SOCIETY OF AMERICAN FORESTERS

# Western Forester

March/April/May 2013 Oregon • Washington State • Inland Empire • Alaska Societies Volume 58 • Number 2

*Thank you Oregon Forest Resources Institute and Oregon Chapter of the Wildlife Society for your financial support of this issue.*

# Opportunities and Challenges for Integrating Wildlife and Forest Management Objectives

BY MIKE ROCHELLE

Global demand for wood is on the rise. And in my opinion, that's positive. Wood is a renewable resource; we can produce what we need today and guarantee a supply for future generations. However, as the demand for wood grows and timberland is converted to other land uses, the need to produce more on a per acre basis will increase, which could mean increased reliance on high-yield forestry regimes. Techniques for plantation forestry in the Pacific Northwest are well developed: Given suitable ground, appropriate silviculture, and technologically efficient harvesting techniques, we can help meet the world's demand for fiber. But we must also not lose sight of the other positive outputs of managed forests: clean water, soil protection, climate regulation, recreational values, and habitat for wildlife. Maintaining adequate habitat and resources for wildlife requires a balance, one that can be achieved through the collaborative efforts of forest managers and wildlife biologists working together on both opportunities and challenges.

In this issue of the *Western Forester* we focus on the topic of wildlife in managed forests. The contributed articles address habitat relationships of a range of species and related management issues across both westside and eastside forests. We'll look at some of the challenges that forest and wildlife managers face and how research efforts are underway to seek solutions that balance the demands of intensive silviculture while maintaining wildlife resources for future generations.

PHOTO COURTESY OF MIKE ROCHELLE

**These Roosevelt elk are looking for forage in a young coast range plantation.**

Wildlife damage to reforestation is an ongoing challenge for forestland managers. In the Pacific Northwest, wildlife that cause damage include deer, elk, mountain beaver, American beaver, and several other species. Deer and elk damage traditionally occurs in young plantations. As timber harvest levels on federal lands have declined over recent years, young stands that ungulates prefer for foraging have become concentrated on private lands and browse pressure has increased. Recent and ongoing research efforts suggest that effects of ungulate browse

*(CONTINUED ON PAGE 2)*

**In This Issue: Wildlife in Managed Forests**

## Integrating Wildlife and Forest Management

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on these early seral communities may create rather dramatic shifts in species composition. Jimmy Taylor, a research wildlife biologist with USDA's Wildlife Services, presents results of collaborative work on the effects of black-tailed deer and elk herbivory in Douglas-fir plantations, and how the interaction of herbivory and vegetation control impact stand development.

Also of concern in young plantations is damage from mountain beaver. Wendy Arjo has spent a number of years researching this unique species and provides a discussion of available tools for managing potential impacts, emphasizing both direct and indirect adaptive and integrated control strategies that can be implemented across a range of ownerships. In much of the Pacific Northwest the impact from American beaver can be significant. Forest engineers in their own right, beaver can create problems with culverts and roads through their dam-building efforts. At the same time we recognize the role they play in helping create habitat for fish and maintaining aquatic functions. This creates a need to better understand how to realize the benefits this species provides while simultaneously reducing conflicts with landowners. Recent efforts conducted collaboratively by the Department of Forest Ecosystems and Society at Oregon State University (OSU) in partnership with Oregon Department of Fish and Wildlife and the Oregon Watershed Enhancement Board have explored this issue; findings from this work are presented here by Anita Morzillo and Mark Needham.

Also of interest to a broad range of stakeholders is herbicide use in managed forests. Use of forest chemicals to control competing vegetation early in the life of a planted stand is an important component of intensive silviculture regimes and can be critical to meeting long-term economic objectives. While our knowledge of the effects of chemical use on habitat of songbirds, insects, and ungulates is limited, research efforts have intensified. Recently completed work by Matt Betts and Tana Ellis at OSU explored thresholds in songbird abundance in young stands as it related to availability of hardwood species; in this issue Matt, Thomas Stokely, and Stephen Fitzgerald discuss ongoing collaborative efforts with private and state landowners, the National Council for Air and Stream Improvement (NCASI) and others evaluating the effects of varying intensities of herbicide application on songbirds and arthropods, and how the interactions between birds and these insects may influence tree growth rates. This experiment also explores relationships between ungulate browse, herbicide application, and young stand development, an effort likely to prove complementary to the work currently underway by Jimmy Taylor.

A discussion of challenges and opportunities facing forest and wildlife managers across the Northwest would not be complete without recognizing the variety of issues related to forest health. One area of intense concern centers on fire risk and fuel reductions. As stands are manipulated to reduce the risk of fires, managers must consider the impacts of these efforts on a variety of wildlife species. For example, on the eastside of the Cascades, fuel reduction strategies have been assumed to be beneficial to large herbivores, yet little empirical evidence has been available to validate this assumption. Efforts by Ryan Long and his colleagues at Idaho State University and the PNW Research Station in La Grande to understand the effects of fuel reduction strategies on mule deer and elk found mixed results. These results are discussed later in this issue and illustrate an important aspect of the challenges of managing for healthy forests and wildlife habitat—in all cases habitat change results in winners and losers, and maintaining a variety of stand conditions and age classes across the landscape will be necessary to provide for the greatest diversity of wildlife. Forest health issues are also


# Western Forester

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*Western Forester* is published five times a year by the Oregon, Washington State, Inland Empire, and Alaska Societies' SAF Northwest Office





Please send change of address to:
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5400 Grosvenor Lane
Bethesda, MD 20814
301-897-8720




**Next Issue: Forest Biomass: To Energy and Beyond**

relevant to habitat relationships of the northern spotted owl and other species associated with mature and older forests. While northern spotted owls have been the focus of much research, little effort has been directed at examining their responses to silvicultural treatments. Larry Irwin and Jake Verschuyl of NCASI present a discussion of spotted owl responses to a range of forest practices intended to promote forest health. This is yet another topic that clearly illustrates the need for collaborative work between forest managers and wildlife biologists; efforts to address forest health issues must consider the habitat needs of a diversity of forest wildlife species. Clearly, trade-offs will be necessary over the long run.

While riparian protection is a basic requirement of forest practices regulations, debates among resource managers continue around issues of sedimentation, shade, stream temperature, and primary productivity, focused primarily on the extent and composition of riparian buffers. Protection requirements for headwater streams have been of concern, leading to research on the effects of forest practices on stream-associated amphibians. Trends in species composition, abundance and occupancy patterns, efficacy of headwater buffers, and stream energetics have been the focus of research by Jim MacCracken and others. Overall, stream-associated amphibians were found to persist in a majority of third-order watersheds dominated by commercial forest management, indicating protection has been adequate. While past and current practices appear to provide protection for this group of species, the interactions of riparian management strategies and wildlife habitats and populations continues to be an area of needed research.

Most collective research efforts to date have focused on how current forest management regimes affect wildlife habitat and populations. A potentially fruitful area of research is the investigation of how potential modifications to existing forest practices rules might provide additional value with very little or no impact to economic objectives. An example is structural retention at the unit scale. It has been acknowledged that intensive silviculture, over the course of multiple rotations, may lead to a paucity of stand-level features of value to wildlife: retained trees, snags, and coarse woody debris. While rules and BMPs ensure these structures are retained, there is little information on how spatial distribution can be of greatest benefit for wildlife. Work by Jake Verschuyl of NCASI, Gary Roloff at Michigan State, and Daniel Linden at the University of Maine seeks to inform operational decisions about in-unit green tree and snag placement to maximize value for wildlife. A recently completed study by Weyerhaeuser researchers examined the value of mechanically created snags for cavity nesting birds. While not a comprehensive solution to snag retention across managed forest landscapes, this operationally practical approach created snags that were found to be beneficial for some species. As part of the discussion around both of these efforts, however, is the need to balance wildlife considerations with issues of safety and operability—again illuminating the common theme of this issue—the need for collaborative solutions to address potential conflicts between forest management and wildlife objectives.

Both large and small landowners alike encounter opportunities for integrating wildlife and forest management objectives. While much of the research presented herein has been conducted on larger landscapes, Nicole Strong and Fran Cafferata Coe conclude this issue by showcasing two small private forestland owners who are successfully managing for multiple objectives, including wildlife and silvicultural goals, on their properties.

PHOTO COURTESY OF MIKE ROCHELLE

**A clearcut with leave trees.**

PHOTO COURTESY OF ERIK BRUHNKE

**A northern saw-whet peers out of a cavity in a created snag.**

Challenges facing wildlife biologists and forest managers will continue to persist with increasing demand for wood products. This issue provides examples of how researchers and managers are working together to identify creative solutions. Research efforts continue to inform practical management solutions that provide for economically sound forestland management and for the needs of our diverse wildlife populations. These efforts are encouraging, as we collectively recognize the need to continue improving our understanding of wildlife responses to intensive silviculture. Forestland in the Pacific Northwest provides a host of benefits, not only for wildlife, but also for other ecosystem services. Forest management has long been the economic foundation of many Pacific Northwest communities; working together to identify opportunities and resolve challenges is imperative if we are to achieve what I believe is our common goal…to keep working forests working. ◆

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# 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.

PHOTO COURTESY OF JIMMY TAYLOR

**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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# Management Strategies to Reduce Mountain Beaver Damage in Northwest Conifer Forests

BY WENDY ARJO

Boomer, sewellel, mountain beaver…these are all names given to the primitive rodent species *Aplodontia rufa*. Although the mountain beaver possesses teeth efficient in cutting down seedlings and saplings, unlike the American beaver, this species is a semi-fossorial (lives underground but forages above ground) animal endemic to the Pacific Northwest. Considered the most primitive rodent species, the mountain beaver's inefficient kidney system has limited the species' geographical distribution to humid climates, which has remained virtually unchanged since the Late Oligocene. Due to their inability to concentrate urine, mountain beavers require almost one-third of their body weight in water daily, which is readily available in these moister climates.

Mountain beaver demographic characteristics are unlike the typical rodent species-prolific breeders and broad-spectrum habitat invaders. However, their solitary nature makes it harder to target a larger area for control since individuals are often found spread throughout drainages, and neighbors are not shy about reinvading territories once the original occupant has been removed. Management strategies for mountain beavers vary depending upon the resource being protected, the amount of area being protected, and the timing. What may work for a small tree farmer, or for protecting a newly planted riparian area, will not be economically or logistically feasible for large private and industrial landowners. Integrated Pest Management (IPM), or the use of several management tools, is likely to provide the best results in the long-term to reduce damage to coniferous forests.

Historically, managers have employed both non-lethal and lethal methods for reducing mountain beaver populations. The most common management tool used in Washington and Oregon from October through February is trapping. Trap types vary between the states based on regulations, yet the method is efficacious in the short-term. One of the obstacles to trapping is timing. Trapping too early before planting allows the species time to reinvade the sites, provided suitable habitat and refugia occur around the harvested area. Recently, in an attempt to slow this reinvasion potential and bridge the time between trapping and planting, Rozol bait was introduced as an IPM practice in the two states. These bait bags are placed sealed underground to reduce the risk and exposure of non-target species. Other options, applicable to smaller-scale operations, may include the use of tree barriers. Although studies have shown that mountain beavers can easily penetrate the meshed (or net) tree protectors, the solid plastic barriers can provide protection for seedlings, but at a cost.

Understanding the biology of the species is as important as understanding the management tools. When designing an effective IPM scheme, foresters should consider these aspects.

• Mountain beavers can rapidly invade newly harvested areas as animals are drawn to the early successional forage. Reinvasion potential is based upon the carrying capacity of the surrounding habitat (old growth usually contains fewer animals than regeneration areas).

• When provided a choice, mountain beavers prefer native vegetation such as salmonberry, vine maple, and oxalis.

• Radio telemetry studies in western Washington have documented that for a small rodent, mountain beavers can travel long distances. Data suggest that home ranges can be over one acre, and are influenced by population density and available forage. Genetic studies of several western Washington populations have found similar genetic composition in populations separated over 12 miles.

• Mountain beaver densities differ depending upon silvicultural treatments with larger home ranges documented in mature timber compared to those ranges immediately following harvest. Home ranges are also larger in chemical site preparation units than in non-treated units. Availability of water is also important and may influence foraging choice as well as contribute to increased movements in mature timber (reduced ground water) versus harvested areas.

PHOTO COURTESY OF D. STALMAN, USDA/NWRC

**Mountain beavers clip seedlings and lateral branches, girdle bases, and undermine roots of larger trees.**

• Although herbicide treatment affects available forage for mountain beaver, units site prepared did not sustain greater seedling damage than units that were not site prepared. Other factors that limited forage availability on the untreated units also contributed to seedling damage (e.g., slash piles, non-preferred forage) and therefore a direct correlation between site preparation and damage could not be made. There is a relationship, however, between damage and the availability of native vegetation due to timing of growth. More damage occurs early in the season (February-March) and then tapers off once green-up begins. Protecting seedlings more intensively during this short window may reduce damage.

