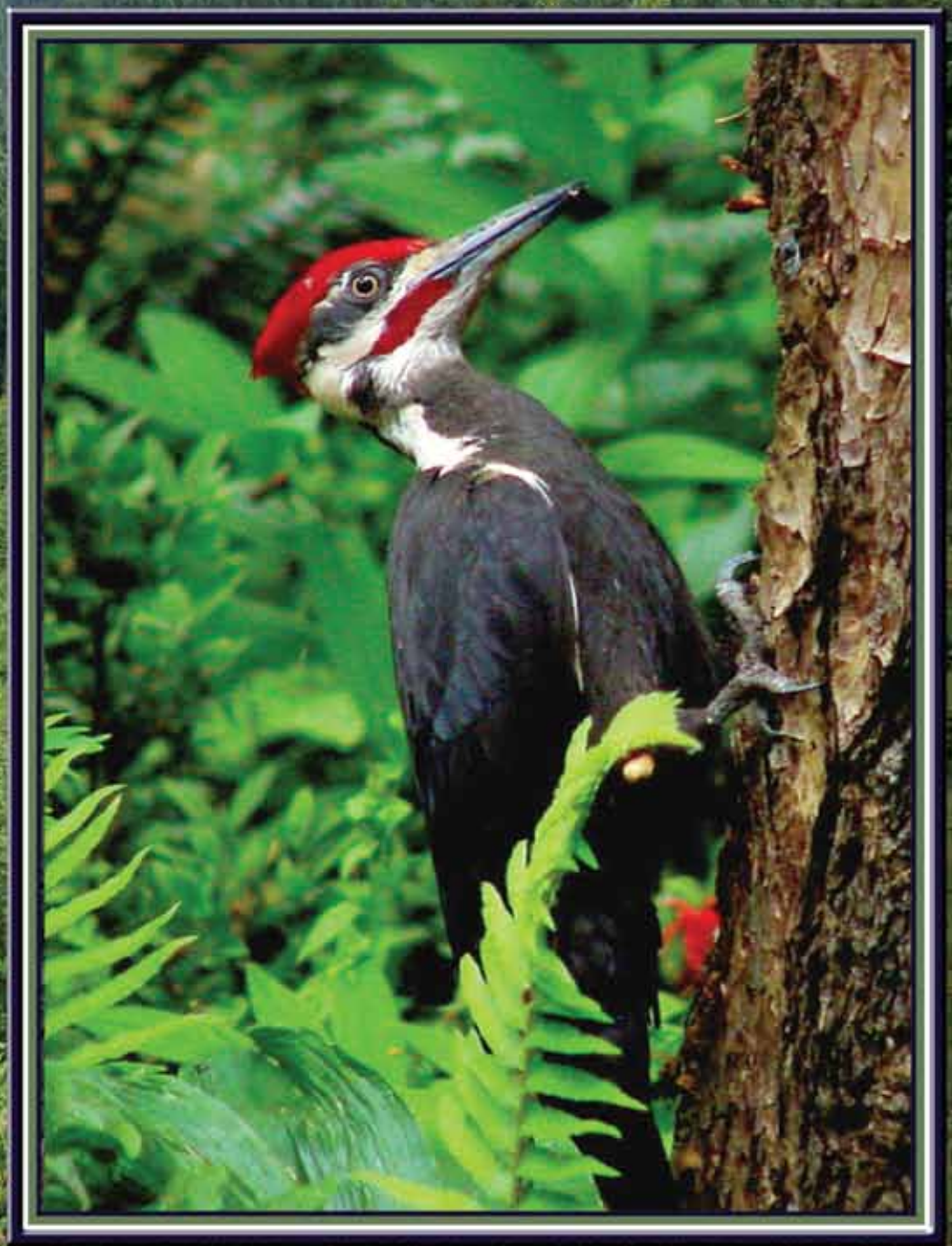
WILDLIFE
IN MANAGED FORESTS

Oregon Forests as Habitat



Wildlife in Managed Forests
Project Overview

A great deal of research has been done by public and private organizations regarding wildlife and wildlife habitats in Northwest managed forests, where management such as thinning, harvesting, prescribed burning, tree planting and vegetation control is practiced. However, the research results and their implications have not been communicated in an accessible, systematic fashion. This publication is part of a series from the Oregon Forest Resources Institute. The Wildlife in Managed Forests Outreach Project aims to synthesize current research findings and make information available to field practitioners in forest and wildlife management, and to interested parties such as conservation organizations, regulators and policymakers. In addition to publications, information will be disseminated through workshops, tours and conferences. (Front cover pilated woodpecker)

Project partners include:

- National Council for Air and Stream Improvement
- Oregon Department of Fish and Wildlife
- Oregon Department of Forestry
- Oregon Forest Resources Institute
- Oregon State University College of Forestry
- U.S. Forest Service Pacific Northwest Research Station
- U.S. Geological Survey Forest and Rangeland Ecosystem Science Center
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Oregon Forests as Habitat

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Contents

Forestry and Wildlife

Enhancing Wildlife Habitat through
21st Century Forest Management

This is the new cornerstone publication of the Oregon Forest Resources Institute (OFRI) Wildlife in Managed Forests series. The series now consists of four reports; the others are titled *Elk, The Northern Spotted Owl* and *Stream-Associated Amphibians*. These reports provide a background and context for better understanding the interplay between forest management and wildlife.

