lose their legs, excrete a waxy covering and live out their lives in that spot. Plants infested with scales appear sickly and lack vigor. Some scale insects produce honeydew. Control is best achieved during the crawler stage, before they produce the protective shell. A second treatment two to three weeks after the first is often recommended. Scales can be controlled with insecticidal soaps and many insecticides during the crawler stage. Control during the adult stage is more difficult. Horticultural or dormant oils will smother adult scale insects. Read and follow label instructions.

**Whiteflies:** These small white insects look like tiny moths. The larval stages of whiteflies are similar in appearance to scale insects. When an infested
plant is disturbed, the adult insects will fly up, but then settle back down. Both larval and adult whiteflies suck sap from leaves. Infested plants turn yellow, wilt and may die. These insects can also produce honeydew, which can make the leaves sticky and can also host a black, sooty mold. They can be controlled with insecticidal soaps and many insecticides. Read and follow label instructions.

**Thrips:** Thrips are tiny, slender insects with rasping-sucking mouth parts. Adults can be yellow, brown or black and have two sets of feathery wings that are held flat on their backs. Immature thrips resemble adults, but are lighter in color and have no wings. They feed on foliage and flowers. Thrips-infested plants may have streaked or silvered foliage. Flowers may be deformed and flower petals may show brown edges. The flower buds may drop off the plant or fail to open. Control is difficult because thrips continually migrate and re-infest plants. Thrips are known vectors of some plant diseases. They are difficult to control, but some control can be achieved with insecticidal soaps and many insecticides. Read and follow label instructions.

**Beetles:** Beetles belong to the order Coleoptera, which is the largest order of insects. Beetles have two pairs of wings. The front pair is generally hard or leathery and the wings meet in a straight line down the center of the back. Beetles may attack any part of a plant and they may do damage at any stage in their life cycle. Some beetles do damage as adults, some as larva (grubs), and some do damage at all life stages, but on different parts of a plant. Some feed only at night and some feed during the day. Because there is such a wide variety of beetles, it is very important to identify the beetle and its life stage. Read and follow label instructions when using insecticides.

**Japanese beetle:** These beetles are less than ½-inch long, with shiny brown wing covers over a metallic green body. Tufts of white hair rim each side of its body, sticking out from under its wings. The larvae are small. White grubs have brown heads and dark tail ends. The adults chew the flowers, leaves and fruit of hundreds of ornamental and fruit-producing plants. The larvae feed on the roots of most plants, seriously damaging lawns, landscapes and gardens. They have not been reported in Nevada to date, but are designated as an “Alert” organism. If they are found, a sample must be taken and the discovery must be reported to the Nevada Department of Agriculture State Entomologist.

**Bronze birch borer:** As the name implies, these insect pests target all species of birch. The adult beetles are ½-inch long, hard-shelled and slender. They are brown with a greenish tint. The larvae are creamy white, slender and flattened. The larvae are responsible for damage to trees. They bore through
the bark to the cambium layer, creating long, winding galleries. Feeding results in raised bumps or welts on the surface of the bark. The feeding larvae damage tissues, interrupting the flow of water and nutrients in the tree. This causes yellowing and thinning of the leaves in the upper crown or marginal burning or browning of the leaves on affected branches. Eventually, the affected tree dies. The larvae pupate within the trunk and large limbs of the birch tree. They emerge as adults through a 1/8-inch D-shaped hole they cut in the bark. The best control strategy is prevention. Maintain healthy trees, as the borers target stressed trees. Mulch to moderate soil temperatures and conserve soil moisture. Woodpeckers and a Chalcid wasp (*Phasgonophora sulcata*) are biological controls. Pesticides may be applied to kill egg-laying adults and larvae before they enter the bark. Once the larvae enter the bark, systemic pesticides are the only effective chemical control. Affected limbs can be removed from the tree. Remove and destroy dead trees or pruned limbs.

**True bugs:** True bugs belong to the order Hemiptera. Their wings form an “X” when folded on their backs. This group is very diverse and includes many beneficial predatory insects. They have piercing-sucking mouth parts and go through simple metamorphosis, which means they have a nymph stage that looks very similar to the adult stage, but without wings. This group includes box elder bugs and stink bugs.