For smaller planting areas, such as parks, rights-of-way, or riparian zones,

several management strategies can be employed with or without trapping. Most important is to ensure that seedlings have an opportunity to grow and survive past the initial mountain beaver browsing. Reducing preferable habitat for mountain beavers can reduce damage. Any type of refugia or habitat features (e.g., slash piles, dense blackberry bushes) that protect the mountain beavers or encourage residency should be removed prior to planting. Initial protection of planted seedlings (tree tubes) until alternate forage is available is encouraged especially in areas that are planted with expensive trees. Once seedlings are planted, managers should consider maintaining alternate and preferred forage in the area, but not to the extent that the seedlings are out-competed.

For large private and industrial forestlands, strategies to reduce mountain beavers will vary slightly between states (similar tools are not available in Washington and Oregon) and management techniques should be flexible and based on surrounding habitat, mountain beaver populations, and terrain. Harvested sites that are surrounded by older forests will likely have less of a continual mountain beaver problem than those sites surrounded by young age (5-15 year) stands. Areas that support a higher population of mountain beavers just after harvest are likely to need many tools, or a combination of tools, to reduce damage as these areas are prone to reinvasion. Additionally, sites with numerous draws, water sources, and riparian habitats are also likely to provide more favorable habitats and hence support mountain beaver populations better than flatter terrain. Several steps to reduce potential mountain beaver damage include:

• Reduce or remove slash and slash piles from the area. If total removal is impossible, ensure that slash piles are limited to ridges and are out of draws. Additionally, riparian area buffers can have a fair amount of wind throw, which can also provide refugia.

• Trap animals just prior to planting to reduce the possibility of reinvasion prior to green-up of other preferred forage species, leaving the seedlings less vulnerable. If trapping occurs several months prior to planting, consider using IPM to reduce reinvasion potential. Spot trapping prior to planting may help eliminate the refugia in the draws where animals may have reinvaded. Baits may also be used in known problem areas to slow and reduce the reinvasion throughout the entire area.

• Plant large stock. Mountain beavers have a difficult time completely clipping seedlings at their base when larger stock is planted. Slightly deformed trees are better than no trees.

• Consider the use and/or no use of chemical site preparation. Although a direct correlation between site preparation and seedling damage has not been documented, there is a relationship between forage availability (presence of forbs not sword fern) and home range size. Less available forage means larger home ranges and more area covered (i.e., more trees potentially damaged) by mountain beavers. A balance between treating units to suppress grass and shrub growth, but not forbs, may offer a potential source of alternative forage for reinvading mountain beavers.

• If possible, protect individual seedlings with mesh tubes or barriers along riparian areas, draws, or in areas where reinvasion potential is the greatest (e.g., next to reprod sites and edges).

• Encourage predators. In the studies conducted with telemetered mountain beavers predation was 27%. Perch trees and reduction of slash piles are advantageous to terrestrial predators. Reducing damage entails managing the habitat as much as managing the wildlife. Choosing the correct management tool will depend on the size of the area managed and timing, as well as available tools. Ensuring that foresters have a variety of management tools depends on maintaining current scientific data on the species, continual testing of methods, and the ability to integrate management tools. A combination of management tools along with variations in silvicultural practices will provide managers with the greatest benefit for reducing mountain beaver damage. ◆

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# Landowner Incentives and Tolerances for Managing Beaver Impacts in Oregon

BY ANITA T. MORZILLO AND MARK D. NEEDHAM

**Anita T. Morzillo**

**Mark D. Needham**

The American beaver (*Castor canadensis*) plays an important role in maintaining aquatic and floodplain ecosystem functions and habitat for other species, and has the potential to be an active contributor to fulfilling objectives outlined in conservation plans such as the Oregon Plan for Salmon and Watersheds, Oregon Conservation Strategy, and Mid-Columbia Recovery Plan. For those reasons, there is interest in reestablishing beaver populations in many areas, including Oregon. For such efforts to succeed, there is a need to address current and potential future conflicts between landowners and beavers, particularly on private lands.

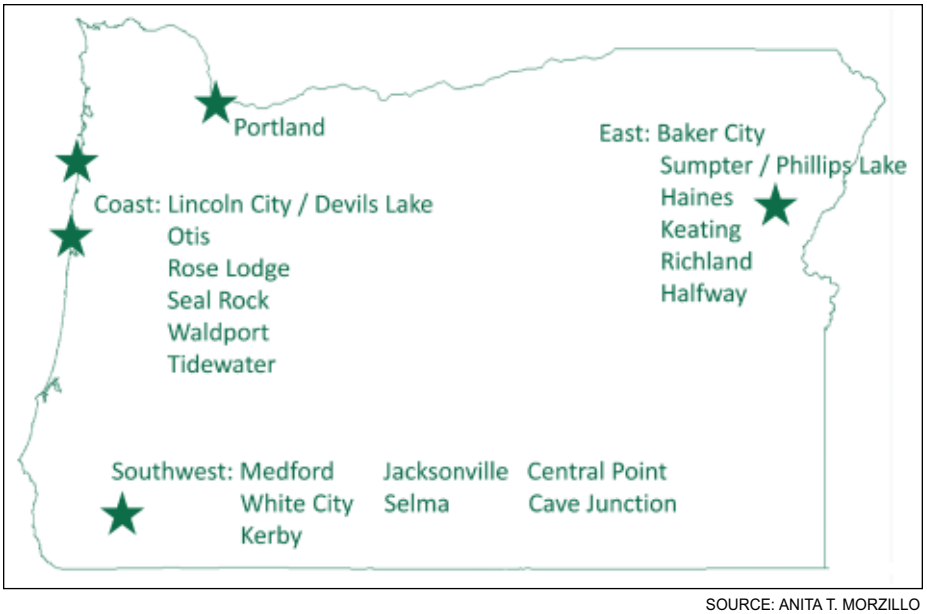
In a study funded by the Oregon Department of Fish and Wildlife, Oregon Watershed Enhancement Board, and Bonneville Power Administration, we collected data from Oregon residents to reveal their: (a) knowledge about, attitudes toward, and tolerance for beavers and beaver impacts on private property; (b) support of strategies for managing beavers and their impacts; and (c) opinions about incentives for encouraging coexistence with beavers (e.g., reimbursements, expert site visits, technical assistance, equipment and labor, information and education). Understanding how humans can coexist with beavers and the role of possible incentives in this process are crucial for advising monitoring and technical assistance associated with reestablishment efforts.

In 2011, we administered questionnaires by mail to random samples of residents living in specific areas within four regions of Oregon (East, Coast, Portland, Southwest; see Figure 1). These areas were selected based on input from stakeholders and agency representatives, and proximity to water bodies, riparian lowlands, and wetlands known to contain beavers or beaver habitat. We received 1,512 completed questionnaires (32% response rate), followed by telephone interviews with 142 residents who did not return their questionnaire. No differences in responses existed between the mail and telephone responses.

## Results

Across all four regions, most respondents owned their current property (86%) with a majority (63%) of parcels less than five acres in size. Sixteen percent of respondents currently have beavers on their property and 26% had them in the past. Twenty percent of respondents have also experienced impacts caused by beavers, particularly those respondents from the East (27%) and Coast (30%). Damage to trees (25%) and culverts (14%), and overflow of water bodies (13%) were the most frequently reported incidents. Few respondents (10% or fewer), however, have taken actions to deal with beavers, such as wrapping trees, removing beaver dams, contacting agencies, frightening the animals, or installing exclusion devices. Respondents from the East and those who have experienced beaver impacts were most concerned about property-related damage, whereas those in Portland were more concerned about health and safety issues. These results suggest that a number of residents in Oregon are actively dealing with beavers and concerned about damage.

Despite potential impacts, attitudes toward beavers were quite positive with the most positive attitudes generally among Portland respondents and the least positive generally in the East region and among those who have previously experienced beaver impacts. In addition, the majority of respondents were interested in seeing (65%) or having (57%) beavers on their property or neighboring properties, although those in the East and those who have experienced damage from beavers were slightly less interested. Respondents were also much more knowledgeable about beavers than has been reported for many other wildlife species (e.g., deer, elk, black bears). Of the knowledge questions that we asked, most respondents knew that beavers build




SOURCE: ANITA T. MORZILLO

**Figure 1. The four regions in Oregon where random samples of residents received questionnaires about the American beaver.**

dams and live in water bodies, whereas the fewest were aware that beavers do not eat fish (they eat cambium, bark, buds and roots, and aquatic vegetation) and that their dams create important habitat for fish.

There was widespread belief that wildlife agencies (particularly state level) and landowners should share equal responsibility for managing beavers and their impacts. Providing information about how to coexist with beavers was the most acceptable management response, and capturing and relocating beavers also was acceptable. Leaving beavers alone was acceptable when beavers only chewed trees, but acceptance declined for more substantial impacts such as flooding. The majority of respondents believed that wrapping trees and installing control devices and screens were acceptable for addressing beaver impacts, and removing dams was also acceptable only in response to severe damage. Regardless of impact severity, however, frightening beavers away and lethal control of beavers were perceived as unacceptable responses.

PHOTO COURTESY OF VANESSA PETRO

**A resident female beaver maintains a dam constructed by her and a relocated, radio-tagged male beaver (not shown) in the Alsea Basin of coastal Oregon. The pair is monitored as part of an Oregon State University study evaluating responses of beavers relocated to locations where their dam-building activities might influence Coho salmon production.**

We also asked residents the extent that they would be likely to take advantage of possible incentives for retaining beavers and their habitat, and coexisting with this species on their land. Most respondents would be unlikely to restrict beavers from their property or neighboring properties. Instead, respondents would be likely to take advantage of: (a) information sent to them about how to coexist with beavers and address their impacts; (b) financial compensation to fix or prevent beaver damage; (c) expert visits to provide technical expertise and resources; and (d) equipment or labor to enable them to retain beavers on their land. Our data suggest that landowners in the East and those who have experienced beaver impacts would be slightly less likely to take advantage of these incentives, whereas those in Portland and those who have not experienced severe impacts are most likely to take advantage of these initiatives. Our results also suggest potential for collaboration among agencies, landowners, and other stakeholders in these efforts (e.g., watershed councils). Lethal control was not a first choice for most respondents and regional-specific management may not be necessary even though some minor regional differences in responses were found in our study.

## Management implications

From an outreach perspective, our results suggest that most respondents are highly knowledgeable about beavers, have positive attitudes toward this species, and are interested in coexisting with beavers. Guidelines for relocating beavers currently exist in Oregon and ongoing research is exploring the viability and success of relocation efforts. Our findings suggest that respondents may be likely to take advantage of information sent to them about coexisting with beavers and are willing to try alternative approaches and incentives for maintaining beavers on their property. An effective use of resources may be to disseminate information dispelling myths about beavers and their habits (e.g., diet), enhancing cognitive linkages between beavers and other ecosystem processes, and providing health and safety information related to interacting with this species, particularly in urban and suburban areas. Given that no single incentive for retaining beavers on private property was preferred over another, a suite of incentives may be the most useful and flexible approach, as long as incentives are efficient and effective for addressing impacts. Possible incentives may include site visits by experts and agency personnel, providing information and feedback about methods for avoiding conflict with beavers, and financial or labor assistance for fixing or preventing damage. Other actions may involve information about planting trees and other resources available for mitigating beaver impacts, and assistance with proper installation of preventive mechanisms (e.g., wire mesh around trees, screening or pipe devices for maintaining flow in culverts). It remains an issue for managers to identify which of these strategies and incentives would work best for individual situations, and then work with landowners to address impacts and prevent future conflicts. Scientific publications from this project are forthcoming, and a full report of results can be viewed at www.dfw.state.or.us/wildlife/living_with/beaver.asp. ◆

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# Tradeoffs Between Intensive Forest Management and Biodiversity: Is it Possible to have our Biodiversity and Plantations too?

BY THOMAS STOKELY, MATT BETTS, AND STEPHEN FITZGERALD

Thomas Stokely

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Stephen Fitzgerald

Global demand for wood resources is expected to double within the next 25 years, requiring approaches that maximize timber production on a limited land base. Intensive forest management (hereafter IFM) relies upon such practices as herbicide application, fertilization, and planting of genetically improved trees to reduce rotational ages and maximize investment returns. IFM has become ubiquitous on private and state lands throughout the Pacific Northwest, and though IFM is becoming more common worldwide, the ecological costs are poorly understood.