OFRI created its Wildlife in Managed Forests series because we know Oregonians care about forest-dwelling wildlife. In the 12 years since our first special report on wildlife – *Forestry and Wildlife: Oregonians Working Together to Manage Environmental Change* – was released, there have been major advances in the science pertaining to passive and managed forests, and major improvements in forestry tools and techniques. Scientists and managers have developed research-based strategies for enhancing wildlife in the course of performing the silvicultural operations that are at the heart of modern forest management. In this publication, we discuss some of these strategies, review the research that supports them, and showcase them as they are being applied by forest landowners across Oregon. The purpose of this publication is to guide forest landowners and managers whose objectives include enhancing wildlife habitat in the course of their forest management activities.

Habitat Enhancement as Part of Forest Stewardship

Many people assume that the standard forest management toolkit – clearcutting, thinning, slash burning, weed control, planting of seedlings – is categorically harmful to wildlife. The debate is often cast in stark either/or terms: You can have wood products, or you can have wildlife habitat, but you can't have both – at least not on the same patch of ground at the same time.

The basics of habitat enhancement

- Identify important habitat areas on your land and learn about the wildlife that live there.
- Plan management activities so as not to disturb wildlife during critical times such as nesting season.
- Herbicides can be as effective as mechanical methods to shape forest structure. Use them judiciously, always according to the label and the law, and avoid using them near habitat during nesting or breeding season.

- Leave a few pieces of large dead downed wood per acre on harvested stands; longer than 10 feet is ideal.
- Leave snags, or create them by topping trees.
- Maintain clean water sources. Minimize disturbances to streams and ponds.
- Manage invasive plants and wildlife.
- Leave some hardwood/fruiting shrubs.
- Talk to your neighbors about collaborating on wildlife enhancement.

Case Study:
Chris and Donna Heffernan, North Slope Ranch

The Heffernans look for synergies to promote long-term stewardship

Chris and Donna Heffernan's North Slope Ranch encompasses several thousand acres near North Powder, in eastern Oregon. For the Heffernans, who manage forestland and raise hay and cattle, wildlife is clearly a priority.

Well-placed windows in the Heffernans' house allow ample spots to view the elk, turkey, bear and cougar when they visit. Chris and Donna like to tell visitors about the spotted frogs, great grey owls, pileated woodpeckers and sandhill cranes they've seen. Elk racks adorn the walls, binoculars are thoughtfully placed next to comfy window seats, and hummingbird feeders welcome their evening visitors.

Wildlife habitat is part of the family's integrated management strategy, which balances profitable cattle and hay production with range rehabilitation, and sustainable timber production with forest health, and generally attends to the long-term stewardship of the land.

"We look for synergies," Chris says. For example, they manage their livestock water carefully, luring the cattle to planned grazing sites by strategically diverting the water. This keeps livestock away from sensitive areas at the wrong times and saves money on fencing, too. Conifers are thinned out of aspen stands, reducing fuel and enhancing competitiveness for the aspen, a high-conservation-value east-side ecosystem.

The Heffernans' cattle do extra duty as a "fire crew," eating down the grass in the spring to reduce fuels. The regrowth feeds grazing wildlife in the summer. Though concerned about fire, Chris and Donna leave shrubs and hardwoods in their forest to feed the birds. They seed their skid trails after a logging operation to provide food for turkey and elk. With the help of the Oregon Department of Forestry (ODF) and the Oregon Watershed Enhancement Board (OWEB), they've improved two ponds to benefit migrating waterfowl and serve as a water source for fighting fires.

But if you ask them about their most important measure of success, it would be that their children remain passionately attached to the home place. The Heffernans' 23- and 26-year-old sons just moved back to North Powder and have started farming 1,200 acres of wheat hay just down the road.

The Heffernans frequently open their ranch to touring landowners and policymakers. Their main advice? "Be patient, but be proactive, especially if forest health is at stake," says Chris. "Don't wait until you have it all figured out, because you'll never have it all figured out."

The past two decades have seen an explosion of research into the habitat needs of forest wildlife. At the same time, scientists, forest managers and the general public are gaining a better understanding of the dynamic character of the landscapes in which these animals live. And, in response to this increasing knowledge, forestry concepts and tools are continuously being refined. Today's forest managers choose from among many strategies to achieve the whole complement of values, goods and services a forest can provide.

Diverse ecosystems

Oregon has a wide variety of forest ecoregions, from moist Douglas-fir–hemlock forests along the coast to the stately ponderosa pine stands of central Oregon to the high-elevation firs, larches and aspens of the Wallowas.[1] Within these ecoregions are forests of varying ages and composition, managed for a wide range of objectives: from wilderness to recreational and aesthetic values to commercial timber harvest. This variety of ecoregions and management goals represents a structural diversity across the forested landscape that provides habitat for many wildlife species.

Created snags in a working forest

This publication is aimed chiefly at landowners, biologists and managers associated with working forests – that is, forests "managed to sustain an array of resources that contribute to quality of life: wood and non-wood forest products, quality water, fish and wildlife habitats, outdoor recreation, and ecological services such as carbon storage."[2] This definition, from dean Hal Salwasser of the Oregon State University College of Forestry, covers a wide spectrum. It includes public and tribal forests, and privately owned industrial, investment and family forests. It includes forests of one or two acres up to those encompassing thousands of acres, and forests of all ages, structures and tree-species compositions.

We believe contemporary forestry techniques, skillfully and thoughtfully applied, can and do enhance wildlife habitat in working forests. For many forest owners and managers, wildlife enhancement is simply part of good forest stewardship.