**Box elder bugs** are nuisances that cause little actual damage. They can make outdoor living and entertaining difficult and they may also try to move into homes as the weather cools in the fall. They prefer box elder or maple trees. They feed on tree litter, especially seed pods, and will overwinter in yard litter. Good sanitation can help reduce the population of box elder bugs during the following year.

There are several varieties of **stink bugs**. They feed on a variety of plants, resulting in to seedling death and stunting of plants. As they feed on plants, they leave a brown liquid called frass, a mixture of excrement and honeydew, which dries to brown spots. They overwinter on plants and in plant debris, so sanitation can help reduce populations.

**Caterpillars:** Caterpillars are the worm-like larval stage of moths or butterflies. They have distinct heads and several pairs of fleshy legs on their bodies. They may be fuzzy, smooth or spiny. They are primarily foliage feeders, so damage consists of irregular holes, ragged edges or entirely stripped leaves. They tend to damage tender new growth. They may also form protective shelters or coverings out of silk or fine webbing. The shelters may harbor the caterpillars continuously or they may feed outside the shelters and return to the shelters for protection from weather, predators,
etc. Caterpillars are also referred to as webworms, tent caterpillars, leaf rollers, leaf folders, bagworms or leaf miners. When only a few caterpillars are present, hand picking is an effective method of control. Larger infestations may call for chemical controls. A single treatment applied when the caterpillars are young usually gives very effective control.

**Sawflies:** Sawflies are wasp-like insects that lack the very constricted abdomen. They are related to bees, wasps and ants. The larvae of sawflies resemble naked caterpillars. Some even appear slug-like, such as the pear slug and rose slug. Depending on the species, the larvae are foliage feeders, consuming the whole leaf, or skeletonizers, consuming the portion of the leaf between the major veins. Other species are wood borers or leaf miners. When only a few sawfly larvae are present, hand picking is an effective method of control. Larger infestations may call for chemical controls. A single treatment applied when the larvae are young usually gives very effective control.

**Bees and wasps:** These are mostly beneficial insects that can become nuisances if they set up housekeeping too close to human habitation.

### Plant Diseases

Good management is the best way to prevent plant disease. This is extremely important to remember when dealing with ornamentals and turf. Unlike production agricultural crops, plant breeding and selection for ornamental plants has been based more on specific horticultural characteristics than on disease resistance. Most management techniques are designed to achieve some selected norm for each ornamental and turf species. Review the general sections of the manual for a full description of plant pathology principles and concepts.

There are six major principles of plant disease management:

- Exclusion
- Eradication
- Protection
- Resistance
- Therapy
- Avoidance

These six principles are discussed in detail in the General Knowledge: General Pest Problems section of this manual.

Successful plant disease management considers all of the potential control methods:
A disease is defined as any impairment of plant health or condition of abnormal functioning.

Root rot and crown rot problems are very common on shade trees and on many conifers used as ornamentals. In most cases these problems occur due to mismanagement.

- Prevention
- Cultural controls
- Physical or mechanical controls
- Biological controls
- Chemical controls

Most plant disease management plans include a combination of two or more control methods. Chemical controls are often used to manage diseases in ornamental plants and turf and include both soil treatments and/or treatment of growing plants.

A disease is defined as any impairment of plant health or condition of abnormal functioning. Plant diseases manifest as a number of symptoms:

- **Rot** is decay or disintegration of plant tissue. It can be caused by hundreds of different bacteria or fungi.
- **Blight** is any plant disease that results in withering and killing of leaves, flowers and shoots.
- **Canker** is a disease of woody plants that causes localized damage to the bark of the plant. It can be caused by fungi or bacteria.
- **Gall** is an abnormal outgrowth of plant tissues. This disease can be caused by fungal or bacterial infections or insects.
- **Wilts** are plant diseases characterized by drooping and shriveling, usually caused by vascular pathogens, such as Fusarium.
- **Rusts** are plant diseases that produce reddish-brown pustules on leaves and stems. Rusts are caused by various rust fungi.
- **Smuts** are destructive diseases of plants, especially cereal grains, that produce black, powdery masses of spores. Smuts are caused by fungi.