The use of IFM to accelerate closed-canopy conditions shortens the early seral stage of succession (grass-forb-shrub stage) by targeting competing vegetation with herbicides (see Figure 1). Highly competitive and floristically diverse early seral plant communities thrive in post-harvest conditions, providing important forage and cover for many wildlife species. Herbicide applications may therefore result in habitats that support fewer native plants and animals. Early-seral habitats are now the scarcest forest type in the region, which may have severe implications for some wildlife species. For instance, populations of several migratory songbirds have declined rapidly, possibly as a result of the loss in early-seral habitat which serves as essential summer breeding ground. Likewise, black-tailed deer populations in Oregon have been on the decline since the 1980s, which some argue is due to lack of early seral forage availability throughout intensively managed landscapes.

PHOTO COURTESY OF THOMAS STOKELY

**Figure 1. Naturally regenerating early-seral plant community (left) and same-age intensively managed plantation (right). Such a reduction in plant diversity and habitat may have severe consequences for some wildlife species.**

Although IFM and biodiversity may appear at odds, the potential tradeoffs between timber production, biodiversity, and wildlife are not well understood. For instance, there is observational evidence that small increases in shrub habitat can dramatically increase bird abundances (see Ellis and Betts, *Western Forester*, Volume 55, No. 2). Likewise, a few researchers and managers observed that herbicide application can sometimes increase the availability of herbaceous vegetation for deer and elk forage by reducing the abundance of non-palatable plants like salal. In general though, there is lack of consistent scientific data tying in wildlife to early-seral plant communities and management, which has fostered heated debate.

## Ecosystem services provided by wildlife

There may be early indication that herbicides can have an impact on biodiversity and habitat, but it is uncertain how wildlife species themselves influence timber production and habitat quality in intensively managed plantations. For example, cervids (members of the deer family, Cervidae) can have a profound influence on vegetation of early-seral forests by intensively foraging highly palatable plants, which can impact succession, nutrient cycling, and songbird habitat. Interestingly, under some conditions, cervids may actually benefit from the growth of less palatable conifer trees by intensively foraging on deciduous saplings and shrubs. However, cervid browsing is known to damage conifer plantations, costing the Oregon forest industry millions of dollars each year (see Figure 2). How are these different possibilities reconciled? In our study, we hypothesize that the effects of cervid foraging on tree growth might depend upon the degree of IFM. At higher herbicide applications, cervids may intensively browse planted seedlings as there isn't much else to eat. However, at low application rates, cervids may be more likely to thin out the plants that tend to compete with Douglas-fir, which

PHOTO COURTESY OF THOMAS STOKELY

**Figure 2. Cervids may help to reduce abundance of competing vegetation (left, Roosevelt elk in no-spray stand), but may more severely browse conifer seedlings when less forage is available (right, black-tailed deer in intensively sprayed stand).**

would constitute an ecosystem service.

In a similar way, songbirds might also benefit plantations. Studies in different forest types have shown that songbirds sometimes increase tree growth by consuming herbivorous insects, constituting a "top-down" ecosystem service. However, these results have been inconsistent across studies; in some systems, insects are so plentiful that birds don't seem to have much effect. Migratory songbirds consume equivalent to their body mass in insects each day during the breeding season, so there is a reasonable chance that they contribute this ecosystem service to forest plantations (see Figure 3). However, if herbicides negatively affect songbird abundances (by reducing their habitat), there may be insufficient songbird abundance to reduce insect herbivory.

## IFM and biodiversity experiment

In order to tease apart these relationships and determine how IFM influences biodiversity and vice versa, we have established a large-scale, long-term experiment in the northern Oregon Coast Range. The experiment consists of herbicide application and wildlife exclusion manipulations in harvested units. With industrial, private, and state collaboration, and

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PHOTO COURTESY OF MATT BETTS

**Figure 3. Songbirds, such as this Swainson's thrush, eat insect herbivores (e.g., caterpillars), detritavores (e.g., beetles) and fruit, therefore having the potential to influence forest growth and succession.**

funding from the US Department of Agriculture, National Council for Air and Stream Improvement, Oregon Forest Industries Council, the Nobel Fund and others, we have established seven study "blocks," each of which contains four 20-25 ac experimental stands that were harvested in 2009 and planted in 2011. Each of the four stands were randomly assigned to one of four treatments: (1) intensive herbicide application (removal of all competing shrubs); (2) moderate herbicide application (a heavy operational standard); (3) light herbicide application (a light operational standard); and (4) unsprayed control.

Throughout each stand, we are measuring bird and arthropod richness and abundance as well as the structure and composition of vegetation. Importantly, we also have long-term plots to measure tree seedling growth and survival. This will allow us to estimate tradeoffs between biodiversity and seedling growth. In all of the blocks starting in 2011, we established three wildlife access treatment plots per stand (see Figure 4): (1) cervid exclusion; (2) bird exclusion; and (3) complete wildlife access.

PHOTO COURTESY OF MATT BETTS

**Figure 4. Cervid exclosure (foreground), bird exclosure (background with netting), and complete access (outside of fence). Large-scale industrial management manipulations, construction of fences, and rigorous data collection in Coast Range harvest units are monumental tasks and provide paramount research opportunities.**

In each of the wildlife access plots, throughout the duration of the study (until canopy closure of intensive stands), we are collecting data on shrub biomass, percent cover, and height by plant species, as well as conifer seedling growth. These metrics will be used to determine the relative effects of herbicide and herbivory on early-seral plant communities, plantation development, and forage availability. In the wildlife exclusion plots, we are also collecting data on arthropod abundance and richness as well as arthropod herbivory damage to determine the effects of herbicides and herbivory on songbird forage availability and arthropod diversity. These metrics will also help us better understand whether songbird predation on arthropods influences vegetation growth. In the plots with complete access by birds and cervids, we have deployed motion sensing camera traps to document foraging by cervids. This will help us understand which species (deer, elk) are the main drivers of vegetation change and whether foraging behavior is influenced by herbicide application. No doubt, stumbling over slash in the rugged Coast Range to build fences and frequently collect data has been a daunting task, but the sacrifice of our technicians' and graduate students' knees will not be in vain!

## Emerging relationships

Though it has only been almost two years since the beginning of treatments, the experiment is already yielding some interesting and useful results.

PHOTO COURTESY OF THOMAS STOKELY

**Figure 5. Effects of increasing herbicide application (left to right) and cervid exclusion (top row) on plant communities. Note a severe reduction in plant cover with cervid access in moderately treated stands (bottom, second from right).**

First, and perhaps most obviously, heavy herbicide applications result in a decreased number of plant species and total cover of vegetation (see Figure 5). This relationship is to be expected, considering the purpose of the herbicides is to knock back the competition. The effect of reduced plant competition is apparent when looking at greater diameter growth of the seedlings, another relationship well known to foresters. However, the effect of deer access is most obvious in the moderate treatments, where cervids browse down many of the plants trying to sprout back after the cessation of herbicides. Though this relationship exists, there is no evidence yet that cervids positively or negatively affect conifer seedling growth. Only time will tell if this decrease in competing vegetation, or increase in browse, will translate into altered tree growth rates.

Regarding the birds, we have found that songbird abundance is generally highest in the no-spray control, likely as a result of abundant and diverse vegetation in those stands. By the second year as vegetation fills in, bird abundance in the light herbicide treatment has increased more than in the heavier treatments, which still have very little shrub abundances. Early results show that when we exclude birds from plots with the use of netting, the number of larger insects nearly doubles. This constitutes some preliminary evidence for a "top down" effect of bird predation. The next step will be to determine if increased insect abundance results in slower rates of tree and shrub growth.

It is important to note that the results we describe here are still preliminary (only 1 year of exclusion, 2 years seeding growth, 3 years of succession). Data collected over the next 5 years will provide more relevant information regarding herbicide application and wildlife exclusion effects.

## Management implications

Long-term results from this study will provide objective information regarding the effects of IFM on biodiversity, specifically with regard to early-seral habitats, cervids, and songbirds and their arthropod prey. Likewise, it will help to determine the role that wildlife species have in influencing succession of managed plantations. There is public concern that IFM negatively affects biodiversity and wildlife habitat. However, it is possible that we will find thresholds where slightly modified IFM practices may allow for floristic diversity, wildlife habitat, and good tree growth. The species that benefit from such IFM modifications may then, in turn, provide beneficial ecosystem services to plantations, allowing us to "have our cake and eat it too" (or have our biodiversity and plantations too, so to speak). Regardless, the information gained from this project should help to guide forest management, especially when management encompasses multiple goals such as timber production and wildlife habitat. ◆

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# Effects of Fuels Reduction on Eastside Elk and Mule Deer

BY RYAN LONG

As a wildlife biologist working at the interface of research and management, I am often faced with the following conundrum: The harder I work to answer some particular question about the natural world so that I can apply what I've learned in the context of land or wildlife management, the more complex and elusive the answer seems to become. For a variety of reasons, the results of my recent research on responses of elk and mule deer to fuels reduction (mechanical thinning and prescribed fire) in eastern Oregon highlight that conundrum particularly well.

Manipulation of forested habitat via mechanical thinning or prescribed fire has become increasingly common across western North America, and those activities are generally assumed to be beneficial to species like elk and mule deer. The mechanisms are simple and presumably well understood: Reducing canopy cover increases availability of light and water to the understory, fire in particular returns critical nutrients (primarily nitrogen) to the soil, and both productivity and nutritional quality of important forage species increase as a result. Surprisingly, however, very few empirical studies have explicitly addressed relationships between fuels reduction and large herbivores, and those studies that have were often limited to evaluating the response of a single species to a single treatment.

An experimental fuels reduction program at the Starkey Experimental Forest and Range in northeastern Oregon provided an unprecedented opportunity to study the effects of fuels reduction on elk and mule deer in greater detail than had ever been possible before. A spruce budworm outbreak at Starkey in the 1980s resulted in high rates of tree mortality in 53 stands of true and Douglas-fir. Two decades later those stands were characterized by high loads of dead and standing woody fuels, and high densities of young trees. As a result, the Forest Service initiated a fuels reduction program in which 26 of the affected stands were selectively thinned and burned between 2001 and 2003, and the remaining 27 stands were left untreated (see Figure 1).

The project was explicitly designed to meet both research and management objectives, and several different studies were initiated in concert with the fuels reduction program. The objectives of my research were to: 1) evaluate how seasonal patterns of stand use by female elk and mule deer changed following fuels reduction; 2) evaluate how factors such as size, time since treatment, and topography influenced seasonal use of treated stands by female elk and mule deer; 3) determine whether mature male and female elk responded differently to the fuels reduction program; and 4) evaluate the effects of fuels reduction on quantity and quality of forage for elk.

I used location data from collared elk and mule deer collected during spring and summer of 1999-2006 to compare use of treated and untreated stands by those species through time. As a result, the study included both a spatial control (stands that were left untreated) and a temporal control (location data collected before, during, and after the fuels reduction program). In addition, I quantified quality and abundance of 16 key forage species for elk in treated and

PHOTO COURTESY OF RYAN LONG

**A treated stand with vegetation sampling transect at Starkey. This picture was taken approximately four years after the stand was mechanically thinned and burned to reduce high fuel loads.**

PHOTO COURTESY OF RYAN LONG

**An untreated control stand at Starkey. This and similar stands suffered high rates of tree mortality from a spruce budworm outbreak in the 1980s.**

untreated stands during spring and summer of 2005 and 2006.

Several key results from the study were unexpected and highlight the fact that effects of intensive management activities on wildlife are rarely simple. During spring (April 1-June 14), female elk selected treated stands and avoided untreated stands. In addition, use of treated stands by female elk during spring was relatively indiscriminate and was not strongly influenced by size of the stand, topography, proximity of the stand to roads, etc. During summer (June 15-August 31), however, the opposite was true; female elk selected untreated stands and largely avoided treated ones. When treated stands were used at all by female elk during summer, they tended to select larger treatment units that were located on steep slopes and were far from roads. Patterns of stand use by female mule deer did not change significantly following fuels reduction, and they either avoided or used all stand types in proportion to their availability during both spring and summer.