Manage forests, create habitat

The purpose of this publication is to guide forest landowners and managers in enhancing wildlife habitat in the course of their forest management activities. Following sections provide an overview of wildlife status and diversity needs of wildlife in forested landscapes across Oregon. We then describe

1 For definitions and maps of Oregon's ecoregions, see pp. 110-111 of the Oregon Conservation Strategy (Oregon Department of Fish and Wildlife 2005), http://www.dfw.state.or.us/conservationstrategy/.

2 To learn more about working forests, see OFRI's publication The Future of Oregon's Working Forests (Oregon Forest Resources Institute 2008).

the survey of research that has brought us to our current understanding of forest management's effects on wildlife and ways to emulate natural diversity with managed strategies. We provide management techniques and successes to accomplish diverse wildlife habitat. Finally, in a series of case studies, we showcase landowners and managers who are applying some of these techniques on their lands.

Because Oregon is home to hundreds of wildlife species inhabiting millions of acres of forestland, this publication can't possibly be comprehensive in covering all their needs. We frequently refer the reader to detailed information contained in easily accessible resources.

When forest landowners host the state's wildlife population, there are costs involved. First, forest management activities to promote wildlife may decrease timber production and involve additional out-of-pocket expenses for landowners. Secondly, animal damage can occur that further reduces timber output and adds protection costs. Fortunately, as we shall see, assistance programs are available from state and federal wildlife agencies.

Two Centuries of Habitat Change

Disturbances, fragmentation and development

Throughout Oregon's natural history, disturbances such as fires, landslides, earthquakes, windstorms, volcanic eruptions, climate changes and diseases led to dramatic changes in the forest landscape and profoundly affected wildlife and its habitat. The result was a diverse natural forest landscape that changed and evolved over time. Oregon is home to more than 700 wildlife species, 92 of which are unique to the state. Many of these wildlife species adapted to natural changes, over time seeking the habitat that best suited their needs. More recently, human activities such as urban growth, highway construction, agriculture, timber harvesting and fire suppression have altered natural disturbances, also resulting in a diverse mosaic of forest ages and habitat features.

Habitats are in a constant state of change

Understanding species and their habitat relationships is paramount to predicting species' responses to past, present and future land uses within a managed landscape. In the past, one approach to habitat management could be considered similar to the motto in the movie *Field of Dreams:* "Build it (habitat) and they (species) will come" (Brown 1985). But to build it or conserve it, resource managers need to know what the relationships are between the individual species and their habitat. Furthermore, because of disturbances and growth, habitats are in a constant state of change, as are wildlife communities in response. Fragmentation and habitat loss are two important types of changes.

Forest fragmentation is the process of reducing size and connectivity of stands composing a forest. Fragmentation is not the same as habitat loss, such as what results from converting forestland to agricultural and urban uses. Fragmentation is a naturally occurring ecological process, and does not always have negative consequences (Franklin et al. 2002). A major determining factor that affects wildlife is the degree of isolation of the fragmented patches. The smaller the patch, the smaller the availability of habitat for wildlife; the reverse is true with larger patches: the larger the patch, the more the available habitat. Most important, according to McComb (2001), is that "a patch of habitat must be sufficiently large to provide energy inputs and energy conservation features to sustain a population." What is equally important for a habitat to be of use for a particular species is the makeup of structural components within the habitat area. Rochelle (1998) suggests there is little evidence of negative effects on vertebrate biodiversity from changes in the configuration of forest habitats across a dynamic landscape. Research has shown that the total amount of suitable habitat is of greater significance to vertebrate survival and productivity than how it is configured.


Development often means habitat loss

A more recent trend has been the parcelization of once-contiguous forestlands and their conversion to residential, agricultural and other non-forest uses, resulting in habitat loss. Even today, with a legal and institutional framework aimed at keeping Oregon's rural working lands economically viable, such conversion continues to threaten habitat even on lands that remain forested. Lettman (2011) noted that 73 percent of the land-use changes between 1974 and 2009 were conversions from forest, agriculture or range to low-density residential or urban uses, and that more houses are being built on forest, agriculture and mixed-use lands within those areas. This suggests that prevention of habitat loss should be a high conservation priority.

Laws, policies, partnerships and voluntary efforts

Over the past 40 years, a number of laws have played a part in shaping our landscapes. Among the most influential federal laws are the Multiple Use-Sustained Yield Act of 1960, Wilderness Act of 1964, Wild and Scenic Rivers Act of 1968, Clean Air Act of 1970, Clean Water Act of 1972, Endangered Species Act of 1973 (ESA), Forest and Rangeland Renewable Resources Planning Act of 1974, National Forest Management Act of 1976 and Federal Land Policy and Management Act of 1976.