**Ornamental plant diseases**

- **Root Rot**: This is a common problem in ornamental plants. Root rot is caused by a number of different fungi species in the *Phytophthora* or *Pythium* genera. Although root rot is caused by fungi, the condition is almost always associated with poor cultural practices that result in waterlogged plant roots. These practices include inadequate drainage, improper planting depth and/or incorrect water management. Correcting cultural practices must be part of the management plan, along with other controls, including chemical controls.
- **Crown Gall**: This disease is caused by bacteria and affects many ornamentals. The bacteria are present in the soil and can remain viable for years. It causes abnormal growth on the roots and trunks or stems of infected plants. Mechanical injuries, such as lawn mower or string weed trimmer damage, create an entry site for this disease. Prevention strategies include minimizing injury to limit entry sites for the disease.
and managing plants to reduce stress. Chemical controls are also available.

- **Fire Blight** occurs in a number of plant species, but is very common in roses, apples and pears. It is a bacterial disease that is spread by pollinators and rain splash. It first appears in the blossom clusters as wilting and collapse of the cluster. Diseased tissue produces brownish, sticky exudates. The tips of the infected, young succulent growth shoots curve into a characteristic shepherd’s hook and appear to have been burnt. Warm, wet spring weather is ideal for disease development. Remove diseased plant parts and prune back to healthy wood. Dispose of infected plant materials. Use streptomycin or copper spray formulations during bloom to help prevent infestation.

- **Verticillium Wilt** is a fungal disease that plugs the water-conducting tissues, causing premature yellowing and death of the foliage. Look for a tan discoloration of the vascular tissues in cut stems of infected plants. This fungus infects the root system through root hairs and wounds. Wounds can be mechanical or caused by insect or nematode injury. Planting resistant cultivars, controlling insects and nematodes and good sanitation will help control this disease. Fungicide treatment offers effective control.

- **Leaf Spots**: Fungal leaf spots, also known as anthracnose, scab, leaf blotch or shot hole, affect many ornamental plants. The disease manifests differently in each plant species, but some generalizations can be made. Many spots are brown or black in color. Many have a distinct margin and are surrounded by a yellow halo. The spots may be circular or irregular in shape. The disease may progress to affect the entire leaf. Leaf drop can occur. Infected leaves that fall and remain in place provide a habitat for fungal spores to overwinter. Leaf spots first occur on the lower leaves, generally in the spring or fall when moisture is high. The disease is spread through wind and rain splash. Cultural controls include cleaning up leaf debris to remove infected leaves, removing diseased plant parts and planting resistant varieties. Foliar applications of fungicides can aid in controlling established infections.

- **Powdery Mildew**: This fungal disease affects almost all ornamental plants, with some species being more susceptible than others. Infected plants commonly show a white or gray layer of fungus growth on the surface of the leaves, stems and flower bracts. Powdery mildew is a common disease of roses, oaks, lilacs and many other ornamental plants. The disease flourishes under moist, cool conditions. Spores can be spread by wind and rain splash to new plants. The fungus can overwinter in plant debris. Cultural controls include planting resistant varieties, good
sanitation (cleaning up and removing plant debris) and avoiding overhead watering. Chemical controls include foliar applications of fungicides.

Turf Diseases

Turf areas present their own problems in landscapes, golf courses or recreational areas. Vigorously growing turf is usually less severely damaged by diseases and recovers more quickly from them. Good cultural practices help to limit most turf diseases. Whenever possible, plant disease-resistant varieties of turf. Thatch and aerate to reduce stress and favor vigorous turf growth. Water deeply and infrequently to promote deep root growth. Try to water early in the morning rather than in the afternoon or evening. Inspect turf often to identify problems early, when they are more easily managed. Rotate the use of fungicides to reduce the possibility of developing fungicide-resistant strains of pathogens.

- **Brown Patch (*Rhizoctonia solani)*: Brown patch is a common fungal disease of grasses, especially fescues and perennial ryegrasses. The disease generally starts from the top of the leaf blade and moves downward. It occurs in light brown patches in lawns, from a few inches to several feet in diameter. The edges of the dead area may have a gray “smoke ring” appearance. Brown patch is favored when daytime highs exceed 80 degrees F and nighttime lows are in the mid-60 degrees F. High humidity and large amounts of nitrogen also favor the disease. Plant resistant turf varieties, control fertilizer applications and maintain a healthy lawn to prevent infestation. For chemical control, use fungicides. Read, understand and follow label instructions.

