Category 2: Pest Control on Forest and Rangelands

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

Pest Control on Forest and Rangelands Learning Objectives

After studying this section, you should be able to:

- Define the major forest and rangeland use objectives.
- Describe the different types of forest insect pests based on the type of feeding damage they inflict.
- List the most common forest diseases.
- Apply Integrated Weed Management (IWM) on rangelands.
- Identify the different control methods available for rangeland IWM.
- Describe the most common vertebrate pests that impact forests and rangelands in Nevada and control strategies for each.

Category 2, Pest Control on Forest and Rangelands

Recent changes in Nevada’s legislation limit forest and rangeland 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
Category 2, Pest Control on Forest and Rangelands, covers insects, plant pathogens, weeds and vertebrate pests that cause damage on or interfere with land use on forest and rangeland sites. Nevada covers more than 100,000 square miles and a significant portion is made up of forests and rangelands. Nevada’s forests and rangelands provide valuable forage and habitat for livestock and wildlife. Recreational activities are also important land uses. Applicators must consider various land use practices and resources associated with these lands when developing pest management strategies.

The primary pests on these sites are weeds and insects. Plant pathogens and burrowing rodents are less frequent but can become pest problems. Pesticides are useful tools but must not interfere with other land management strategies. In order to accomplish effective pest control, applicators should take into account all land uses, consider all control methods available and apply pesticides according to label instructions.

**Forest Insect Pests**

Native and exotic species present unique threats to forests and wildlands. Most pest species are only occasionally important in forests. The damage resulting from chronic outbreaks is often dependent on the management history and environmental conditions when the outbreak occurred. Also, insect species that attack abundantly planted younger trees in already established areas are usually of less concern than those attacking the more valuable and less numerous mature trees.

Forest insect pests are usually grouped by how they feed and the location on the tree where they feed. Pest control is targeted accordingly.

- **Defoliators**: These are chewing insects that attack and remove foliage from trees. Defoliation of evergreens is much more serious than defoliation of hardwoods. Evergreens often die from a single year of attack, whereas some hardwood trees can withstand one or two defoliations in a single year or repeated defoliation over two or three consecutive years. Outbreaks of defoliators usually develop slowly and are often recognized by land managers late or near the peak of the outbreak.

Native defoliators include Douglas-fir tussock moth (occurring in eastern Nevada, Pioche area), various sawflies, tent caterpillars, chafer beetles and various leaf beetles. In North America, the primary introduced defoliator...
of forests is the gypsy moth. This moth was intentionally brought into the U.S. It then escaped and became a major pest of deciduous trees in the eastern U.S. In recent years, established populations have been found in Oregon and California. Individual male gypsy moths have been trapped in many western states, including Nevada.

Control of defoliators can be difficult. Outbreaks may cover wide expanses of up to one million acres or more, and may be recurrent and progressive. It is against this group of insects that most chemicals are applied in forest areas. Leaf-feeding insects can be easily controlled in the forest habitat with aerially applied chemicals. Many can also be controlled with various biological materials, including bacteria and viruses.

- **Cambium and Phloem Feeders:** This group is the most destructive group of forest pests. These insects feed on the water- and food-conducting tissue of trees. Most are secondary pests that attack stressed and dying trees, although a few, especially bark beetles and some flatheaded borers, may attack and kill healthy trees. Death of trees usually results from the girdling of the cambial tissue, but the introduction of disease may also kill trees (e.g. Dutch elm disease). Other insect pests in this group include pitch moths and round headed woodborers.

Chemical sprays applied to individual trees prior to infestation or while infestation is not advanced can afford protection to highly valued trees, especially in the urban environments. The chemical should be applied as high as possible on the trunk and coverage should include the lowest branches if possible. Trap trees and selective thinning or salvaging of infested trees can be used on larger infestations in forested areas. The latter method is the primary method of controlling bark beetle infestations. Bark beetle populations can also be effectively monitored with the use of pheromones for the specific type of beetle. Pheromones can also be used to enhance the effect of trap trees.

- **Shoot and Root Feeders:** These insects are the most important insect pests in the nursery and Christmas tree industries. They seldom kill trees (except small seedlings) but can cause deformity in tree growth that is important both to the lumber and Christmas tree industries. Severe damage can cause a reduction in growth.

