Effects of Black-tailed Deer and Roosevelt Elk Herbivory in Intensively Managed Douglas-fir Plantations

BY JIMMY TAYLOR

Black-tailed deer and Roosevelt elk are found throughout conifer-dominated Pacific Northwest forests west of the Cascade Crest, where they are important aesthetically, culturally, ecologically, and recreationally. Throughout their annual cycles, deer and elk use a variety of forest types and age classes to meet their basic requirements: food, water, cover, breeding, and young-rearing. Although their foraging strategies differ, black-tailed deer (browsers) and Roosevelt elk (grazers) often use the same forests. In general, forage plants for deer and elk are shade intolerant and are stimulated to grow when exposed to direct sunlight. As such, deer and elk often use clearcut patches following harvest. For Douglas-fir and other conifer species in the Pacific Northwest, the first five years after planting (i.e., stand initiation) is the most vulnerable period in which trees are exposed to wildlife damage, as young trees are within forage height and have not yet reached a free-to-grow condition. Because of this, foraging by deer and elk (hereafter, herbivory) has been documented as the most widespread form of damage in reforestation efforts in the Pacific Northwest.

Deer and elk bite succulent young seedlings as they forage through clearcuts. Multiple bites often cause death of a seedling, while bites to lateral and terminal leaders alter tree growth. Damage to the terminal leader is the most severe form of damage to conifer seedlings and can cause delayed growth and/or lengthen the stand rotation period. Repeated browsing can distort the growth of the tree often causing brushy growth. Young trees that survive may eventually reach free-to-grow conditions; however, they face the effects of shading by adjacent dominant and co-dominant trees. Furthermore, repeated browse damage may reduce wood quality of surviving trees. Likely due to their grazing habits, elk also have a tendency to pull seedlings, often uprooting them and resulting in tree mortality. Many foresters use a technique called “interplanting” to replace severely damaged or missing trees with new seedlings. Like preventive maintenance (e.g., exclusion, repellents, hazing), interplanting increases upfront costs and may decrease profit margins at harvest.

In western Oregon and Washington, the dominant commercial tree species is Douglas-fir, which are generally planted at a density of approximately 400-450 trees per acre and harvested on a planned rotation to maximize economic return (e.g., 40-45 years). In general, sites are chemically prepared for planting to reduce competition between seedlings and competing vegetation, and logging slash is piled and burned. Between planting and harvest, silvicultural prescriptions to promote stand growth and vigor may include precommercial thinning, fertilization, commercial thinning, and herbicide applications. In the Pacific Northwest, fire as a site preparation tool has been replaced with herbicide use. Private land managers are often accused of providing poor quality browse habitat for deer and elk, further suggesting that ungulates are left to forage on conifer seedlings. This theory, however, has not been properly tested.

Wildlife damage to trees is a perceived economic impact on private forests in the Pacific Northwest; however, impact assessments are rare and difficult to quantify. One study published in 2000 projected $8.3 billion in annual losses to Oregon timberlands due to wildlife damage, although damage specific to deer and elk was not reported.

Several tools and techniques are available for protecting seedlings from ungulate browse; however, they are generally cost prohibitive in an operational design or are ineffective in sustained protection. Complete exclusion through fencing is a common technique used to protect small-scale progeny trials in forestry, but large-scale fencing has been dismissed due to high costs in installation, maintenance, and removal. Furthermore, fencing is not always 100% effective and is limited by several factors, including the quality of materials and construction. One or more deer or elk inside an exclosure can cause significant damage in a short time period. In a two-year study conducted in western Washington, National Wildlife Research Center (NWRC) scientists found seedling survival was similar inside and outside experimental fencing in areas of sustained herbivory; however, seedling height was greater inside fences. Future studies should evaluate the long-term effects of short-term fencing (e.g., 5-6 years) to quantify cost:benefit ratios.

Another form of exclusion is to protect individual trees. Tubing has been used to protect Douglas-fir seedlings at planting; however, it is generally ineffective against deer and elk herbivory. Elk often pull up plastic or mesh tubes along with seedlings, thus causing complete loss of the seedling and the extra cost of protection. Tubing also can cause deformities in seedling growth and can create micro-climates for fungal growth. When terminal leaders exceed the height of tubes, deer have little trouble biting them off or uprooting the seedling completely, often leaving tubes in place.

Several chemical repellents are commercially available and targeted toward reducing deer browse. Chemical repellents are often a socially appealing management option because they offer a potential non-lethal alternative. However, repellents in general have short-term effects and are influenced by a variety of factors such as animal density, food availability, and climatic conditions. Studies have shown that for a repellent to be effective, its residue must persist directly on the plant and it must cause a physiological or evolutionary consequence to the herbivore (e.g., fear, irritation, aversion). When alternative plants are available, repellents with no consequences may provide acceptable protection. However, when alternative plants are scarce, repellents must produce a consequence to the consumer (e.g., deer or elk). A study published in 2010 evaluated 10 commercial deer repellents and found that no product provided 100% protection and that usage of chemical repellents was affected by cost, the ability to follow recommended reapplication schedules, and the type of plant to be protected, among other factors. Highly motivated animals will ignore even the most effective products.

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Douglas-fir trees take on a brushy appearance when they are repeatedly browsed. In these cases, trees survive, but they do not produce high-quality wood.

Frightening devices such as propane cannons, human effigies, pyrotechnics, and automated sound devices have had varying results at deterring deer from protected areas. The primary reason for product failure is due to habituation, although use of animal-activated devices may delay habituation. Recent advances in frightening devices for deer include animal activation and use of bio-acoustics (i.e., recorded distress and alarm calls of deer). A recent study in the Midwest found that a deer-activated bio-acoustic frightening device reduced white-tailed deer entry into protected areas by 99.3% and bait consumption by 100%. A current study conducted by the NWRC is evaluating this product in western Oregon clearcuts.

Ultimately, forestland managers need to better understand how much herbivory is acceptable and to weigh the costs of management actions with expected benefits at harvest. In a two-year study in western Washington, NWRC scientists found that deer and elk were present in clearcuts every month. Furthermore, ungulate scat (a measure of relative abundance) was identified at some of the highest levels during hunting seasons, which suggests that human presence and/or additional hunting pressure may not reduce browse. Understanding more about the timing of when deer and elk are found in young stands helps managers plan integrated strategies to reduce browse. Year-round presence of ungulates, especially given their rapid ability to habituate, suggests that non-lethal techniques such as scare devices or repellents would not be practical. Additionally, maintaining high densities of large herbivores is not consistent with management goals to maximize net above-ground primary productivity and forage quality or to maximize ungulate body condition and reproductive potential. Future studies involving ungulate herbivory in managed forests should evaluate the proper proportions of ungulate density, above-ground primary productivity, and biological plant diversity necessary to meet stakeholder needs. ◆

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