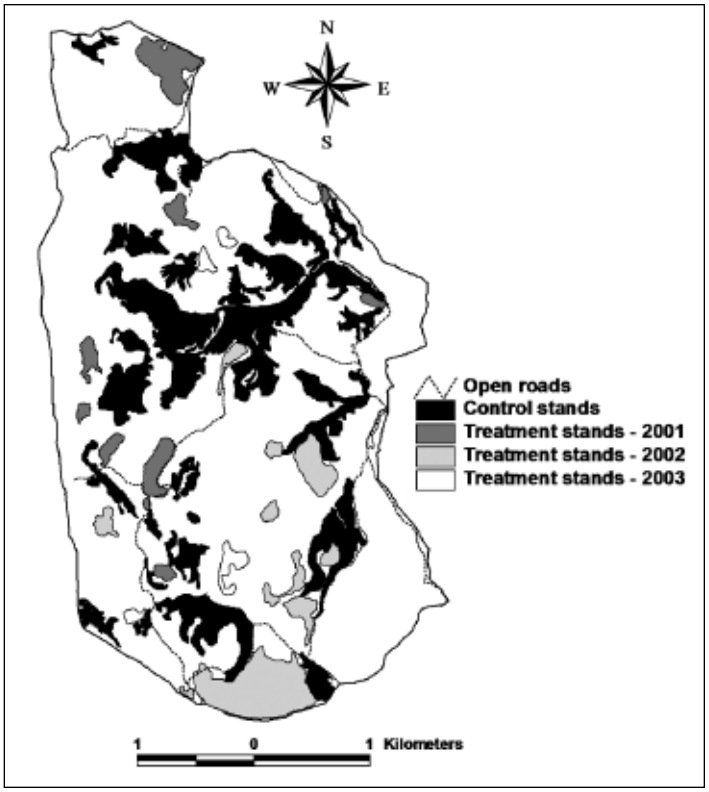
Patterns of stand use also differed substantially between female and mature male elk. During spring, females primarily selected older (> 4 years since treatment) burns, whereas males avoided all treated stands. In addition, untreated stands were avoided by females but selected by males during spring. During summer, untreated stands were selected and treated stands either avoided or used in proportion to their availability (i.e., at random) by both sexes.

The response of female elk to fuels reduction at Starkey was closely related to effects of fuels reduction on quantity and quality of forage. Although the responses of individual forage species varied, total abundance of forage was higher in treated than untreated stands during spring, whereas the opposite was true during summer. In addition, nutritional quality of many forage species was higher in treated than untreated stands during both spring and summer by the fifth post-treatment year.

## Forest management implications

So what are the take-home messages from this research with respect to forest management? First, it should be noted that the results of this study at Starkey may not apply well to other systems that differ substantially with respect to climate, soil, vegetation, species composition, etc. (e.g., westside forests). That said, however, there are several important management implications stemming from my research:

1. Although elk may increase use of forest stands following fuels reduction, the magnitude of that response will likely vary seasonally and be influenced by a variety of factors. Consequently, maintaining a mixture of burned and unburned forest habitat on the landscape may provide the best long-term foraging opportunities for eastside elk.




SOURCE: RYAN LONG

**Figure 1. Locations of 26 forest stands treated with mechanical thinning and prescribed fire from 2001 to 2003, and 27 untreated control stands at the Starkey Experimental Forest and Range.**

2. Elk are widely known to compete with mule deer for resources, so where these species co-occur, manipulating forest habitat with prescribed fire may be of greater short-term benefit to elk than mule deer. This possibility is especially important given the decline in mule deer populations that has occurred throughout the West over the past several decades.

3. Although fuels reduction treatments at Starkey appeared to increase foraging opportunities for female elk in spring, those treatments likely were of little benefit to mature male elk. Consequently, managers may wish to consider potential tradeoffs between increasing foraging opportunities for females and decreasing foraging opportunities for males when planning fuels reduction projects. For example, if management objectives include a high percentage of large males in the population, then manipulating habitat in a way that benefits only females may prove counterproductive.

4. Effects of fuels reduction on quantity and quality of forage for elk highlight the importance of considering interactions between seasonal changes in plant growth and substantial reduction of canopy cover when planning fuels reduction activities. My results suggest that the reduction in canopy cover associated with fuels reduction increased growth of quality forage for elk during spring, but led to more rapid senescence of important forage species during summer.

Managing wildlife resources in our forests is a complex task, but one that is worthy of our best efforts. Opportunities to integrate research and management like the fuels reduction program at Starkey abound, and the more we can capitalize on such opportunities, the better our on-the-ground decisions are likely to be. ◆

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# Potential for Silviculture to Contribute to Conservation of Spotted Owls

BY LARRY L. IRWIN AND JAKE VERSCHUYL

**Larry L. Irwin**

**Jake Verschuyl**

In 2011 the U.S. Fish and Wildlife Service (Service) indicated in the revised recovery plan for the northern spotted owl (NSO) that active forest management can support recovery of the northern spotted owl. Yet, a great deal of skepticism persists, with the public as well as the scientific community, that active forest management should be considered either necessary or beneficial to conservation of NSOs. There is particular concern for traditional regeneration harvesting methods that simplify forest structure and composition, and for extensive treatments that may degrade NSO habitat while supporting forest-health objectives.

Responding to such skepticism, the Service recently clarified its position for promoting active management, at least for dry forests, by providing support for a view that large changes are occurring in wildfire frequency, severity, and total area burned, and that certain types of silvicultural intervention should be considered that would likely benefit spotted owls over the long run. Yet, when treatments are considered over the short term at the stand level, language in the 2011 revised NSO recovery plan (Recovery Plan) seems to discourage widespread implementation of silvicultural options. For example, the Recovery Plan decrees that long-term benefits of forest thinning treatments must *clearly outweigh* the short-term impacts, with "short-term" defined as less than two decades or more realistically up to 10 years. Here, we provide a summary of the range of possibilities for judicious applications of silviculture to contribute to conservation of spotted owls in both the short and long runs. These possibilities vary among physiographic provinces and depend upon the ecology of the NSO's preybase, ecology of the associated forests, and vegetation response to wildfires.

We subscribe to the philosophy that developing silvicultural options for NSOs requires that investigators should first quantify the specific structural and compositional factors associated with nesting, roosting, and foraging by NSOs, because these are the direct environmental cues to which NSO adaptations likely have been molded by forces of evolution. This view also holds that retrospective examinations of situations where NSOs successfully occupy forests that have been treated by active forestry provide suggestions for silvicultural options that may be tested. Such a view holds that if NSOs occupy managed-forest conditions created by accident or by default, then professional silviculturists should be able to create suitable habitat by design. This view also holds that active adaptive management experiments involving various silvicultural options are best evaluated by monitoring owl behavior and responses by the owls' preybase. We also adhere to this view because it lends toward modeling of NSO distributions and life-history traits in relation to vegetation dynamics, which is important for silvicultural applications. Moreover, this second view is strongly grounded in habitat selection theory.

Although few studies have examined direct responses by NSOs to variation in habitat structures and composition created by silvicultural treatments, the scientific record provides retrospective evidence that judicious forestry can favor populations of the owl's small mammal preybase in the short run and nesting sites over the longer term (4-5 decades). Beneficial silvicultural treatments appear most plausible for mixed-conifer dry forests and for productive, coastal redwood forests. In those provinces, major proportions of

PHOTO COURTESY OF LAURIE CLARK, NCASI

**A northern spotted owl in a managed forest in Oregon.**

the NSO preybase are comprised of woodrats (*Neotoma* spp.) and other ground-dwelling species such as deer mice (*Peromyscus* spp.) and pocket gophers (*Thomomys* spp.) that are abundant in early-seral forest stages or in mixed-age forests dominated by shade-intolerant, fire-resistant tree species. Retrospective studies in mesic, western hemlock/Douglas-fir forests suggest suitable foraging habitat can be created in <30 years, and suitable nesting sites can be produced within 50 years following regeneration forestry, as long as small patches or individual remnant older trees are retained.

Support for silvicultural intervention in areas occupied by NSOs is gaining greatest momentum for dry, fire-prone forests. Federal land managers, scientists, and conservationists generally agree that these forests, as well as populations of NSOs, and the suite of open-canopy associated dry-forest wildlife species, are not sustainable over the long run. Although some argue that NSOs are adapted to intense wildfires, large, intensely-burned forests such as the Tillamook Burn in Oregon (1930s) and the Yacolt Burn (1940s) in Washington do not support NSOs except along their edges. Forests in dry, fire-prone forests appear increasingly unsustainable because forest conditions are well outside of the range of natural variability. This has resulted in increased frequencies of large, uncharacteristically-intense wildfires and

large-scale insect outbreaks. In dry forests of the Klamath region and along the eastern slopes of the Cascades, decades of fire suppression efforts have led to increases in closed canopy, mature forests. Although much of these late-seral forests are considered to provide NSO habitat, the proportions of shade-tolerant tree species (primarily grand fir or white fir) and overall tree densities have increased around NSO nest sites. Some therefore argue for selective removal of the true firs to favor large, fire-resistant Douglas-fir and sugar pine trees, which are more important to NSOs for nesting and foraging.

Indeed, since implementation of the 1994 Northwest Forest Plan, fire has had the largest effect on the amount of NSO habitat along the eastern slopes of the Cascades. Fifty to 80 percent of the NSO nesting sites in the eastern Washington Cascades may still be at risk of loss to uncharacteristic wildfires. Several NSO sites were likely lost in the late-summer fires of 2012. The remaining dilemma, often preventing action on federal forests, is a debate as to whether silviculture can contribute specifically to the long-term conservation of NSOs. In the face of conflicting management paradigms for sensitive dry-forest species requiring open and closed canopy habitats, a shifting mosaic approach has been suggested. In theory, management would allow multiple forest trajectories across the larger landscape: retaining or recruiting closed-canopy forests in moist forests, creating open-canopy, pine-dominated stands in dry forests, and producing timber for harvest. Which portions of the landscape receive a given treatment would likely be based, at least in part, on biophysical characteristics such as slope position, aspect, and elevation.

A recent assessment of the best dry-forest NSO habitat and high priority fuels-treatment areas found a fairly high degree of overlap (34%), highlighting the challenge for managers and decision makers. For NSO conservation efforts at local scales, it is suggested that negative effects of silviculture may be minimized by applying treatments outside of owl core areas (defined as 500 acres of suitable owl habitat within a 0.7 mile radius of an owl site). Treatments would thus target lower-quality "Matrix" type forest habitat. Nearly 4 million acres of federal lands fall under the Matrix habitat heading. The original intent of the Northwest Forest Plan was to allow harvest in portions of these lands, specifically calling for "ecological forestry" to occur on federal lands to address climate change concerns, forest health issues, or fire risk.

The Recovery Plan calls for additional research to determine direct NSO response to variations in vegetation management associated with ecological forestry. Neither the Recovery Plan nor the associated Critical Habitat Rule (2012) described specific silvicultural treatments, which would vary with local conditions at the stand-to-district level. However, a recent *Journal of Forestry* article describes parameters for ecological forestry experiments in areas that include NSOs in western Oregon. We expand on the general phi-

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losophy for active management of forests occupied by northern spotted owls by briefly describing important considerations of specific silvicultural applications below.

***Clearcut Silvicultural Practices.*** The only eco-region where clearcut timber harvests apparently result in benefits to northern spotted owls within a relatively short period of time is the productive coastal redwood region of northern California. For that area, the NSO Critical Habitat Rule suggests that "some (unspecified) degree of fine-scale fragmentation" (active management) appears desirable, in which 5- to 20-year-old shrub-dominated openings (i.e., "brushy-stage" clearcuts) provide habitats for prey and may allow NSOs to persist in the face of competition from barred owls. Recent research shows that NSOs utilize shrub fields in lower elevations to hunt, especially in the winter. Clearcuts in lower elevations may offer similar seasonal benefits for NSOs in the southern portion of their range.

***Partial Harvest Strategies.*** Researchers studying mixed conifer forests of the eastern Washington Cascades found that 46% of spotted owl *nest trees* were located in stands that had been partially harvested >4 decades prior to their work. Spotted owls successfully produced young in 95% of those sites, suggesting a long-term benefit resulted from partial harvesting that removed commercially valuable large pines and Douglas-fir trees but retained mistletoe-infected trees. Others observed extensive use by NSO pairs shortly after relatively mesic stands were partially harvested in the eastern Washington Cascades, in which canopy cover remained above 50%. Shelterwood harvesting may have the greatest potential among regeneration silvicultural methods for creating foraging habitat because it has the ability to favor either shade-tolerant or shade-intolerant conifers while retaining some large snags and downed woody debris and promoting understory shrubs and hardwoods that support NSO prey. Radio-tagged owls have been observed using shelterwood-harvested stands in winter in the Six Rivers National Forest in California, coastal redwood forests, and in mixed conifer forests in the eastern Klamath region. On the other hand, one study found that partially harvested units were generally used less than their availability within NSO home ranges on an annual basis.