Insects that are common pests in this group include tip moths, pine sheath and needle miners, white grubs and a variety of weevils. Control of these pests is difficult. Few, if any, effective controls exist for root-feeding insects. Timing of chemical application to coincide with the...
vulnerable life stages of the shoot-feeding insects is very critical. Mechanical control (removing tips) on small areas may be effective but is expensive and time-consuming. Cultural controls, such as site selection and delayed planting, can help control some of these pests. One newly introduced shoot feeder is the Nantucket pine tip moth. It was first found in the Las Vegas area on pines from California. This insect has the potential of becoming a very serious pest of pines. It commonly prefers smaller trees and can cause severe tip damage if not controlled.

- **Sap Suckers**: This group includes mites (not insects), aphids, scales, mealy bugs, spittlebugs and plant bugs. These pests extract food from the plants through sucking mouthparts. This often results in the infested tree having a dry appearance. Trees often drip honeydew from the insects. If infestations continue, defoliation can occur. With evergreens, this is usually seen as loss of the two- to four-year old needles. The trees start taking on a sparse appearance. Deciduous trees generally lose their leaves and if the infestation continues, the new leaves will be much smaller than normal. Death of all trees usually results only from continuous infestations. Outbreaks of many of these pests are often directly correlated with man's activities in the infested area. Biological control agents offer some control, but more detailed studies are required to develop improved methods in this area.

### Forest Disease Pests

Disease control in the forest environment is generally based upon management decisions designed to reduce loss. Cultural practices that produce the most vigorous stands of forest species also tend to reduce incidence of disease. There are several disease control practices that apply to forest nursery production. Only a limited number of recommended disease management practices involving chemicals apply to the urban environment.

- **Dwarf Mistletoe**: Seed-producing parasitic plants commonly called dwarf mistletoe cause one of the most important diseases of western forest conifers. Most of the dwarf mistletoes are host specific; that is, each species of mistletoe has its own host or group of host conifers. They live only as parasites on living conifers from which they absorb water, minerals and organic compounds from the phloem and xylem.

  Dwarf mistletoes suppress tree vigor and growth. This results from a gradual reduction of the effective needle surface of the tree and a disturbance of the tree’s normal physiological processes. Damage by dwarf mistletoe is recognized in four general categories:

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**Sap-sucking pests**

include mites, aphids, scales, mealy bugs, spittlebugs and plant bugs.

**Dwarf mistletoes**

are host-specific parasitic plants.
- **Reduced incremental growth.** This may be 75 percent in some species.
- **Increased mortality.** This is often very high in young trees.
- **Lower timber quality.** Increased cull of logs or degradation of lumber.
- **Indirect losses.** Affected trees are predisposed to attack by opportunistic insects and fungi.

Dwarf mistletoes spread by seeds that are forcibly ejected from a capsule. This ejection system is a very efficient means of seed dispersal; 50 to 75 feet of dispersal is common. In addition, seeds have a very sticky surface and remain where they hit. If they land on a susceptible host, a new disease cycle is initiated. Mistletoe plants are perennial and will produce seed for many years. Mammals and birds also move seeds to new areas.

Management of stands infected with dwarf mistletoe is difficult. It is important to remove infested overstory trees, keep stands as even in height as possible, and in some cases clear-cut the stand. In individual high value trees, pruning out infestations is an effective control practice. Replanting no-host species is a viable alternative where mistletoe infestations are severe.

- **Cytospora canker:** This fungal disease of poplars, cottonwoods, willows and some other shade trees is a common disease in Nevada. Pruning out infected branches and destroying them will help control this disease. It is important that trees not be stressed for water by drought or stressed by other factors in the establishment phase, as this increases their susceptibility to infection.

- **Forest nursery diseases:** Disease problems common in the forest nursery environment can be summarized as follows:
  - **Root and soil-borne diseases:** *Fusarium* root rot, damping-off, black root rot of pine, *Phytophthora* root rot, crown gall and some nematodes are examples of this group. Seed treatment with certain chemicals has given some control. Soil fumigation with various formulations has been relatively effective. Disease incidence is dramatically increased by overwatering or improper drainage.
  - **Foliation, stem and branch diseases:** *Phomopsis* canker, white pine blister rust, *Lophodermium* needle cast, *Cercospora* blight of juniper, and *Cytospora* canker of poplar are examples of this group. Various

Chemical formulations change all the time. Consult your local dealer for recommendations for your particular pest and site.
protective fungicides have provided control for some of these problems. Cultural practices can reduce disease incidence. Avoid wetting foliage, promote a dry microclimate between nursery stock, isolate or destroy diseased nursery stock, and practice conscientious sanitation.