- **Sclerotinia Dollar Spot (*Sclerotinia homeocarpa)*: Dollar spot affects a wide range of grasses. It is active throughout the growing season, especially when there is low soil moisture and an excess of dew or fog. It most commonly occurs in the spring. The disease commonly forms small white patches, 1-inch to 3-inches in diameter. Individual grass blades show spots that are tan with reddish edges that start at the leaf margins. The lesions may grow across the grass blade, forming girdling lesions that kill the blade tip. To prevent infestation, control soil moisture and maintain a healthy. Chemical controls include fungicides. Read, understand and follow label instructions.

- **Melting-Out (*Dreschlera ssp. and Bipolaris ssp.)*: Another common fungal turf disease in Nevada is called melting-out disease. From a distance, the affected patches of turf appear yellowed, as if they are drought-stressed. The disease starts as eye spot lesions on individual grass blades in the spring when temperatures are cool. As the weather becomes warmer and drier, the roots and crowns of grass plants can be
affected, with patches of turf dying off or “melting out.” Cool, wet weather during the spring followed by drought in the summer favors development of this disease. Prevent this disease by controlling soil moisture and maintaining a healthy lawn. Fungicides provide chemical control. Read, understand and follow label instructions.

- **Pink Snow Mold (Monographella nivale):** Pink snow mold is a fungus that grows under cool, wet conditions. It can begin growing under snow cover in turf areas, hence the name “snow mold.” It is active across a wide range of cool temperatures (32 to 65 degrees F), but temperatures above 70 degrees F inhibit the growth of the fungus. The disease first appears as a small circular area that rapidly expands. The crown or basal area of the dead stems appears pink or purple and grass blades may take on a pinkish cast in early morning light. The mycelia of the disease are pink to white. The fungus survives in plants and plant debris as dormant mycelia. Prevention consists of good sanitation, controlling soil moisture and maintaining a healthy lawn to prevent infestation. Fungicides provide chemical control. Read, understand and follow label instructions.

- **Fairy Ring (Marasmius oreades and Lepiota spp.):** Fairy ring appears as a discolored circular patch of grass with a dark-green outer band. The dark-green band is darker than the grass in the center of the ring and the unaffected grass outside of the ring. The grass inside the dark green ring commonly dies. The mycelium of the fungus responsible for this disease is water-repellent. The mycelia grow through the pores in the soil, preventing water from reaching the turf roots. As a result, the turf roots dry out and eventually the affected turf dies. The dark green color of the grass in front of the brown, dead or dying turf results from nitrogen the fungus releases as it decomposes organic matter in the soil. A second type of fairy ring may show only a ring of mushrooms (the fruiting structures of the fungus) and no discoloration of the lawn inside the ring. Prevention consists of providing adequate soil moisture, as the fungus prefers to grow in dry soil. Maintain a healthy lawn to prevent infestation. Do not bury lumber, stumps or other wood products in lawn areas, as these materials promote fungal growth. Mechanical control consists of drilling or aerating the affected patch and adding water and, if possible, a wetting agent to keep the soil moist. Fungicides provide only partial control of fairy ring.
Weeds

General information on weeds is covered in the General Knowledge: General Pest Problems section of this manual. Please refer to that chapter for a discussion of the stages of plant development and plant life cycles.

It is impossible to describe and discuss every weed you may encounter in Nevada in this publication. However, it is essential to identify the weed, its lifecycle and its stage of growth in order to formulate an effective weed management plan. There are many resources available to help you identify weeds. The Nevada Department of Agriculture and the University of Nevada Cooperative Extension can help identify weeds. Many books contain pictures and descriptions of weeds. There is great variability in Nevada’s climate. Weeds found in southern Nevada can be very different than those in northern Nevada. Not all weeds that occur in the Las Vegas area occur at Lake Tahoe, and vice-versa. It is best to consult sources specific to your geographic area. There is a wealth of information available on weed identification on the Internet, but use caution and only trust information from reputable sources. Most University resources have been reviewed for accuracy.

It is important to understand some of the living dynamics of plant growth to understand how herbicides work and the different ways they may affect plants. Plants consist of roots, stems or trunks, and leaves. Water movement in most plants is from the roots upward through the trunk or stem and into the leaves, where transpiration occurs. Plants produce their own food or carbohydrates through photosynthesis. Movement of this “food” is from the leaves downward through the trunk or stem to the roots.

Weed control strategies

Most effective weed management plans include two or more control strategies. Weed control can be split into five separate categories.