***Thinning.*** Recent literature supports a view that thinning may indirectly benefit spotted owls over time by favoring understory shrubs, hardwoods, herbs, or other features such as snags that are expected to influence the owl's small mammal preybase. Recent meta-analyses of 17 studies across North America suggest that thinning benefits a majority of small mammals and that fuels-treatment thinning has a greater magnitude of positive influence on small mammals than other types of thinning. Yet, literature on responses to thinning by northern flying squirrels (*Glaucomys sabrinus*), the owl's primary prey, and hypogeous fungi, an important component of the squirrels' food supply, is ambiguous in mesic forests, and may depend upon specific conditions of study areas. To our knowledge there is only one publication that examined direct responses by spotted owls, that being a case study of a single spotted owl in mesic Douglas-fir forests. A retrospective study found NSOs preferred to forage in stands with moderate basal areas resulting from thinning 1-3 decades previously in mixed conifer forests. Results of a more detailed before-and-after study that showed both positive and negative effects of thinning on NSOs have yet to be published.

***Forest Health Thinning.*** Habitats in dry forests may require intervention to retain spotted owls or promote high reproductive success. Thinning may also be necessary in some dry forests to increase access to prey that seek refuge in dense stands, or to remove shade-tolerant tree species in favor of shade-intolerant trees. NSOs in mixed-conifer forests prefer to forage in stands in which basal area had been reduced. Thinning treatments in dry forests may benefit spotted owls by improving habitat for ground-dwelling prey species such as woodrats, and reducing wildfire hazards. Such treatments potentially create less optimal habitat in the short term, which needs to be weighed against risk of stand replacement wildfires and loss of nesting and roosting habitat over large areas. New analyses are needed to determine the appropriate core area within which fuel treatments should be excluded.

Efforts to model forest succession and likely NSO responses in dry forests under several management scenarios suggest a bleak scenario for owl habitat within the <10 yr window described by the 2011 revised recovery plan. In the short-term or at small spatial scales it is argued that forest-health type thinning would likely result in a decrease in available owl habitat even when compared to habitat lost through catastrophic wildfire during the same time period. After several decades, however, the forests treated silviculturally were considered to have more NSOs than those not treated. A majority of federal scientists now caution, despite acute short-term pressures facing NSOs, that successful management and restoration of dry forests will require a long-term, landscape or eco-regional perspective that involves active silviculture. ◆

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# Stream Amphibians and Intensive Forestry

BY JAMES G. MacCRACKEN

In 1995, I took a position as a wildlife biologist with Longview Fibre Company (now Longview Timber Corp.), headquartered in Longview, Wash. At that time, forestry and spotted owl conservation issues were being addressed by a number of research and monitoring projects. Issues associated with other endangered species, big game, mountain beaver, and cavity-nesting birds seemed relatively quiet at that time.

However, a somewhat new concern was the presumed decline of many species of amphibians. Suspected causes of the decline included global climate change, higher levels of UVB radiation due to ozone layer depletion, and poor water quality due to chemical pollution, sedimentation, and overheating. Forest practices were also implicated, particularly in the Pacific Northwest where there are many species of amphibians—some that occur nowhere else. Most people associate amphibians with wetlands, ponds, and lakes, and those habitats are generally well protected on forestlands by buffering requirements, equipment exclusion, and no-spray zones. However, there is a unique community of stream-associated amphibians that occur primarily in and near headwater streams in the Pacific Northwest. This includes the tailed frog (*Ascaphus truei*), two species of giant salamander (*Dicamptodon copei, D. tenebrosus*), and four species of torrent salamanders (*Rhyacotrition cascadae, R. kezeri, R.olympicus, R. variegatus*). These species lay their eggs in streams. Two species that belong to the family of lungless salamanders (*Plethodon dunni, P. vandykei*) are often found very close to streams, but lay their eggs out of the stream.

### Study challenges

Several studies completed in the 1970s, '80s, and '90s compared the abundance of stream-associated amphibians in streams running through old-growth forests with streams in recent clearcuts. These studies occurred at a time when small streams that did not support fish did not receive much, if any, special considerations. For most species, except giant salamanders, there were more amphibians in the old-growth streams, leading to the conclusion that forest harvesting negatively impacted stream amphibians. However, there were exceptions to this general pattern for most species that seemed to be site-specific. In addition, my observations and studies by other biologists indicated that many of these species could be found in many streams on commercial forestlands that were in their second or third harvest rotation. Something was not adding up.

Many previous studies suffered from a number of problems. In general, the sample size was small because stream studies are labor intensive. Study areas often encompassed only a single watershed due to both logistics and a desire to reduce variation to increase the power of statistical tests. When considering a species' geographical range, these problems lead to an error termed pseudoreplication, where subsamples are treated as replicates in statistical analyses. Associated with this is a publication bias that leads reviewers and journal editors to reject papers that do not find statistically significant effects—in fact researchers may not even bother to report on studies that have non-significant outcomes. Sampling was often opportunistic because there was little ability to sample at random or devise an experiment with the random application of harvests. The most common statistical procedures employed rely on an assumption of random sampling. In addition, there was little opportunity to collect pre-harvest information. This is important because streams in harvest units may have supported fewer amphibians prior to harvest for a variety of reasons. Perhaps most importantly, there was no information on the capability of sampling methods to find amphibians, when they are present, under different habitat conditions. For example, finding amphibians in streams covered with logging slash is much harder than finding amphibians in streams without slash.

PHOTO COURTESY OF JAIMEE McINTYRE

**The cascade torrent salamander ranges from central Washington to central Oregon in the Cascade Range. They are most abundant in and near small headwater streams and seeps. Clearcut harvesting may reduce populations, but narrow stream buffers are effective in mitigating harvest effects. Canopy reductions of 30-50% that increase light to streams appear to benefit torrent salamanders.**

In addition to those design and sampling problems, most researchers were asking the wrong questions. For example, there is no reason to expect that forest harvesting that changes habitats in such a dramatic fashion would not have an effect on amphibians. As with any community of wildlife species, large habitat changes result in ecological winners and losers as some species are more adapted to dealing with change than others. This scenario fits the observed response of giant and some populations of torrent salamanders. The most pertinent research questions center around estimating the amount of change in species abundance due to harvest and time to recovery as replanted forests establish and grow. Measures other than abundance (e.g., reproductive rates, survival rates, body condition) may be more sensitive indicators of an effect. Finally, on commercial forestlands, the benchmark condition would be streams in harvest-aged stands as old growth will likely always be a minor component of those landscapes. However, if it is found that some species do not recover within the typical rotation, stream buffers and

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other areas may need to be retained through two or more rotations.

### New studies look at amphibian responses

With these issues in mind, several colleagues and I undertook a number of studies from 1997-2009 that would provide a clearer picture of stream amphibian response to a variety of forest practices. The first study examined the effects of converting riparian alder stands to cedar, hemlock, and Sitka spruce in the Coast Range of southwest Washington. The impetus for the study was habitat restoration for salmon along a river whose riparian area was dominated by red alder. The conversion treatments involved reducing red alder cover by 30-70% and underplanting with conifer seedlings. Several small, headwater streams ran through the riparian area and directly to the river. These streams were occupied by Columbia torrent salamanders and we sampled six streams that ran through conversion reaches and six streams in riparian areas outside conversion areas (reference sites) for salamander abundance and body condition. That study found that salamanders were lower in abundance, but in better body condition (had greater energy stores) in the conversion streams vs. the reference streams.

Two other studies were conducted by graduate students enrolled at Utah State University. The focus of those studies was on the effects of clearcut harvesting

PHOTO COURTESY OF JIM MacCRACKEN

**Giant salamanders occur throughout the Pacific Northwest in headwater and larger streams. They may have wider temperature tolerances than either torrent salamanders or coastal tailed frogs, and are more tolerant of habitat changes that result from timber harvest. Buffering headwater streams appears to reduce the potential positive effects of forest canopy openings for giant salamanders.**

PHOTO COURTESY OF RYAN O'DONNELL

**Coastal tailed frogs range from California to British Columbia and are most abundant in the lower reaches of headwater streams. The larvae (tadpoles) are algae grazers and several studies have shown that reductions in forest cover can benefit tailed frogs. Canopy reductions of 30-70% appear to optimize algae production and use by tailed frogs.**

on Cascade torrent salamanders. They first sampled streams in forests ranging from recent clearcuts to more than 90 years old. Torrent salamander abundance was lowest in stands 0-24 years old, highest in stands 25-60 years old, and intermediate in stands 61-96 years old. This pattern was likely related to successional changes in tree species composition and varying levels of sunlight reaching the streams. We hypothesized that harvesting reduced salamander abundance, but stream productivity increased with more light, increasing salamander foods and nutrition. However, because salamanders have low reproductive rates, there is a lag of 20+ years in abundance, and as the canopy closed, abundance declined.

The second graduate student thesis examined the effects of buffering headwater streams on the abundance of giant salamanders, Cascade torrent salamanders, and tailed frogs. At that time, buffers on headwater streams were not required, but managers occasionally met harvest leave-tree requirements by buffering headwater streams. In this study, we compared the abundance of these species in buffered streams, unbuffered streams, streams in harvest-aged stands, and streams in old-growth. We found that buffers benefitted torrent salamanders and tailed frogs, but not giant salamanders.

Another issue surrounding stream amphibian research was the mismatch in the typical size of a harvest unit (50+ acres) and the area sampled in most studies (150'-300' stream reach). To address this, we sampled first-, second-, and third-order basins to estimate detection probability and occupancy patterns of giant salamanders, torrent salamanders, tailed frogs, and Dunn's salamander. Managed forest basin occupancy was >90% for all but the tailed frog, which was about 60%.

We recently completed an experimental study examining the effects of three levels of forest canopy openings on sunlight reaching streams, water temperature, leaf litter inputs, stream algae, aquatic insects, tailed frogs, giant salamanders, and three species of torrent salamander. Reductions in canopy changed stream energy sources from domination by litter inputs to domination by algae growth. Stream temperatures also increased with greater canopy openings. Insects that specialized on leaf and wood litter declined and those that focused on algae increased or did not change. In general, amphibian abundance, growth rates, or body condition changed with canopy openings and the response was most often greatest at intermediate light levels. These findings indicate that incorporating periodic canopy openings, similar to our intermediate shade retention levels (30-70%), as part of riparian management may benefit stream amphibians as long as other potential stressors (fine sediment delivery or water temperature) are not significant.

In summary, these studies indicate that stream amphibians are widespread and abundant throughout intensively managed forests in western Washington and Oregon. Although clearcut harvests may reduce populations of some species, most appear to recover in two to three decades. Parent geology, aspect, and stream gradient appear to be important in how harvesting affects some of these species. Buffering streams reduces impacts associated with timber harvest, but canopy openings increase stream productivity, which benefits some stream amphibians. Buffers that retain 30-70% canopy cover likely optimize stream protection and stream productivity. ◆

*James G. MacCracken is the Walrus Program supervisor in the Marine Mammals Management Office of the US Fish and Wildlife Service in Anchorage, AK. He can be reached at 907-414-2122 or jgmac01@gmail.com.*

# Green Trees and Snags in Pacific Northwest Clearcuts: Does Wildlife Care?

BY GARY J. ROLOFF, DANIEL W. LINDEN, AND JAKE VERSCHUYL

Gary J. Roloff

Daniel W. Linden

Jake Verschuyl

Forests that are intensively managed for wood production have historically lacked the structural complexity favored by many wildlife species. More recently (i.e., within the last 20-25 years), forest practices rules and forest certification standards (like the Sustainable Forestry Initiative) have emphasized retaining forest structures like green trees, snags, and downed wood in clearcut harvest units. These structures are typically left as parts of riparian buffers around stream channels, in areas of unstable or inoperable slopes, and around special sites such as wetlands, seeps, or rock outcrops. Some landowners also leave structures scattered throughout the harvest units. Current structural retention practices often result in clearcuts with more structural complexity than was found in clearcuts prior to the 1990s. This structural complexity undoubtedly influences wildlife use of intensively managed landscapes.

The scientific support for describing the contribution of structural retention in intensively managed landscapes is sparse. Public forestland managers face a similar dilemma, with numerous management guidelines, plans, and policies in place for retaining structural elements but few tests on the ecological consequences of implementing those activities. Numerous studies have documented relationships between wildlife species and specific structural elements (e.g., snags and cavity-nester abundance) in managed forests, though few consistent trends or patterns have emerged. For example, investigators report variable results on the relationships between downed wood and vertebrate abundance, a testament to the complex relationships that influence wildlife use of any given structure or clearcut harvest unit.