**Forest and Range Weed Pests**

Properly managing for current and potential weed infestations on Nevada’s vast rangeland is vital to protect and preserve rangeland health. There is a smaller amount of forest land, but weed management is equally important on these sites.

Undesirable native woody and herbaceous vegetation as well as noxious weeds, which are usually non-native invasive plants, may infest grazing lands and recreational areas. State law defines a noxious weed as any plant that is detrimental or destructive and difficult to control or eradicate. Landowners and managers are required to control noxious weeds on their lands; therefore ranchers, farmers and resource managers should be familiar with weeds that are considered noxious. A current listing of state-designated noxious weeds and laws regarding their control may be obtained from the Nevada Department of Agriculture, [http://agri.nv.gov/Plant/Noxious_Weeds/Noxious_Weed_List/](http://agri.nv.gov/Plant/Noxious_Weeds/Noxious_Weed_List/).

Plants such as leafy spurge, perennial pepperweed (tall whitetop) and Scotch thistle are found in forest and range lands throughout the state. Saltcedar, also known as tamarisk, is well adapted to alkaline soils commonly found in Nevada and will invade riparian areas. Because of their unpalatability and invasive nature, all noxious weeds have an adverse effect on wildlife and domestic range animals.

The objectives of weed management on forest or range lands are to:

- Improve carrying capacity and productivity of range and forest lands.
- Reduce competition from weeds, thus improving growth of desirable vegetation and overall health of the range or forest.
- Improve reforestation success by reducing competition from weeds.
- Reduce the presence of ladder fuels and the potential for wildfire in the forest.
- Improve and protect habitat for wildlife and domestic range animals.
- Improve sites subject to erosion through weed removal and re-vegetation.
- Protect riparian areas and improve water quality.
• Enhance and maintain recreational access to forest and range lands by preventing the spread of invasive weeds.
• Enhance species diversity and the beauty of Nevada’s forests and range lands.

**Integrated Weed Management (IWM)**

Integrated weed management (IWM) utilizes a number of management strategies including prevention, cultural, physical, mechanical, Biological and chemical control methods. Successful weed management programs do not rely on any one control technique, but use a combination of control strategies.

**Prevention:** Prevention of weed infestations is a major component in effective long-term range and forest weed management programs. When planting in forests or on rangelands, use certified weed-free seed. Many weed species including noxious weeds are transported to uninfested areas in contaminated hay and straw. It is important to restrict the movement of contaminated hay, straw or other commodities into an area. Each product should be certified weed-free before it is transported to the area as feed, for erosion control or any other purpose.

Equipment, recreational vehicles, livestock and wildlife are capable of moving weeds. Clean equipment after working or traveling in an infested area to prevent weed spread. Preventing wildlife from spreading weeds may be impossible, but controlled rotational grazing to avoid heavily infested areas during weed seed production can help reduce the spread of noxious weed species by livestock. Keep a close watch and control new infestations around loading areas, such as corrals and loading ramps, as these are sites where noxious weeds often are introduced when horses or cattle are transported to range or forest lands. Do not move grazing animals from an infested area to a weed-free site without holding them for seven days and feeding them clean feed. Do not move soil, sand or gravel that is infested with noxious weeds or use it in constructing roads, dams, ramps, etc.

**Cultural:** In the forest, selecting and planting adapted tree species is wise. Adapted tree species grow best, are competitive and require the least number of inputs per acre. Most have fewer pests associated with them and, as a result, have better vigor. Planting trees close together reduces weeds but increases competition among the trees. High tree densities at planting reduces weed establishment and can be followed up with tree thinning as the trees grow to reduce tree-to-tree competition and develop larger trees.

**Physical and Mechanical:** In Nevada, bulldozers with brush blades or chains dragged between two dozers are used to remove brush and prepare a site...
To prevent new weed infestations:

- Plant certified weed-free seed.
- Restrict movement of contaminated hay, straw and other products.
- Clean vehicles and equipment.
- Avoid grazing heavily infested areas.
- Do not move weed-infested soil, sand or gravel.
- Hold and feed grazing animals for seven days with weed-free forage before moving them to a new area.