- **Prevention**: Prevention includes such practices as using certified weed-free seed, hay, transplants, amendments and mulches. To prevent the spread of weed seed and weed plant parts from one area to another, clean equipment between uses. Prevention also includes removing weeds before they can form seedheads or spread by other methods. It is more difficult to prevent weed seeds from blowing in from adjoining properties.

- **Cultural controls**: Cultural controls are management practices that reduce the incidence of weed infestations. Cultural controls include using proper planting times and planting rates, planting materials that are well-adapted to Nevada’s climate, and managing fertilization and
irrigation to favor desired plants rather than weeds. Another cultural practice that will help control weeds in turf areas is to mow the grass high. Mowing high shades grass plant roots and helps to conserve soil moisture. It also prevents weed seeds from sprouting and growing and encourages deeper root growth. All these factors contribute to healthier lawns.

- **Mechanical/physical controls**: These controls include tillage, hoeing, mowing, hand-pulling, mulching, etc.
- **Biological controls**: Biological control is the use of a living organism to control a pest. Success depends upon selectivity, reproduction, adaptation, and ability of the organism to reach a high level of effectiveness.
- **Chemical controls**: Chemical control is the use of pesticides, in this case, herbicides, against a target pest (weeds). Many herbicides are available. In order to be effective a herbicide:
  o Must contact the plant (leaves, stems, trunks, roots, etc.).
  o Must remain on the plant surface long enough to penetrate or be absorbed.
  o Must reach a living site to disrupt a vital process or structure.
  o Must be able to kill the target weed.

### Noxious Weeds

A noxious weed is a plant that has been defined as a pest by law or regulation. This designation requires that land owners control noxious weeds growing on their property. If a plant is found to be detrimental or destructive and difficult to control or eradicate, the Nevada Department of Agriculture (NDOA) can recommend to the state board of agriculture that the plant be designated as noxious. Nevada’s noxious weed list can be found at [http://agri.nv.gov/Plant/Noxious_Weeds/Noxious_Weed_List/](http://agri.nv.gov/Plant/Noxious_Weeds/Noxious_Weed_List/).


### Vertebrate Pests

Vertebrate pests are those pest animals that have backbones. Specific control measures vary for different species and are discussed in the sections for individual species.
Common vertebrate pest control practices:

- **Exclusion**: Exclusion is the practice of keeping the pest out or away from trees, ornamental plants, gardens and lawns by using barriers such as exclusion fencing, tree guards and netting.
- **Sanitation**: Eliminate food and water sources. Store food and animal feeds, grain and seed in rodent-proof containers. Repair leaky pipes.
- **Trapping**: There are several types of kill traps and live traps available for most vertebrate pest species. Choosing the proper trap and learning the correct way to use it is essential. It is illegal to live trap and release vertebrate pests. Individuals who release live trapped animals are relocating the pest problem and any diseases they host, such as rabies, distemper or plague. Live trapping followed by an approved method of euthanasia is recommended. The American Veterinary Medical Association has specific guidelines for euthanasia.
- **Repellents**: Repellents may be applied to valuable vegetation or can be used in areas that pests are known to frequent. They often don’t work as effectively as expected. Sunshine can break down the repellent, and sprinklers and rain can wash away the product. New growth on plants must be retreated and animals may simply get used to the repellent.
- **Rodenticide baits**: Baits, such as seeds, grains and vegetation treated with rodenticides, are used to control several types of vertebrate pests. Most baits must be applied in bait stations or underground within animal burrows to lessen the risk of killing non-target species. Pesticide labels describe methods for applying the bait. Pesticides used include strychnine, zinc phosphide and various anticoagulants. Strychnine may only be applied underground.
- **Fumigants**: Aluminum phosphide fumigants are available either as tablets or pellets. Their use is limited to insects which infest stored commodities and control of burrowing pests. Use of these products is strictly prohibited on single family and multi-family residential properties, nursing homes, schools (except athletic fields), daycare facilities and hospitals. When applied in rodent burrows, they produce phosphine gas, which is deadly. Applied improperly, aluminum phosphide has resulted in numerous human deaths. To purchase, apply or supervise the use of this pesticide, applicators must successfully pass the state rodent burrow fumigation certification category.