Over the years, Oregonians have mounted many efforts – public and private, mandated and voluntary – to address wildlife conservation. Oregon's land use planning laws require counties to prepare comprehensive land-use plans that include consideration of wildlife habitat, open space needs and ecologically

significant natural areas. The Oregon Endangered Species law has provisions that protect native vertebrates and plants. In 2006, the state adopted a policy framework called the Oregon Conservation Strategy that is intended to "create a broad vision and conceptual framework for long-term conservation of Oregon's native fish and wildlife …" (Oregon Department of Fish and Wildlife 2005). Much of the information in this publication is taken from the comprehensive book of the same name. For the reader who desires in-depth information on wildlife species and their habitats, as well as more knowledge of conservation tools, policies, regulations, incentives and voluntary efforts, the *Oregon Conservation Strategy* is a good place to turn.[3]

Oregon has a history of progressive laws and policies concerning land and resource use. These have lent protection to fish and wildlife in the course of development and management activities such as farming and timber harvest. In the case of forest management, legal requirements are spelled out in the Oregon Forest Practices Act and associated rules.[4] Oregon's broader forest policy is contained in the *Forestry Program for Oregon.*[5]

Oregon has strong laws to protect species, including Southern torrent salamander

Oregon is also engaged in statewide planning to improve wildlife habitat in all regions across the state with the Oregon Plan for Salmon and Watersheds,[6] which encourages voluntary restoration of fish habitat by private landowners, coordination of action across government agencies, monitoring of progress and scientific oversight. Finally, many voluntary programs offer different kinds of financial and technical help for landowners who want to improve conditions for wildlife on their lands.

In sum, there is a lot of information and support for the landowner who wants to get started with a wildlife-enhancement project, and landowners should not assume their forestland is too small to matter. Just as Oregon's profusion of wildlife inhabits landscapes at all scales, so too wildlife enhancement works at all scales, from the smallest harvest sites to the largest river basins.

3 See Web version at http://www.dfw.state.or.us/conservationstrategy.

4 See the summary on OFRI's website, www.oregonforests.org.

5 Oregon Department of Forestry, http://www.oregon.gov/ODF/BOARD/fpfo2011.shtml.

6 Please see the Web version at http://www.oregon-plan.org.

Habitats at risk

Western gray squirrel

Some Oregon habitat types are of high conservation value. Recognizing high-conservation-value forests is important in the American Tree Farm System and other forest certification systems. The forest habitats on this list include the aspen woodlands of the eastern mountains; oak woodlands of west-side valleys; late-successional mixed-conifer forests on the western slopes of the Coast Range, Cascades and Klamath mountains; and the east-side ponderosa pine woodlands.

These areas are important to certain wildlife species that are narrowly adapted to particular habitat conditions. These habitat specialists, as biologists call them, are more vulnerable to changes in their habitat – whether from fragmentation or outright loss – than are other wildlife species that are more broadly adapted. Some of the high-concern habitat areas are also at risk from invasive plants, fragmentation or other factors that threaten their continued existence as intact habitat.

For example, aspen woodlands provide essential habitat for songbirds such as the red-napped sapsucker, mountain bluebird, hairy woodpecker and yellow warbler, as well as several other species. Aspen are not reproducing as fast as they once did, because historical fire suppression has allowed pine trees to encroach on their range. Fire suppression also has altered historical wildfire patterns, putting aspen groves at risk of uncharacteristically severe fires.

Oregon white oak woodlands, which are essential habitat for the Lewis' woodpecker, acorn woodpecker, western gray squirrel and the rare Kinkaid's lupine, have been similarly affected by exclusion of fire. Pre-settlement oak habitat was maintained by Native Americans who used fire as a forest management tool. Natives set frequent, low-intensity fires that enhanced oak reproduction and kept competitors at bay. The latter-day absence of fire has allowed Douglas-fir to encroach on the white oak's territory throughout its range. Without active intervention, the Douglas-fir will eventually overtop the oaks and kill them. Oak woodlands have also been greatly reduced by agriculture and other settlement and development.

Post-settlement timber harvest and fire suppression have altered habitat in ponderosa pine woodlands in the Blue Mountains, eastern Cascades and Klamath Mountains, and in late-successional conifer forests west of the Cascades. Ponderosa pine forests provide food for mule deer and a variety of birds, including white-headed woodpeckers, Clark's nutcrackers, Cassin's finches, red crossbills and evening grosbeaks, as well as small mammals such as mice, chipmunks and tree squirrels. Older conifer forests of the Coast Range, western Cascades and Klamath Mountains support rare or threatened species such as the northern spotted owl, marbled murrelet, red tree vole, American marten, fisher and Oregon slender salamander.

Cavity nest in aspen

Wildlife 101

For this publication, "forest wildlife" means mammals, birds, reptiles and amphibians that spend all or part of their lives in forests. Fish are not addressed in this publication – not because they are unimportant, but because enhancing fish habitat has been covered elsewhere.[7]

Wildlife habitat matches the needs and habits of a particular wildlife species; e.g., orange-crowned warbler habitat. A species' habitat is an area with the combination of the necessary resources (e.g., food, cover, water) and environmental conditions (temperature, precipitation, presence or absence of predators and competitors) that promotes occupancy by individuals of that species (or population), and allows those individuals to survive and reproduce. The arrangement of these habitat resources and features to meet the biological needs of a species provides a framework for the ecological role or function that an individual species plays within the environment – i.e., the species' niche (Brown 1985). How much habitat is enough, and what kind is right, varies greatly among wildlife species and across the seasons of the year.

Because of this variability, the concept of "habitat" literally covers a lot of territory. In fact, the entire landscape may be considered habitat, because different wildlife species and communities interact with the land and with one another at multiple scales – from a drainage basin to a river valley to a watershed within the valley to a riparian area associated with a single stream. Habitat is also changeable through time, as forests and other landscapes move through natural and human-altered successional pathways.