Use biological controls as a part of a weed management program. When used alone, insects, pathogens or grazing will not eradicate a weed species.

for planting. Unfortunately, wheeled and tracked vehicles are limited to gentle terrain.

Prescribed burning can sometimes be used for pre-plant brush control, but is usually not effective on long-lived perennial noxious weeds and some native shrubs that re-sprout from the roots.

Hand removal of weeds by pulling, digging or hoeing, can be effective for selected weed species. Small infestations of annual and biennial weeds, such as musk thistle, Scotch thistle and dyer’s woad, may be controlled in this manner. Remove weeds prior to flowering and seed set. The practice is usually not effective on perennial noxious weeds. Hand removal is labor-intensive and requires repeated treatment for several years to be successful.

Biological: Biological control uses living organisms or natural enemies, such as animals, insects, other plants and microorganisms, to interrupt the life cycle of the weed and control it or reduce its competitive advantage.

Intensive grazing can reduce or remove some weedy species in young forests or on rangelands. Unfortunately, grazing is not entirely selective and trees or range plants can be severely damaged. Matching the proper control agent and timing are important. For example, goats will feed on leafy spurge, but cattle will not. Many animals will eat weeds early in the year, but not after they have become coarse and unpalatable. Pathogens or insects are only rarely used because of the possibility that they may infest non-target species, especially economically important crops. Consult Nevada Dept. of Agriculture for information and permits for insect biocontrols.

Chemical: There are many herbicides registered for use on non-crop range, and forest sites and weed infestations in these areas often require herbicide treatment. For herbicides to be effective they must be applied according to label instructions. Herbicide selection should be based on the site and the weed species. Proper weed identification, environmental conditions and plant growth stage must be considered to get the maximum benefit from herbicides. Products that are effective at controlling one species may have no effect on others.

Serious infestations of Canada thistle, leafy spurge, purple loosestrife and perennial pepperweed will often be found in riparian areas and very near or sometimes in shallow water. Many chemicals effective on these weeds are prohibited from being applied directly to water. Refer to the aquatic pest control section in this manual if you are doing weed control in or near waterways or ponds.

The success of a chemical treatment on weeds in forests and on rangelands is affected by:
• Site specific conditions, including soil class, type of terrain and aspect.
• Applicator skill.
• The chemical applied.
• The species and growth stage of the weeds.
• The type of equipment used.
• Climatic conditions at the site.

Environmental Fate of Herbicides

After an herbicide is applied, one or more things may happen. The herbicide may be taken up by the target plant or be washed off the plant and onto the soil by precipitation or irrigation. The herbicide may volatilize or be broken down by sunlight, a process called photodegradation. When herbicides contact the soil they may be broken down by microbes or sunlight. Herbicides can be transported through the soil into groundwater. This process is called leaching. Herbicides may also be carried by runoff from the target site into surface waters.

Application Methods

The size of the weed infestation, terrain and accessibility of the site are all factors when selecting application methods. Aerial applications are appropriate and necessary for some locations, while backpack spray applications are fine for others. Proximity to sensitive sites, such as water or urban and landscaped areas, may require that buffer zones be implemented, especially if using aircraft.

Foliar Applications: Spraying foliage is effective in controlling many forest species, and is recommended when controlling hard to kill noxious weeds. Aerial and ground equipment is used in spraying. Backpack sprayers apply 3 to 10 gallons per acre, while aerial spraying requires 5 to 10 gallons per acre of mixed product.

Because many forest and rangeland herbicide applications are conducted on large areas, sometimes by plane or helicopter, drift must be eliminated or controlled. Without adequate drift control, damage can occur to non-target plants in nearby watersheds, the herbicide may contaminate water, and private property may be damaged. Always read and follow the instructions on the label. Doing so reduces risks to the applicator, other people, non-target plants, animals and nearby properties. It is also the law.

1. Spot treatments are especially useful in controlling noxious weeds while avoiding drift. When making spot treatments, mix and load at the application site. To avoid water contamination, never mix and load herbicides near waterways, lakes, or wells. Use a nurse tank to supply the water, rather than
filling spray tanks directly from a water source.

Wick applicators or weed wipers are sometimes used to apply herbicides to foliage. This application method reduces the potential for drift and is effective in areas where there are environmental concerns near water or sensitive species.