Specific Vertebrate Pests:

- **Ground squirrels**: Four species cause damage to crops and ornamental plants in Nevada: Richardson’s, Belding’s, Townsend’s and California ground squirrels. They may also damage irrigation lines by chewing or damage landscape and buildings by burrowing. The best time for control
is after emergence from hibernation in early spring. At this time of year, there is little green vegetation, so ground squirrels are more likely to accept rodenticide baits. Also, at this time of year, they have not yet mated and given birth. If control is postponed until later in the spring, there is green vegetation available and the ground squirrels are less likely to accept rodenticide baits. Advanced planning and preparation are essential. Attempting to control squirrels after they have reproduced can be frustrating, expensive and practically impossible. In order to eliminate exposure to non-target species, product labels for some rodenticide baits require application in bait boxes. Live trapping followed by euthanasia is also used to control ground squirrels. Check traps often and use caution to prevent unintended injury or death to non-target species. Strychnine bait, a restricted use pesticide, is well accepted but it may be used underground only to protect non-target species. When applying grain baits, pesticide labels advise users to pre-bait. This is the process of applying untreated grain and monitoring to see if the animal takes it. If the animal isn’t taking the untreated bait, it won’t take the treated bait. As these animals can be carriers of bubonic plague and other diseases, use care in handling sick or dead animals.

- **Marmots or rock chucks:** Marmots cause damage by consuming ornamental plants and burrowing. Common along the Eastern Sierra, these animals tend to like areas with large boulders, which provide cover. Many landscaped areas, such as golf courses, provide the perfect mix of vegetation for food and boulders for cover. Control is similar to that for ground squirrels. Use live trapping and subsequent euthanasia, zinc phosphide baits or strychnine bait. Use caution when using strychnine, especially in urban areas. It must be applied underground to reduce the potential for harm to other wildlife and dogs. Strychnine is especially poisonous to dogs.

- **Moles:** Moles are insectivorous and are not a serious problem in Nevada. They eat soil-dwelling insects as well as other invertebrates like worms. Often found in urban areas, moles cause damage by building shallow surface tunnels that dislodge plants or push up turf. Trapping controls moles. Soil insecticides may be used to reduce the mole’s food supply. This may encourage them to move off a property.

- **Pocket gophers:** Pocket gophers live underground and damage crops and ornamental plants by feeding on roots and sometimes foliage. Their burrows also cause damage to farm equipment and sprinkler systems. Gopher activity produces fresh mounds that are typically horseshoe-shaped. Burrows are found 4 to 10 inches below the soil surface. Strychnine grain bait, a restricted use pesticide, is most effectively
applied in fall or early spring. The bait must be applied below ground. Hand-apply or use in a burrow builder for large areas. Synchronize application with neighbors for best results. Anticoagulant and zinc phosphide baits are also available. Trapping with kill traps is another commonly used control method for pocket gophers.

- **Mice and rats:** These rodents eat and contaminate food and animal feed. They will both defecate and urinate on food and feed. They feed on alfalfa crowns and damage forage, seed and ornamental plants by girdling. They also cause structural damage by chewing both wood and wiring. They carry diseases contagious to humans, such as Rickettsial pox, bubonic plague and leptospirosis. No control method will be successful unless mice and rats are excluded from entering the site. Seal any opening over one-quarter-inch in size. Use good sanitation practices to remove any food supply that may attract these rodents, including seed for planting. Use rodent-proof containers to store all food and animal feed to prevent attracting and feeding these pests. Anticoagulant baits are most commonly used. Use care in placing baits. Pesticide baits must be applied in approved bait stations. Snap traps can be effective, provided exclusion measures are also put in place. Baits for trapping include peanut butter plus oatmeal, bacon, gumdrops (for mice), nutmeats and dried fruit. Both rat and mouse urine fluoresces under UV light. This characteristic can be used to locate their trails and commonly frequented areas. Bait and trap in these areas. Check traps daily and use care when handling dead rodents.

- **Voles:** Voles are also referred to as meadow mice or field mice. They eat a wide variety of plants including grasses, forbs and seeds. When populations are high, voles cause damage to cropland and turf by constructing tunnels and surface runways. They eat bark, primarily in the fall and winter. This can cause severe damage to trees and shrubs by girdling the trees. Voles breed throughout the year and may have five or more litters of young annually. Populations fluctuate and may reach extremely high densities. Habitat modification and toxicants are the primary means of vole management. Remove ground cover, weeds and litter around croplands to reduce populations. Zinc phosphide is the most common rodenticide used for vole control and is available on grain bait. Pesticide labels require that zinc phosphide baits be applied in burrows and runways. Some product labels require the use of bait stations.