In presenting our topic in this broad context, we do not mean to suggest that the landowner should try to enhance the habitat of every species of wildlife everywhere; that is not feasible. Many habitat goals are mutually exclusive: What improves conditions for one species of wildlife may degrade them for another. Not every wildlife species is, or can be, present on every acre at any point in time. Rather, we suggest that forest owners and managers consider the array of opportunities presented by their forest's ecological context and their own management objectives, and select those that have a reasonable chance of success.

American three-toed woodpecker

The science

Starting in the late 1980s, several major research efforts were launched in response to concerns about the impacts to wildlife of extensive timber harvesting in the Northwest (Carey 2009).[8] While a major driver of this research was concern about old-growth-associated species (the northern spotted owl is the

7 For an introduction, see OFRI's pamphlet Private Landowners Can Help Make the Difference for Coastal Coho. On the Web at http://www.oregonforests.org; go to Facts & Resources/Publications.

8 Four major efforts in western Oregon have been the College of Forestry Integrated Research Project (CFIRP), the Demonstration of Ecosystem Management Options Project (DEMO), the Forest Research Laboratory Fish and Wildlife Habitat in Managed Forests Program, and the Young Stand Thinning and Diversity Study (YSTD). Please see the section "Selected Research Programs" for overviews and further information.

Case Study:
Jim and Sandy LeTourneux

The LeTourneuxs utilize assistance programs to promote the Fender's blue butterfly (female shown)

Jim and Sandy LeTourneux manage 460 acres, mostly conifer plantations, in the Oregon Coast Range. When Jim's dad bought the property back in 1964, "it was entirely cut-over and mismanaged," Jim says.

Tripletree Tree Farm looks great now, thanks to 45 years of family management. When Jim started working with the property in 1976, he augmented his dad's timber management with wildlife-focused silviculture. Jim and Sandy see no conflict between their twin objectives: maintain a working forest for income, and maintain and enhance habitats for wildlife.

In the course of commercial timber management, they've created snags throughout their property to provide nesting opportunities for pileated woodpeckers and forage for many other species. They leave open patches in their timber stands to lend structural and compositional complexity.

The LeTourneuxes put up nest boxes for songbirds. They keep a pond that provides habitat for waterfowl and amphibians, although its primary objective started as water to fight fires. They reseed the landing after a logging operation to restore forest-floor vegetation and provide forage for upland birds, elk and deer. Recently they have completed restoring 10 acres of oak woodlands to provide nesting habitat for redtail hawks and several species of owls; they are continuing with five additional acres.

"We've had very successful outcomes," Sandy says, "but we don't always see the result we're expecting." For example, the Oregon Department of Fish and Wildlife tried a pheasant-release program at Tripletree that included planting bird-friendly plants such as sunflowers and millet. The release didn't work very well, "but the winter songbirds really liked the plants," says Sandy. "So we may not benefit our target species, but something else usually benefits and it's always interesting to see what species of wildlife come and use the habitats we provide."

The LeTourneuxes have taken advantage of several assistance programs over the years. They're currently working with the Natural Resource Conservation Service and the U.S. Fish and Wildlife Service to establish a permanent conservation easement to preserve habitat for the endangered Fender's blue butterfly.

iconic example), biologists and silviculturists alike recognized that forests of all ages – including early-successional planted forests – are important for wildlife habitat.

The following overview notes only a few of the hundreds of studies that have shed light on the relationship between forest management and wildlife habitat. To learn more, the reader is urged to explore the literature cited and the resources listed at the end of this publication.

A key theme emerging from these studies is that, in general, species respond more to the availability of a forest's key structural and compositional architecture than to the age of the forest *per se* (Bunnell et al. 1997). A forest's architecture is shaped by growth dynamics through time, including disturbances – natural or human-caused or both. Forest disturbances come in varying intensities, frequencies and spatial extents (McComb and Chambers 2005). They include fire, wind, insect and disease outbreaks, and human management. Death and regeneration occur as part of the natural cycle of tree growth and mortality in the forest; species may inhabit or be present in a given area, partly in response to continued changes in forest structure. Any change in forest conditions creates "winners" and "losers" (OFRI 2005). Some species do best in young, open stands. Some species do best in older, complex forest stands; few do best in both. Features of a particular stand, rather than the age of the stand, appear to be the most important determining factor.

Managers make important decisions affecting structure and composition in forests

Diverse habitats that encompass both structure and composition can be achieved by using silvicultural systems that feature management for wildlife and other forest resources. Managing a forest essentially means manipulating disturbances to achieve a desired set of conditions in the near and distant future.[9]

At each stage of a forest management operation – harvest, site preparation, establishing a new stand and intermediate treatments such as thinning and weed control – a manager has choices about what kind of disturbance may be applied, how intensely and how often (McComb, personal communication). These decision points offer opportunities to shape vegetation at each successional stage, and hence to alter wildlife habitat in purposeful ways (McComb 2001).

To explore the wildlife-habitat ramifications of each choice is beyond the scope of this publication. Rather (and admittedly at the risk of oversimplifying), we discuss silvicultural actions in terms of how they affect the forest characteristics that seem to matter most to wildlife: **structure** and **composition**.

9 For a thorough grounding in the principles underlying silvicultural manipulations to achieve habitat benefits, see Oliver and Larson's text Forest Stand Dynamics (Oliver and Larson 1996).