Adding to this complexity, the mechanism by which different industrial forest landowners retain structural elements in or adjacent to timber harvest units vary. In some situations structure retention is required by law (most commonly state-based forest practices rules). For example, forest management in California, Oregon, and Washington is regulated by forest practices rules that contain specific provisions for structure retention. All credible industrial forest landowners follow state rules for structure retention and some even exceed these requirements as a matter of policy. Additionally, some landowners retain structures to fulfill forest stewardship certification requirements. Other landowners voluntarily retain structures to aid in biodiversity, wildlife, water, soil, and aesthetics conservation. When it comes to understanding how much retention is enough and how it should be placed in and around clearcut areas to support wildlife, foresters and biologists have little available information to guide operational decisions. Thus, our goal was to develop a better understanding of how structural retention contributed to wildlife habitat in intensively managed landscapes given that operational and safety concerns strongly influence implementation of retention programs.

Through the support of the National Council for Air and Stream Improvement's (NCASI) Western Wildlife Program and NCASI member companies, we implemented a study that explored the role of structural retention in providing wildlife habitat. We summarized the types of structures that were being retained as isolated elements within clearcut boundaries, which species of wildlife were using those structures, and what features of the structures influenced wildlife use. We also looked at how birds were using the clearcut unit as a whole, recognizing that recent clearcuts are structurally more complex because of retention practices.

We studied 85 clearcuts in 4 different areas of the Pacific Northwest. Clearcuts ranged in age from 3 to 12 years old at the start of our study, which was conducted in 2007-2009. Our regions

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PHOTO COURTESY OF GARY J. ROLOFF

**Clearcut harvest unit with patch retention in southern Oregon.**

included central Washington (CWA), southwest Washington (SWA), southern Oregon (SOR), and northern California (NCA). The forests in Washington and Oregon were primarily Douglas-fir and hemlock dominated, whereas a variety of conifers (e.g., white fir, ponderosa pine, Douglas-fir, red fir, incense cedar) occurred in California. Forest practices rules and hence the requirements for structural retention varied by state, but all states required some level of retention. We mapped and sampled retained green trees, snags, and downed wood in each clearcut area. We also conducted wildlife observations (ranging from 30 minutes to 2 hours per survey point) at different locations throughout the clearcut units. Some of these observation points were centered on individual retained structures or in retained patches.

### Characteristics of retained structures

We found that isolated structures within the clearcut were relatively rare, confirming that logging preference is to fulfill retention requirements in riparian zones or along the edges of harvest units. Here, we define isolated retention as those green trees or snags that were not part of a riparian zone or located next to an unharvested forest edge. Isolated green trees and snags were grouped into patches (≥3 trees and/or snags) or single structures. We found 1-2 patches per 25 ac in Washington and Oregon and ~49 patches per 25 ac in California. A similar pattern was observed for single green trees, with ~3-5 per 25 ac in Washington and Oregon and ~30 per 25 ac in California. This difference among the regions is likely due to multiple factors including an increased emphasis of putting retention in riparian zones and along harvest unit edges in Oregon and Washington, and smaller patch sizes (coinciding with smaller clearcuts) in California. We found ~3-5 snags per 25 ac in all locations except CWA, where 17 snags per 25 ac were documented. In CWA, snags in some harvest units were knowingly supplemented with mechanically created snags.

PHOTO COURTESY OF GARY J. ROLOFF

**Conducting downed wood surveys in a southwest Washington clearcut.**

In addition to measuring how many isolated structures occurred in harvest units, we quantified the diameters and heights. Generally, diameters of green trees in patches did not differ from single trees that were retained, with diameters averaging 12-20 inches. Average snag diameters ranged from 14-19 inches, with diameters of single snags tending to be larger than snags found in patches for some of the study sites. The majority of retained snags were <20 inches in diameter. Approximately 20% of the green trees had defect, except in California where about 8% had defect. Our measurements also indicated that logging crews retained a broad range of sizes with preference for larger and shorter snags when available, likely reflecting the type of logging operation (e.g., tractor or cable) and safety concerns.

PHOTO COURTESY OF DANIEL VARLAND

**Retained single green trees in southwest Washington.**

We found that downed wood was abundant in the clearcuts we sampled. Sources of downed wood included purposefully retained logs (usually large, legacy structures), logging residue, and blow down of green trees and snags. Volume estimates ranged from 68 $yd^3$/ac (California) to 344 $yd^3$/ac (Oregon). Differences in downed wood among regions is likely caused by different decay rates depending on location, the occurrence of historical legacy structures (e.g., large, burned logs), and historical and current management practices and forest practices rules. Most of the downed wood volume was >20 inches diameter.

### Wildlife use of retained structures

The vast majority of wildlife observed using retained structures were birds, although some mammals were also observed using the areas associated with structures. We focused our analyses on birds because they are relatively easy to detect, they are known to be sensitive to changes in vegetation structure, and several have habitat requirements that depend directly on green trees and snags (like cavity nesters).

Over a two-year period, we observed 54 species of songbird and woodpecker species directly using structural retention in clearcut harvests. This is in contrast to the total number of species we observed occurring in the clearcuts. Of the species we observed directly using structures, 7 were known to forage in the upper canopy of trees, 6 were known to forage on insects and seeds in the bark of trees, and 8 species were listed as regional concern by Partner's in Flight. We found that bird use of single structures was lower than bird use of patches. We also found that patch size was an important determinant of bird species richness, with patches containing more than 15 trees (up to a maximum of 30 trees) not resulting in more species using the patch. Our data support a minimum group size for retention sites of >10-15 green trees with diameters >10 inches.

Surprisingly, we found that bird use of structural retention was not affected by distance to the nearest unharvested forest edge or snag count. Although we

rarely saw birds using individual snags during our surveys, we frequently saw evidence of use by excavating and cavity-nesting species. We suspect that distance to unharvested forest edge was not an important factor influencing bird use of retained structures because of relatively small clearcut sizes (i.e., we rarely measured distances >984 ft) and that scattered structures likely softened the harvest unit thereby diluting the edge effect.

### Bird use of clearcuts with retained structures

We observed 73 songbird and woodpecker species using clearcuts among our four study sites. Species richness of birds found in the clearcuts varied across the regions and followed an elevation gradient ranging from the highest region, northern California (41 species; elevation 4,921 ft) to the lowest region, southwest Washington (54 species; elevation 558 ft). We observed 9-11 cavity nesters and 9-15 upper

PHOTO COURTESY OF DANIEL W. LINDEN

**White-headed woodpecker nest in retained snag, northern California.**

canopy/bark foragers depending on the region. We found that black-capped chickadee, black-throated gray warbler, Brewer's blackbird, brown-headed cowbird, and common yellowthroat occurred less than expected based on regional abundances. Spotted towhee, Stellar's jay, Swainson's thrush, and willow fly-

PHOTO COURTESY OF DANIEL W. LINDEN

**A hairy woodpecker uses a snag for nesting in a central Washington clearcut.**

catcher occurred more often than expected in clearcuts based on regional abundances. Bird species richness estimates in clearcuts represented roughly 60-80% of the diurnally active bird species documented to occur in Pacific Northwest forests.

Regardless of how individual wildlife species use clearcuts, our results indicate that clearcuts harvested according to contemporary forest practices rules and sustainability standards serve as useful habitat for a broad suite of Pacific Northwest birds. We do not contend that clearcuts with retention replace older forest habitats for certain bird species. Rather, our results suggest that retention in clearcuts allows mature forest species to use a greater percentage of intensively managed landscapes. ◆

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### For Additional Information

Linden, D. W., G. J. Roloff, and A. J. Kroll. 2012. Conserving avian richness through structure retention in managed forests of the Pacific Northwest, USA. Forest Ecology and Management 284:174-184. www.sciencedirect.com/science/article/pii/S037811271200477X.

# Can You Have it All? Managing Your Land for Forestry and Wildlife

BY NICOLE STRONG AND FRAN CAFFERATA COE

**Nicole Strong**

**Fran Cafferata Coe**

We have always suspected that it is possible to promote healthy wildlife populations and healthy forests that provide current and future harvest income, and over the years have met many motivated landowners who have been able to do so. We decided to visit with two landowners who are managing for both timber and wildlife to glean the secrets to their success and to share that knowledge with you. The following case studies from around Oregon show us that it is indeed possible to have it all.

Questions we asked:

1. How did you come about owning or managing your land?
2. What are your land management goals (timber and otherwise)?
3. What wildlife species do you actively manage for on your lands? What species do you try to discourage? (e.g., any nuisance species?)
4. How are you able to create habitat to maintain these healthy wildlife populations while still managing for timber production and your other management goals?
5. What has been the most gratifying moment on your land? The most frustrating?
6. What are the most important lessons you've learned to manage for timber and wildlife?
7. Who has been the biggest influence on your management? What lessons did they teach you?
8. How has your woodland management experience been different than what you had imagined?
9. What are your dreams for your woodland? What will it look like in 50 years?

## Case Study 1—Paradise in Elkton: Bill and Joan Arsenault by Fran Cafferata Coe

I am sitting at my computer after just having a wonderful telephone conversation with Bill Arsenault—I'm trying to stop myself from jumping in the truck and driving to Elkton for a tour of the property. Bill's passion for sustainable forestry is clear in the way he talks about his land. Bill and his wife Joan own and manage the Paradise Creek Ranch in Elkton, Ore. They were recently named the 2012 Oregon Tree Farmers of the Year and after my conversation with Bill I can see they are extremely worthy of the award! Bill and Joan bought "the ranch" back in 1971 when they were still living in California. They managed the property remotely, enduring many long I-5 corridor drives for five years before moving to Oregon.

Bill says one of his greatest joys for the property has been fixing up the old farm house over the last 40 years. The entire property is 360 acres, of which about 270 is forested. Five years ago, Bill sought help from Rick Barnes (professional forester with Barnes and Associates) and Bob Young (ODF Stewardship forester) to formalize the management plan he'd been operating with since ownership. Bill and Joan manage for sustainable forestry and aim to have a range of tree age classes (currently 4-70 years) so they are able to consistently harvest trees. Simply put, Bill and Joan grow, cut, and preserve trees. Their goals clearly align with the goals of forestry in Oregon—keeping forestland in forestry.

PHOTO COURTESY OF THE ARSENAULT FAMILY

**Bill and Joan Arsenault of Elkton, Ore., Oregon's 2012 Tree Farmers of the Year.**

The Arsenaults have some specific management goals for wildlife and are lovers of all wildlife. Paradise Creek and Little Paradise Creek are located on the ranch. They have conducted extensive work through partnerships with Oregon Department of Fish and Wildlife and the BLM to restore fish habitat in these creeks for many fish species including the listed Oregon coast coho. In addition, Bill and Joan have fenced the creeks so that their steers, raised in adjacent pasture land, are excluded from the creek and riparian area. The plantings and riparian areas are flourishing since cattle were excluded.

I asked Bill what the most rewarding aspect of his years at the ranch has been, and after some thought he said, "Well I think we live in the most beautiful place in the world." He must mean that he feels his hard work has paid off. He is able to harvest and grow trees, and he is able to observe wildlife that are encouraged to visit and live on his land as a direct result of his management actions.

Bill provides for a wide variety of wildlife by having a diverse mix of age classes on his property. The adjacent pasture land and riparian areas also provide the variety and structure that really attract wildlife. I had to ask if there were any nuisance species they deal with, and his prompt response was "turkeys!" They are a nuisance not because they cause damage to trees, but just because there are a lot of turkeys out there. One of the biggest frustrations that the Arsenaults face is the uncertainty surrounding management of the northern spotted owl. Bill says that one spotted owl could easily tie up a third of his assets, which is very scary for them and for all small woodland owners with property within the range of the northern spotted owl. Bill would like to see regulations that encourage landowners to manage sustainably—not the opposite. Bill thinks landowners are worried that if they allow their trees to reach the age where they provide habitat for northern spotted owls, then they won't be allowed to harvest them.

Bill and Joan are lovers of wildlife and they enjoy that they have coyotes, elk, deer, and many bird species living on their land. They particularly enjoy

watching the birds. One of the ways that Bill and Joan maintain wildlife habitat is by controlling Scotch broom and allowing natural browse species for deer and elk to remain. Bill recognizes that vegetation control is very important for establishing a new tree plantation and he constantly fights Scotch broom, but he has found that native species like hazel and elderberry don't compete too much with his trees, so he leaves some of these for the deer and elk.

Oregon's Tree Farmers of the Year would advise new landowners to seek the expert advice that they need. Bill says don't be afraid to sign up for the OSU Extension classes (http://extension.oregonstate.edu) designed for family forest owners and also to seek advice from professional foresters for site prep and forest management ideas.