- **Blacktailed jackrabbits:** Jackrabbits cause damage by feeding on crops and ornamental plants. A cut to stems or branches at a 45-degree angle is typical of rabbit damage. Jackrabbits don’t hibernate, so they are
active all year long. They have cyclic populations and will travel long
distances for food. The best control is exclusion. Jackrabbits are not
easily trapped. Since they generally come in from surrounding lands,
trapping and removing one simply allows another to take its place.
Exclusion fences are recommended around lawn areas, ornamentals and
gardens. Shooting is an option as blacktailed jackrabbits are not
protected, but it must be done only where it is safe and legal to do so.
Repellents only provide temporary protection and must be reapplied on
a regular basis, especially after rain or irrigation water washes it away.
There are no registered poisons or fumigants for use on rabbits in
Nevada. Strychnine, a restricted use pesticide, is no longer registered for
jackrabbit control.

- **Cottontail rabbits and whitetailed jackrabbits:** Cottontail rabbits and
  whitetailed jackrabbits are usually considered pests in the landscape.
  Control is similar to that for blacktailed jackrabbits. Exclusion is the best
  control option. While they can be trapped, trapping is not the best
  control method, and there are no toxicants registered in Nevada for
  control of either of these rabbits. The information provided for
  jackrabbits applies to both of these rabbits as well, with one exception:
  cottontail rabbits and whitetailed jackrabbits are game species in
  Nevada. Since they are designated game species, they can only be
  hunted during cottontail rabbit and/or whitetailed jackrabbit hunting
  season, and you must have a hunting license.

- **Birds:** Droppings, disease potential and consumption of crops and
  livestock feeds all make pests of certain birds. Caution must be used
  when dealing with bird pests, as many birds are protected under the
  Migratory Bird Treaty Act (MBTA). As with all other pests, you must first
  identify the pest causing your problems. The following common bird
  pests are not protected by the MBTA:
  - **Pigeons (Rock doves):** Pigeons were introduced to the U.S. as
domesticated birds and are now found throughout the country. They
  rely on human activities to provide them with food and shelter and
  have become serious pests in agricultural and urban areas. Pigeons
  feed on grains, seeds, and garbage. Humans also feed them
  intentionally. Damage also results from the accumulation of pigeon
  fecal material and filth deposited in areas where they nest, roost and
  loaf. Pigeons assemble sticks and twigs to form crude nests that are
  built in on or on buildings and other structures, such as billboards.
  Breeding occurs year-round but peak reproduction is in the spring
  and fall.
  - **House sparrows:** House sparrows were introduced to New England
in 1850 and have spread throughout the North American continent.
They prefer human habitats, especially urban and farm areas. House sparrows feed mainly on grains and seeds but garbage and other refuse contribute significantly to their diet. Breeding can occur any time, but commonly from March through August. Problems are result from feeding activities and fecal contamination in feed storage areas as well as inside and outside of other buildings.

- **European starlings**: These birds were introduced to North America in the late 1800s. Starlings cause problems at livestock facilities and in urban areas by consuming fruits and livestock feed. Holes or cavities in trees and structures serve as nesting sites. Large roosts in buildings and trees cause health concerns and other problems due to filth, noise and odors.

**Bird Management**: Exclude birds from nesting sites by closing openings that are larger than \( \frac{3}{4} \)-inch. Eliminate access to nesting and roosting sites by installing barriers, such as metal, netting or needle strips (porcupine wire). Roosting sites, such as ledges, can be eliminated by changing the angle to 45° or more. To discourage birds use tactile repellents, such as sticky bird glue on ledges and roosting areas. Recreational bird feeding attracts pest species. Limit the availability of food by storing livestock and other food in bird-proof facilities and containers. Prevent access to water sources.

Pesticides used for bird control are called avicides. These products are applied on baits and are classified as restricted use pesticides. Bait material may include small grains and whole kernel corn, depending on the bird species. The process of pre-baiting is recommended on avicide labels.

## Conclusion

The most important factor in ornamental and turf pest control is to identify the pest. This is true for all pest control activities, regardless of the pest, category or site. Pest managers should identify the pest, understand its life cycle and identify other host plants before they try to control it. Another important consideration is the goals for the landscape. A low-maintenance landscape will have different management strategies than an arboretum or park.

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