Structure and composition

As we've noted, wildlife respond to a forest's vertical and horizontal architecture (its **structure**) and the food and shelter it offers (its plant **composition**). Forest stands that are varied in both structure and composition provide habitat for a broader range of mammals, birds, amphibians and insects (Hagar 2007).[10] It is these architectural elements and qualities that provide habitats on both coarse and fine scales. This diversity can also be provided by having stands or patches with different structures and compositions adjacent to each other. The following lists are examples of structural and compositional diversity that can occur over time and with planning in all forest types and ages.


Created snags to provide more structure

Structural diversity includes:

- trees of different sizes, ages and shapes
- large old trees
- snags, especially big ones
- large and small pieces of dead wood on the forest floor
- irregular spacing of trees, understory plants and dead wood

Compositional diversity includes:

- a variety of tree and understory plant species
- hardwood trees
- shrubs, especially bigger, older ones

Younger forests that regenerate naturally after disturbances (wind, wildfire, etc.) retain some of these legacies from the previous stand. Although young planted forests can be presumed to be structurally simpler and more homogeneous, because of safety and other considerations with harvests, today's modern forest practices result in an array of structurally diverse habitats similar to those following a natural disturbance. Landowners managing young forests for diverse wildlife habitat can make a large impact on species that favor early successional habitat. For example, during the 19th and early 20th centuries, wild turkey populations decreased significantly due to hunting and habitat loss. Realizing that turkeys favor young forest structures, many Oregon landowners participated in conservation efforts to restore and improve habitat for this species. The National Turkey Federation estimates that Oregon's wild turkey population has grown tenfold over the past four decades, from 4,000 in 1969 to 27,000 in 1999 to an estimated 30,000 in 2009. Forest landowners and managers had a large part in the success and dramatic comeback of wild turkey populations.


Wild turkeys flourish in young open stands

10 For a thorough development of this brief summary relative to young managed forests on the west side of the Cascades, see Hagar (2007).


Deer mouse thrives in all forest ages

In older, or late-successional, forests, the legacy of disturbance is often diversity and irregularity. Trees may be of multiple ages, and other plants may be more or less abundant and randomly distributed. Cover may be patchy – dense in some places and sparse in others – and tree branch structure may vary according to age, size and species of the tree. Snags and dead logs may be clumped or scattered or both.

It is our premise that if managers, acting within the scope of their larger objectives, make silvicultural choices that favor structural and compositional diversity, and when they incorporate or retain certain key features (for example, large logs and snags, or mature fruiting shrubs), they can enhance habitat diversity on their forestlands.[11]

Stand-scale considerations

Thinning

Probably the most versatile technique for enhancing wildlife habitat in managed forests at the stand scale is **thinning**, especially at varying densities and spatial patterns. The most common objective of thinning is to maximize timber production by channeling the site's resources into the most valuable trees. But thinning also influences the development of wildlife resources throughout the life of the stand (Tappeiner et al. 2002).[12] A recent review of 33 studies of biodiversity response to thinning (Verschuyl et al. 2011) revealed that forest thinning had generally positive or neutral effects on diversity and abundance of all wildlife except some amphibians. The researchers note that the magnitude of wildlife response is likely tied to the type and intensity of thinning.


Thinning can encourage structural features

Thinning can enhance habitat in both the short term and the long term. For example, in the short term, thinning can increase the diversity of features immediately available for particular species; in the long term, thinning can encourage the development of **structural features** such as big, large-limbed trees (Altman and Hagar 2007). These provide roosting and nesting platforms for birds and tree-dwelling mammals. Bigger branches support more species of lichens, which are a food source for deer and a source of insect prey for birds. Bark with thick fissures harbors insects, spiders and grubs, which are prey for many bird species. Older conifers have hollows, cavities and decayed spots, which are important nesting sites for bats and cavity-nesting birds.

11 Table 6 in Altman and Hagar (2007, p. 24) details management activities in early- and mid-successional forests that may be used to produce desired habitat features.

12 For a detailed treatment of the information summarized here, see Altman and Hagar (2007).

Case Study:
Dave Hibbs and Sarah Karr

A cedar waxwing spotted on the tree farm

When Dave and Sarah bought their 92-acre tree farm, it was a mess of suppressed Douglas-fir saplings overtopped by blackberry and shrubs. The previous owners, who'd used the property to hunt band-tailed pigeons, "knew nothing about forests or forestry," says Hibbs, a forest ecologist and silviculturist with the OSU College of Forestry. "They logged it, and then they replanted because they had to. By the time we saw it, some of the trees were dead and the rest were covered with weeds."

The property, in the Coast Range foothills of the Willamette Valley, has a mineral spring, one of the valley's few remaining undisturbed springs. An important habitat element for band-tailed pigeons, the spring lies in a creek-bisected meadow once dominated by oak. The property also has patches of older Douglas-firs left after the first logging.

The couple's first task was to tackle the weedy overgrowth with an aerial herbicide spray to release the planted Douglas-firs. Dave follows up with periodic backpack spraying. The 20-year-old trees are now 30 feet tall and 8 inches in diameter.

"We obviously have an economic goal," Dave says, "but we also have a wildlife goal, which plays out in different ways on different parts of our property." In his precommercial thinning, he is leaving selected hardwood trees, especially madrone, whose fruit is prized by birds, and also maple, cherry, cascara and dogwood. He is also pulling out the Douglas-fir that has encroached on the meadow, to reduce competition for the oaks and maintain open space for the pigeons.

He's had problems with deer nibbling on the Douglas-firs – a case of wildlife sometimes being too much of a good thing. Controlling the 20-foot-tall maple-sprout clumps where the deer were hiding has helped reduce browse problems.