Bill and Joan are passionate about sustainable forestry and they are passing this passion onto their three children who are also owners of the Paradise Creek Ranch. I am planning a visit to them the next time I drive down toward Elkton!

### Case Study 2—Critters, Cattle, and Christmas Trees by Nicole Strong

Marge and Gene Bieraugel tend over 500 acres of forest and rangeland in Wallowa County, Ore. Of the 500 acres, 340 are in a Stewardship Plan. They started their forest stewardship venture in the 1970s, a Navy couple living in Texas, looking for land where they could hunt. They looked for some time before finding a property in Wallowa County they could use not only for hunting, but for farming, forestry, and pasture. By trying to diversify their cash flow opportunities on the land they were also able to obtain an ecologically diverse land that affords "wildlife ample conditions for what they need to thrive and survive." They added to their property in 1994, including an over-logged piece that required reforestation. They feel much more invested and knowledgeable now that they live on the land and can be there every day.

Their management goals are well articulated in their Stewardship Plan, which was originally written in 1993 and updated in 2003. Their goals are to:

- Improve and maintain timber health;
- Harvest timber periodically;
- Dedicate an area to produce big trees for aesthetics and silviculture;
- Maintain and enhance wildlife habitat, and encourage aspen stands using management techniques; and
- Continue to implement multi-use management of timber, cattle, wildlife and recreation.

They manage their land for species of wildlife that occur in the region and are suited to their site, including deer, elk, bear, grouse, and turkey, as well as some other game and non-game species. They have encouraged bluebirds by constructing 50 bluebird houses, and have found both mountain and western species in the nesting boxes. They stack small thinned trees in piles to provide cover for cottontail rabbits, chipmunks, and other "creepy crawly things." There are numerous springs, as well as several "Texas-style" water tanks that provide water sources. Two heritage orchards have been left wild to provide fruit in the fall for bears, birds, and deer. They also encourage fruiting shrubs such as serviceberry, choke cherry, hawthorn, snow berry, and elderberry, which provide important food for grouse, songbirds, and mammals. Luckily, they seem to have found balance with the wildlife, though they have had to deal with mountain lions, coyotes, ground squirrels, and rattlesnakes.

Marge and Gene have found that their goals to produce timber and create wildlife habitat go hand in hand. They recently created a windbreak for wildlife, which attracts many species. The acres they are managing for large trees are more open than surrounding areas and large snags have encouraged cavity nesters from chickadees to pileated woodpeckers. The more open stand creates more forage from light reaching the ground, which means elk like to graze there in the summer, and move to the tighter stands when they seek thermal cover in the winter. They allow shrubs to the extent that they don't prevent seedlings from growing.

They planted trees along an edge of their largest pond, hoping to create shade and provide nesting habitat for waterfowl. Every year they plant between 100-1,000 trees.

All of this work has its rewards. They love watching the trees grow, the cattle graze. They keep binoculars in every rig so they can spot wildlife. There are wildflowers in the spring, bright foliage in the fall. In the winter they ski and snowshoe on the skid roads, looking for tracks. Their grandkids love to come and fish, help water trees, and go sledding.

Each grandchild has their own "management acre" so that they can learn about forest stewardship themselves. Everyone has gotten into hunting and gathering off the land. Nothing quite beats venison steak topped with freshly harvested morel gravy! The family also cuts their own Christmas tree every year, another great way to get kids involved in forestry.

However, it's not all fun and games on the land. Getting seedling trees to grow is always a challenge, but after much trial and error they have figured out a way to successfully regenerate trees. They also learned, the hard way, to "never fall in love with a tree" as there are many factors out of their control, including wind, insects, or snow break that might remove a tree they were focused on.

Over time they learned not to rush any harvest, taking time to know exactly what their goals are, waiting for the market to be right, and finding a logger who shares their values and understands the kind of harvest they want to do. They were warned not to harvest when they needed money for such things as a new pick up, which "is maybe why we didn't buy a new pick-up for 20 years."

The Bieraugels have a lot of support, as they have tapped into great local resources, including their state Stewardship foresters and the OSU Extension Service. They took the

*(CONTINUED ON PAGE 28)*

# SAF Council: March 2013 Meeting Highlights

BY BOB ALVERTS,
JOHN WALKOWIAK,
AND JOHNNY HODGES

SAF President Joann Cox led her first SAF Council meeting at the national headquarters in Bethesda, Maryland, on March 8-10.

President Cox began the meeting with an overview of the SAF Brand Promise information that was initially shared at the 2012 National Convention in Spokane, and is continuing to be shared at all local and statewide SAF meetings in 2013. It is important for SAF leaders and members at all levels to understand this language and use it to help SAF expand its capacity. Brand is the core promise of our organization and branding provides the signals we send that transmit the promise.

The core language of SAFs Brand Promise is summarized below:

**Thriving Forests. Essential Resources. A Strong Community.**

**We challenge landowners, decision-makers, and society at large to make choices about our forests based on professional knowledge, leading-edge thinking and a century of practical experience.**

**We seek viable pathways forward, balancing diverse demands on our natural resources.**

**We set the standard in forest management, bringing science, best practice, and the best people together to actively shape the future of the profession.**

**"For the greatest good. For the greatest number. For the long run."**

**Society of American Foresters Evolving Forest Management since 1900**

President Cox also focused on the need to lead change within SAF, and the roles of executive vice president, SAF National Committees and Council in being key change agents. We also addressed reasons why organizations resist change, and how important it is to work to build a commitment to change and institute the new brand promise throughout the entire SAF organization.

She also addressed Council performance. Council has "graded" itself on key performance indicators over the last few years with the idea of improving performance over time. Key Council performance indicators include: keeping focus, parliamentary procedure, agenda/meeting preparation, committee use, National Office staff, delegation, decision support/unity, database decisions, task force use, and serving as a change agent for SAF.

President Cox discussed the importance of SAF nominating committees in providing quality candidates for key SAF leadership positions, as well as


**Left to right: Council representatives John Walkowiak, Johnny Hodges, and Bob Alverts.**

awards and professional recognition. She invited Council Member Dave Lewis to discuss how Southeast SAF handles nominations. Dave noted that it is critical to SAFs future to nominate people with good leadership potential or really deserving of an award. We discussed nominations all the way to our foundational unit: the local SAF chapters. The SAF chapter is the "pipeline" that feeds SAF leadership needs at the state and national levels.

The Finance Committee reported on a number of issues, including the year-end budget numbers for 2012. Although the overall approved budget remains in a deficit, as it has for the past four years, we saw major improvement in 2012 and are planning for a balanced budget in 2014. The early 2013 budget numbers also look promising, with revenue for several major program areas ahead of recent years. The Finance Committee is working with SAF staff to develop a five-year budget so we can look forward and plan accordingly. The Finance Committee also shared a new tool for use in all future revenue requests, as well as analysis of current SAF program areas, to be sure they address actions that will enhance SAF strategic priorities and mission objectives. Key questions will have to be answered for new program funding (basically a benefit/cost analysis). A simple spreadsheet was presented for evaluation of budget planning for new and existing SAF committees, task forces, and pro-

grams. New or existing programs will need to earn an appropriate "rate of return" relative to the budget and must fit within the priorities of the strategic plan (or SAF brand). The Finance Committee and Strategic Planning committees are working together to develop a system that ensures funding goes to activities that fit the brand framework, meet strategic plan goals, and reflect budget constraints.

Since the soft launch in Spokane, the SAF Founders Circle has received over $55,000 in donations from 29 participants. This is an excellent early response considering that we are just getting started. We learned the sale of the Wild Acres property continues to proceed with no serious concerns at this point, and the Finance Committee is developing policies and strategies for maximizing long-term investment revenue while minimizing risks.

The Strategic Planning Committee is working closely with the Finance Committee to identify and carry out strategic priorities. As part of SAF's strategic planning effort, the Finance Committee is helping define core values and looking to enhance SAF's future. The process will lead to changes in SAF. We have hired a consultant to lead us in this change program, and you can expect to hear more about the SAF brand framework as we move ahead. Council discussed a detailed road map provided by the consultant that showed where SAF will be in three months, six months, a year, and 18 months in terms of (1) seamless customer service; (2) bridge the gap with inclusive language; (3) uber (exceptional) networking; (4) "go to status" (SAF the go to organization for forestry information); and (5) change the conversation on forest stewardship. Council recognizes that as we move ahead, building our understanding and experience, there will be a need to make necessary changes in language, but for now, in this initial year of sharing our new brand information, we intend to use the documents as drafted.

We learned the Task Force on Membership/Credentialing has been set up and a charter developed. This task force will address the issues related to a broader membership (since we will soon be accrediting natural resource management academic programs).

The chair of the Science and Technology Board (STB) raised a question concerning what type of science issues Council expected the STB to focus on. Should it be emerging issues, emerged issues, or critical issues? And what type of products does Council expect?

The chair of the SAF Policy Committee discussed the first meeting of the 2013 Policy Committee that was held on March 10.

The next SAF Council meeting is scheduled for May 31-June 2, 2013, in a location to be determined. ◆

*This Council report is a collaborative effort between District 1 (Washington State, Alaska and Inland Empire) Council member John Walkowiak, District 2 (Oregon) Council member Bob Alverts, and District 4 (the Intermountain West from Canada to Mexico) Council member Johnny Hodges. John Walkowiak can be reached at 253-320-5064 or jewalkowiak@harbornet.com. Bob Alverts can be reached at 503-639-0405 or balverts@teleport.com. Johnny Hodges can be reached at 970-218-3394 or jah.16@live.com.*

## Managing Your Land for Forestry & Wildlife

*(CONTINUED FROM PAGE 25)*

Master Woodland Manager course a few years ago, and now work closely with Extension to help other landowners in the community.

Life and land management is certainly different in Wallowa County than in the Minnesota land they grew up on. They have decided that active management is helping them reach their timber and stewardship goals much quicker than would occur if they let "nature take its course."

Ultimately, Marge and Gene want a healthy forest that can be harvested every 15 years or so. They want their children and future generations to feel attached to this land, to enjoy recreation, fishing, jogging at 4,400 feet, marksmanship, and winter sports like cross-country skiing, snowshoeing, and hunting.

### Summary

We hope these examples will encourage and motivate you to examine your own goals for forestry and wildlife. There are many types of working forests and each has their own challenges with regard to wildlife management. We believe these two case studies exemplify what it means to be a family forest landowner in Oregon and that achieving both forestry and wildlife goals on working forests IS having it all. ◆

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*Nicole Strong has worked for Oregon State University Forestry and Natural Resources Extension for eight years as an educator. She coordinates the Master Woodland Manager Program, and teaches forestry and wildlife classes around the state. She can be reached at 541-829-1270 or nicole.strong@oregonstate.edu. Fran Cafferata Coe is a Certified Wildlife biologist and owner of Cafferata Consulting, LLC based in Hillsboro, Ore. She can be reached at 503-680-7939 or fran@cafferataconsulting.com.*

# Sustainable Forestry Tour for Educators Set for June

The Idaho Forest Products Commission announced the 2013 Sustainable Forestry Tour will take place June 24-28 in north Idaho. The tour is especially designed for 3rd to 12th grade educators and counselors to learn about forests, the sustainable cycle of forestry, and the forest products industry to help them educate their students about forest resources. This marks the 12th year for this highly successful tour that provides a first-hand look at the sustainable cycle of forestry and a one-on-one experience with loggers, foresters, landowners, land managers, and others in Idaho's forest products industry. Key concepts are introduced and reinforced throughout the tour. This year, the tour has been expanded to include more time on the ground and more educational activities that can be taken back into the classroom. "Every year we use participant and presenter feedback to fine tune the tour agenda to improve the experience and outcome," said Betty Munis, IFPC director. "Our goal is to help the educators be better prepared to help their students make informed decisions about resource management, wood products, and career choices. They will also share their personal experiences with the friends, families, neighbors and peers."

**Sponsorship Opportunities Available.** Forest tours are one of the best ways to show the dynamics of the forest products industry. The commission generally receives over 100 applications from teachers or school counselors that want to attend the tour. Past participants claim the experience has been a turning point in their attitudes about forest management and the products industry. Educator sponsorships are $300 plus transportation costs to and from the tour, unchanged from past years. The commission will match educators and sponsors. Meal and general sponsors are also needed to make the tour possible. If you're interested in sponsoring a teacher or the tour in general, know a teacher that should apply to participate, or have a suggestion for the tour, contact Betty or Michelle at 208-334-3292 or ifpc@idahoforests.org. More information about the Sustainable Forestry Tour including teacher and sponsor applications can be found at www.idahoforests.org/tour.htm. ◆

# Calendar of Events

**Western Hardwood International Convention and Exposition,** April 30-May 2, Portland, OR. Contact: David Sweitzer, 360-835-1600,wha@westernhardwood.org, www.westernhardwood.com/ICE2013.htm.