Many herbicides used on forest and range sites are foliar applied compounds. Be aware that herbicides used for controlling weed species may also damage or kill desirable vegetation, and many native plants are extremely vulnerable. Some foliar applied products also have soil activity and may prevent germination of desirable species after the weeds have been controlled.

**Basal Application:** Trunks of trees and brush can be treated to selectively control woody species. The bottom 15 to 18 inches of the trunk must be soaked to be effective. Application in spring gives the best top kill, while summer and fall treatments control sprouts. Winter treatments require greater concentrations of product to be effective. In all cases, it usually takes 1 to 2 years to completely kill a woody plant. Low-volume and thinline basal bark treatments use herbicide products in increasingly greater concentrations to control small woody plants less than 6 inches in diameter.

**Cut-surface or Cut-stump and Other Applications:** Trunks that are frilled or hacked at intervals around the trunk and stumps can be treated with herbicides to kill woody species and prevent resprouting. Cut-stump treatments are commonly used to control brushy or woody species, such as saltcedar (tamarisk). Seasonality affects how well a chemical works with this treatment method. Many products work best during the spring when the movement of sap is upward. Others are effective when the sap is moving down into the roots during the fall. Some work best during the growing season, from June through November. Many products are labeled for direct injection. Conifer stands are commonly thinned using injection methods.

**Soil Active Herbicides:** Several herbicides are active when applied to the soil, where they form a barrier to sprouting weeds or are absorbed by the roots of weeds. Rainfall, snowmelt and irrigation move them into the soil. They may break down more quickly during warm, moist conditions because of increased microbial activity. They may be leached from the soil with excessive precipitation. Some formulations have both a pre- and post-emergence effect and are used in conifers to control annuals and some perennial weeds. Because these chemicals are commonly water-soluble and can easily contaminate water, including groundwater, they must be applied at the proper rate and according to label directions.

If more than one application of herbicide is required to control a weed infestation, it is imperative to use herbicides with different modes of action to reduce the risk of developing herbicide resistance.

Without adequate drift control, damage can occur to non-target plants in nearby watersheds, the herbicide may contaminate water, and private property may be damaged. Always read and follow the instructions on the label.

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Soil active or pre-emergence herbicides are the most common pesticide contaminants found in Nevada’s groundwater. Some pesticide labels advise the applicator not to apply or to reduce applications of these products in sites that are vulnerable to groundwater contamination. Risky sites include those with sandy or gravelly soils and areas where groundwater levels are near the surface (areas with shallow ground water).

Applicators must take into account the proximity of desirable non-target vegetation. Some soil active herbicides will damage or kill existing vegetation and some have no effect on it at all. Product labeling describes precautions related to protecting non-target trees and other vegetation. Serious violations, resulting in enforcement actions, have occurred after applicators have damaged or killed adjacent non-target vegetation with pre-emergence herbicides.

**Forest and Range Vertebrate Pests**

Animals play an important role in range and forest ecosystems. Several species of rodents including pocket gophers and ground squirrels occur naturally in range and forest sites. Other native species, such as deer and rabbits, also inhabit these areas. Harm to rangelands and forests is rare but adjacent agricultural lands or urban landscapes may sustain significant damage due to burrowing and feeding activities.

While uncommon, animal damage may occur during reseeding, land rehabilitation or reforestation activities. Forest nurseries may also sustain damage by gophers, squirrels, deer or rabbits. Baits or traps are most commonly used on burrowing rodents such as gophers. Using wire cylinders to protect individual plants from deer and rabbits is labor intensive but effective. Chemical repellents can be useful in some situations but must be reapplied when washed off by precipitation.

Using toxic baits to control deer and rabbits is **strictly prohibited**. Deer and some rabbit species are game animals and are protected under state fish and game laws.

**Conclusion**

Nevada’s forests and rangelands provide valuable forage and habitat for livestock and wildlife. Recreational activities are also important land uses. Applicators must consider various land use practices and resources associated with these lands when developing pest management strategies.

The primary pests on these sites are weeds and insects. Plant pathogens and burrowing rodents are less frequent but can become pest problems.
Pesticides are useful tools but must not interfere with other land management strategies. In order to accomplish effective pest control, applicators should take into account all land uses, consider all control methods available and apply pesticides according to label instructions.