Dave and Sarah have seen waxwings, black-headed grosbeaks, western tanagers and dusky-footed wood rats, as well as the band-tailed pigeons that still flock around the spring (the Oregon Department of Fish and Wildlife does an annual survey of them). The couple keep track of wildlife activity by avid watching – and listening. With the help of OSU Extension, Sarah started a program that pairs landowners with bird experts willing to visit a tree farm and identify the birds there. "It's impressive," Dave says, "to stand in the woods and hear someone name off 20 birds simply from hearing the calls."

Case Study:
Portland Metro

Managing forest habitat in an urban landscape

Portland Metro is in a unique position to restore remnants of forestlands within a dynamic urban center. The agency's land portfolio includes about 12,000 acres of forestland throughout greater Portland, ranging in size from a few acres to the 1,200-acre Chehalem Ridge southwest of the city. Most of the land is low-elevation, mixed-conifer forest with hardwood components.

"Our mission is threefold: water quality, wildlife habitat and human access to nature," says Jonathan Soll, manager of Metro's Science and Stewardship division. "Because we're not a commercial landowner, we're not constrained by harvest objectives. So we can manage for less-common vegetation communities and provide habitat for a variety of species."

Metro purchases and restores degraded lands with funding from a bond passed in 1995. Grant funding is sought for specific restoration work. Resource specialists led by certified forester Kate Halloran have afforested abandoned farm fields, thinned overgrown timber stands, controlled non-native species such as English ivy, planted native understory vegetation, and re-established oak woodlands threatened by Douglas-fir encroachment.

The program monitors outcomes as much as it can afford to do. It conducts point counts for birds in the forested areas, and it has a volunteer amphibian-monitoring program focused mostly on non-forested wetlands, headed by a part-time employee.

"It's a unique challenge to manage forestlands in an urban landscape," Soll says. "Forested areas here are fragmented, by definition. But all the forested properties we manage are healthier and in better shape than when we got them."

In dense west-side forests, thinning increases both cover and diversity of **understory shrubs** by permitting more sunlight to reach the forest floor. Shrubs, especially those that produce fruit and seeds, provide food and cover for many birds and mammals, including large animals such as deer and elk. Insects that feed on the leaves of these shrubs also are a major food source for birds. Older shrubs, with more foliage and fruit, are generally better habitat elements. Generally, savory browse species are intolerant of shade or lose their nutrient value with shading. In addition to thinning for shrubs, landowners may plant legumes in seeding mixes for firebreaks, skid trails and cut/fill slopes after entering a stand for harvests.

Thinning to favor wildlife may be especially effective at two relatively brief turning points: when a young stand is getting started (stand initiation) and controlling vegetation growth is important, and when it begins to thin itself (stem exclusion), often done as precommercial or commercial thinning (Harrington 2010). Strategic thinning during those two periods – notably, managing the timing and intensity of treatments, and controlling levels of hardwood presence – enables a manager to fine-tune the trajectory of a conifer stand to achieve varying wildlife-habitat goals.[13]

13 For more operational detail, see Harrington and Tappeiner (2007).

If a management objective is to include goals for wildlife diversity, thinning at **variable densities** might be considered. Variable-density thinning maintains some dense patches of conifers for thermal and hiding cover while also maintaining some sun-filled openings for hardwood trees and shrub development. A pattern of patches and gaps of different sizes and shapes meets a broader range of wildlife needs than does uniformly spaced vegetation (Carey 2003, Carey et al. 1999). There is no standard for variable-density thinning. On larger acreages or at a landscape level, leaving unthinned and unpruned blocks of 5 to 40 acres between thinned stands supplies thermal and escape cover, among other habitat components. On small acreages where individual stands are managed, leaving two patches (less than 50 feet in diameter) very lightly thinned or unthinned and two patches heavily thinned (less than 40 percent coverage) per acre will create a highly diverse wildlife habitat (Bottorff et al. 2005). Caution is advised on this practice if the potential for wind-throw is high.

A highly used legacy snag

Retaining legacy structures

Retaining **legacy structures** from the previous harvest (green trees, shrubs, snags, fruit- or mast-bearing trees and patches of forest) retains a measure of complexity and habitat richness in the subsequent stand (McComb and Chambers 2005, Holmberg 2007). These structures offer refuge that may make it possible for certain birds and mammals to persist in the new stand.

Managers may choose to retain **dead wood** beyond what regulations require, in the form of both snags and down logs. A large body of wildlife science attests to the critical role of dead wood, especially large wood, in providing habitat for forest-dwelling wildlife (Hagar 2007). **Snags** and **dying trees**, especially large-diameter ones, provide valuable standing habitat elements as places for species to feed, nest, perch and roost. Snags are important for cavity-excavating birds such as pileated woodpeckers, chickadees and nuthatches, and for other wildlife that use already-excavated cavities. Some birds that inhabit tree cavities feed on insects that may cause damage to commercial crop trees. Also, owls, kestrels, weasels and martens use snags as perches to prey on gophers, voles, hares and mountain beaver that may cause significant seedling losses in young forest stands. Snags are used by a succession of different wildlife as they decay over time, and some animals use snags at different stages of decay for different life needs. Snags may provide habitat over a period of 30 to 70 years, depending on the size and species of tree and the type of forest in which it occurs. Evaluating worker safety issues and lightning threats should be included in managing in-unit snags.