**University of Idaho: Logger Education to Advance Professionalism,** May 1-3, Moscow, ID. Contact: UI Extension Forestry, 208-885-6356, rbrooks@uidaho.edu, www.uidaho.edu/extension/forestry/content/leap.

**Starker Lecture Series: Environmental Considerations in Forest Biomass Use and Bioenergy Production,** May 2, Corvallis, OR. Contact: Starker Lectures.

**Washington GIS Conference,** May 6-8, Lynnwood, WA. Contact: 2013WAGISConference@waurisa.org, www.waurisa.org/conferences/2013_Conference_Index.html.

**Uniform Management Plan Training,** May 8 in Sisters, OR, and May 14 in Roseburg, OR. Contact: Jen Rains, 503-588-1813 x1, jenerains@gmail.com, http://extension.oregonstate.edu/benton/forestry/events.

**Mother's Day Weyerhaeuser Pacific Rim Bonsai Collection Tour,** May 12, Federal Way, WA. Contact: 253-924-5206, www.weyerhaeuser.com/Company/Bonsai/Events.

**ESRI Forestry GIS Conference,** May 14-16, Redlands, CA. Contact: ESRI Forestry Group, 909-793-2853, info@esri.com, www.esri.com/events/forestry/index.html.

**Starker Lecture Series: Oregon's Biomass Experience: An Integrated Approach to Forest Biomass,** May 16, Corvallis, OR. Contact: Starker Lectures.

**OSAF Foundation Fellows Luncheon,** May 22, Corvallis, OR. Contact: Jennifer Beathe, 541-929-2477, jennifer@starkerforests.com.

**Starker Lecture Series: Capstone Field Trip,** May 31, Corvallis, OR. Contact: Starker Lectures.

**Northwest Seed Managers Association meeting,** June 5-6, Canby, OR. Contact: WFCA.

**Urban Forestry Strategies: Linking People and Landscapes,** June 6, Portland, OR. Contact: Rick Zenn, 503-488-2103, rzenn@worldforestry.org, http://oregoncommunitytrees.org/conferences/.

**Oregon Small Woodlands Association annual meeting,** June 13-15, Roseburg, OR. Contact: Jim James, 503-588-1813, jimjamesoswa@yahoo.com, www.oswa.org/.

**OSU Natural Resources Leadership Academy,** June 17-28, Corvallis, OR. Contact: Maurine Powell, 541-737-3993, maurine.powell@oregonstate.edu, http://outreach.oregonstate.edu/nrla/contact.php.

**Western Forest Economists and Western Mensurationists meeting,** June 23-25, Leavenworth, WA. Contact: WFCA.

**Sustainable Forestry Tour for Educators,** June 24-28, north Idaho. Contact: Betty Munis, Idaho Forest Products Commission, 208-334-3292, ifpc@idahoforests.org, www.idahoforests.org.

**Council on Forest Engineering annual meeting,** July 7-10, Missoula, MT. Contact: Beth Dodson, 406-243-5542, elizabeth.dodson@umontana.edu, www.umt.edu/ce/cps/forestengineering/.

**Forest Insect and Disease Field Session,** July 8-12, The Dalles, OR. Contact: WFCA.

**Western Forest Nurseries,** August 6-7, Olympia, WA. Contact: WFCA.

**Forest Products Forum: Portland,** Sept. 17, Portland, OR. Contact: Greg Lewis, 978-469-6335, glewis@getfea.com, www.getfea.com/component/content/article/210.

**Who Will Own the Forest?9** Sept. 17-19, Portland, OR. Contact: Sara Wu, 503-488-2130, swu@worldforestry.org, http://wwotf.worldforestry.org/wwotf9.

**PNW Reforestation Council,** Sept. 25, Vancouver, WA. Contact: WFCA.

## Contact Information

**Starker Lectures:** OSU College of Forestry, 541-737-1585, http://starker-lectures.forestry.oregonstate.edu/.

**WFCA:** Western Forestry and Conservation Association, 4033 SW Canyon Rd., Portland, OR 97221, 503-226-4562, richard@westernforestry.org, www.westernforestry.org.

**Send calendar items to the editor, *Western Forester,* 4033 SW Canyon Rd., Portland, OR 97221; rasor@safnwo.org.**

# Policy Scoreboard

*Editor's Note: To keep SAF members informed of state society policy activities, Policy Scoreboard is a regular feature in the* Western Forester. *The intent is to provide a brief explanation of the policy activity—you are encouraged to follow up with the listed contact person for detailed information.*

**Oregon DEQ Pushed to Complete Coastal Water Pollution Control Plans.** A 2010 settlement prompted by a lawsuit under the federal Coastal Zone Act Reauthorization Amendments (CZARA) required Oregon DEQ (ODEQ) to develop a comprehensive plan for modifying forest practices on private lands to control nonpoint source pollution in coastal watersheds, or risk the loss of millions of dollars of federal grant funds. The plan's implementation could be the first example of Oregon forest landowners being subject to significant forest practice requirements and agency oversight beyond the Forest Practices Act and Rules administered by the Department of Forestry. In December 2012, EPA and NOAA administrators sent a joint letter to the ODEQ raising serious concerns about the agency's progress to date in developing the plan as well as the adequacy of a number of water protection strategies under consideration. The latter include managing forest road impacts and riparian and landslide-prone areas. In discussing some of the concerns, the EPA and NOAA made several references to more restrictive management measures now required in "neighboring coastal states," which clearly have "raised the bar" as the federal agencies consider Oregon's efforts. Contact: Paul Adams, OSAF Policy chair, 541-737-2946; paul.adams@oregonstate.edu.

**OSAF Salvage Harvest Position Updated; More Updates to Follow.** The OSAF Policy Committee recently updated the OSAF position statement on "Salvage Harvesting on Public Lands." Approval of the updated position by the OSAF Executive Committee is expected by the time you read this. Notable changes include the addition of "on Public Lands" to the position title, to reflect the primary focus of concerns about salvage. The reference list also was updated and some of the background discussion was tightened up. Although salvage has not been a high profile issue in Oregon in recent years due to the limited number of large wildfires, fire hazards remain high in many areas and a single, large burn could quickly renew the controversy.

In the coming months, the OSAF Policy Committee will review and update two other position statements that are scheduled to expire: (1) Clearcutting; and (2) Active Management to Achieve and Maintain Healthy Forests. Both of these positions remain important given ongoing concerns related to wildfires and forest health, and negative perceptions of clearcutting. The latter issue has been renewed by the recent western Oregon BLM's pilot projects that include "regeneration harvests." All members are encouraged to review OSAF's position statements (www.forestry.org/oregon/policy/position/) and use them to articulate a professional perspective when discussing forest resource issues with people outside the profession. Contact: Paul Adams, OSAF Policy chair, 541-737-2946; paul.adams@oregonstate.edu.

**Anchor Forests Pilot Project.** The Intertribal Timber Council has been awarded a substantial grant by the US Forest Service to conduct a pilot project of the anchor forest concept in three areas of Eastern Washington that include forestlands on the Yakama, Colville, Spokane, and Coeur d'Alene Reservations. An anchor forest may be defined as: "A multi-ownership land-based area that will support sustainable long-term wood and biomass production levels backed by local infrastructure and technical expertise, and endorsed politically and publicly to achieve the desired land management objectives." This is a landscape-scale collaborative approach to active forest management with three main goals: restore infrastructure capacity, coordinate management across ownerships, and provide economic benefits. Lead contractor for the project is Northwest Management, Inc., a consultancy based in Moscow, Idaho. Team members include US Forest Service and Washington Department of Natural Resources representatives, and researchers from the University of Washington, The Nature Conservancy, and your correspondent. Contact: Jay O'Laughlin, Inland Empire SAF, 208-885-5776, jayo@uidaho.edu. ◆

## We Remember

### Ed Miles
### 1937-2013

Ed Miles was born on May 18, 1937, in Great Falls, Mont., and passed away February 21, 2013, in Spokane, Wash., at the age of 75.

Ed graduated from Browning High School in 1955 and graduated from the University of Montana with a Bachelor's degree in forestry in 1961. Ed was inducted into the Army on January 30, 1962, serving in the 102nd Division Engineering Company and received an honorable discharge on December 31, 1967. He then went to work for the Bureau of Land Management in Spokane, and later started his own forest consulting business, in which he worked until his death.

Ed was a Fellow and Certified Forester for the Society of American Foresters. As an SAF member, he served the local area in both elected and appointed positions, and volunteered for many tasks, including national meetings. He was also the Inland Empire SAF's membership chair.

Ed was a member of Washington Farm Forestry Association, where he served on the board of the Spokane Chapter and was vice-president of the chapter at his passing. His last big task with the WFFA was serving as the committee chair for organizing the state WFFA annual meeting held in Spokane during May 2012.

In addition, Ed served as president of the Friend to Friend of Greater Spokane, and with his wife Connie, worked diligently for this organization that provides companionship for people in long-term care facilities. Ed loved to travel to national forests and loved photography and hunting.

He is survived by his wife, Connie Miles; daughters, Carolyn Bergren, Phyllis Meyer, and Rebecca Wayne; and eight grandchildren.

A celebration of life was held March 2. In lieu of flowers, donations can be made to Friend to Friend of Greater Spokane, 4001 N. Cook St., Spokane, WA 99207, or All Saints Lutheran Church, 314 S. Spruce, Spokane, WA 99201. ◆

# Oregon 2012 NAIP Imagery Available for Free Download

BY JON ASCHENBACH

In 2012, the entire state of Oregon was flown under the National Agricultural Imagery Program (NAIP). This imagery is available as a compressed county mosaic (CCM), with each file representing one county. The imagery is one meter resolution and in color. These files are in a MrSID format, which can be viewed from a variety of free software programs such as Irfanview. They also are readily viewable in ArcGIS, ArcView, MapInfo, and several other mapping programs.

Once a county of this imagery is brought up on a computer screen, users can zoom in to see detail down to being able to recognize individual larger trees, cars, and roads.

This imagery is available in a MrSID file format at no charge. Interested users can download the imagery at the US Dept. of Agriculture NRCS Geospatial data gateway. The link is datagateway.nrcs.lusda.gov/GDGO.aspx. File sizes are often very large, especially for large counties such as Lane and Douglas. The imagery is in the Universal Transverse Mercator (UTM) projection. ◆

*Jon Aschenbach is owner of Resource Supply LLC in Tigard, Ore. He can be reached at 503-521-0888 or jon@resourcesupplyllc.com and can answer any questions about the 2012 NAIP imagery.*

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## THE LASER TECHNOLOGY SURVIVAL GUIDE TO FIELD WORK

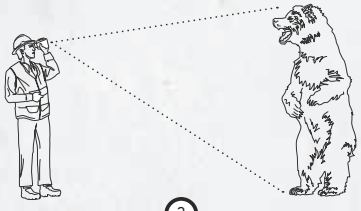
### SURVIVING A GRIZZLY BEAR ENCOUNTER

1

Use your TruPulse laser, in distance mode, to see how far away the bear is.

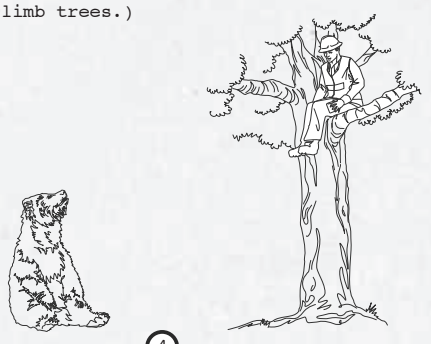
2

From that data, decide if you should run, or if you need to climb a tree. (NOTE: Make sure it's a grizzly. Other bears climb trees.)



3

If you chose to climb, measure the bear's height using your TruPulse's height routine.



4

Climb a tall enough tree and hang out until the bear gets bored and leaves. (NOTE: To pass the time, measure the height of other surrounding trees.)

**SOME DAYS IN THE FIELD ARE MORE EXCITING THAN OTHERS.** Whether you're out cruising timber or flagging sale boundaries, you're bound to encounter the unexpected. Not to worry though. The power and versatility of LTI lasers let you adapt to ever-changing conditions and situations while still having confidence in the data you log. To explore our complete line of forestry products, visit www.lasertech.com/stories/atterbury . While you're there, share your craziest day in the field, and be registered to win LTI equipment.