A northern saw-whet owl using a created snag

A recent study of the use of conifer snags as roosts by three species of forest-dwelling bats in western Oregon (Arnett et al. 2009) revealed that Douglas-fir snags were frequently used, and the frequency of use differed with density of snags in the landscape. Big brown bats and long-legged myotis used only snags and live trees as roosts, long-eared myotis used a diversity of structures, and the frequency of use of these structures differed with the density of snags in the landscape.

Long-legged myotis (bat) uses conifer snag for roosting

If no natural snags remain on a site, it is possible to **create snags** by girdling or topping trees. Artificially created snags can become suitable habitat for foraging and cavity-nesting birds within a few years (Chambers et al. 1997). Various snag-creation methods (herbicides, full topping, girdling and partial topping) cause a live tree to die at different rates (Brandeis et al. 2002), affecting the pattern of decay progress through the bole, and hence the length of time the snag remains standing and available to wildlife. The most productive cavity habitat will be present when a variety of tree species, diameters and heights are available throughout the forest. It is recommended that cavity trees should be located within riparian zones, along the upper one-third of slopes, and on south and east slopes.

Leave snags near riparian areas and along upper slopes

In 2008-10, a research team at Weyerhaeuser Co. monitored nest cavity creation and nesting success in 1,123 created snags on 31 regenerating second-growth harvest sites. The snags had been created by mechanical topping during harvesting between 1997 and 1999, and had been left clumped or uniformly scattered in a variety of densities. The team observed 338 successful nest sites, out of 505 total – a 67 percent success rate. Ten avian species were observed nesting in the snags, with northern flickers, house wrens and chestnut-backed chickadees comprising the bulk of the observations. Northern flickers and chestnut-backed chickadees have been noted as declining bird species associated with Pacific Northwest young-conifer forests (Altman and Hagar 2007). The Weyerhaeuser team's findings suggest that, for some cavity-nesting bird species in the western Cascades, creating snags appears to be a sound strategy for providing nest sites (Mike Rochelle, personal communication).[14]

Down logs, especially large-diameter ones, provide cover, travel pathways and breeding space for mammals, reptiles and amphibians. As they advance in decay, snags and dead wood are colonized by fungi, insects and arachnids, increasing food for many species.

14 From a 2010 PowerPoint presentation, "Avian nesting use of created snags in intensively managed forests, Cottage Grove, Oregon," by Mike Rochelle, A.J. Kroll, Josh Johnson and Matt Hane, Western Wildlife Program, Weyerhaeuser Co.

As large woody material decays over time, it continues to provide benefits for forests. Decaying wood acts as a reservoir for water storage by slowly releasing moisture throughout the summer (Pederson 1991). Phosphorus, potassium and other nutrients are released, providing essential elements for the growth of trees, including nitrogen-fixing bacteria that live in decaying wood. Oregon forest practice rules require at least two pieces of large, downed woody material per acre in various stages of decay. If feasible, landowners are encouraged to leave large logs greater than10 feet long, because they are the most effective in maintaining wildlife habitat diversity and forest health.

Retaining shrubs and broadleaf trees

We have already mentioned some of the values of **shrubs**. Many private landowners in Oregon provide the necessary forage for deer and elk in young-forest stands. Deer and elk are opportunistic feeders, able to eat and digest a diverse suite of plants that may be perennially or seasonally available as they make their migratory rounds. However, they show strong preferences for certain more-nutritious plant species if they can find them. Cook (2005) found that elk selected deciduous shrubs such as bigleaf maple, hazelnut and cascara, and forbs such as queen's cup beadlily, northern bedstraw, false Solomon's seal and oxalis. They avoided most conifers, evergreen shrubs such as salal, Oregon grape and rhododendron, and sword and deer fern. Neutral species – plants they neither preferred nor avoided – included most grasses, alder, elderberry, salmonberry, many forbs and lady fern.

Managers may also choose to retain **broadleaf trees**, which make important habitat contributions in managed forests (Hagar 2007). In west-side conifer forests, natural cavities that form in Pacific madrone, bigleaf maple and Oregon white oak trees provide habitat for cavity-nesting birds and bats (Bunnell et al. 1999). Oaks are one of the premier wildlife trees in Oregon, providing acorns as food for deer, elk, bear, squirrels, chipmunks, turkeys and many other bird species. Their tender green leaves are food for browsers in the springtime, and they provide good habitat for insects that are eaten by many birds and small mammals (Bottorff et al. 2005). Many west-side forest hardwoods grow in moist places such as riparian zones, seeps and small wetlands, where they may not interfere much with timber harvest (Altman and Hagar 2007). Retaining them in these situations may be a relatively inexpensive way to achieve considerable habitat gains. Out of a total of more than 430 species of forest-dependent wildlife on the west side of the Cascades, more than 200 species breed or rear young in hardwood-dominated riparian and wetland zones. The east side has about 325 species, but nearly 190 use deciduous riparian habitats for feeding, and more than 120 use these habitats for reproduction (Bottorff et al. 2005).

Oaks are a premier wildlife tree

An acorn woodpecker's home range is two acres of oak woodlands

Deer and elk forage primarily in open young forests

YOUNG OPEN STANDS

Closely associated

American goldfinch, badger, chipping sparrow, common nighthawk, creeping vole, deer mouse, dusky flycatcher, fox sparrow, Lazuli bunting, MacGillivray's warbler, mountain beaver, northern pocket gopher, spotted towhee, striped skunk, western bluebird, western jumping mouse.

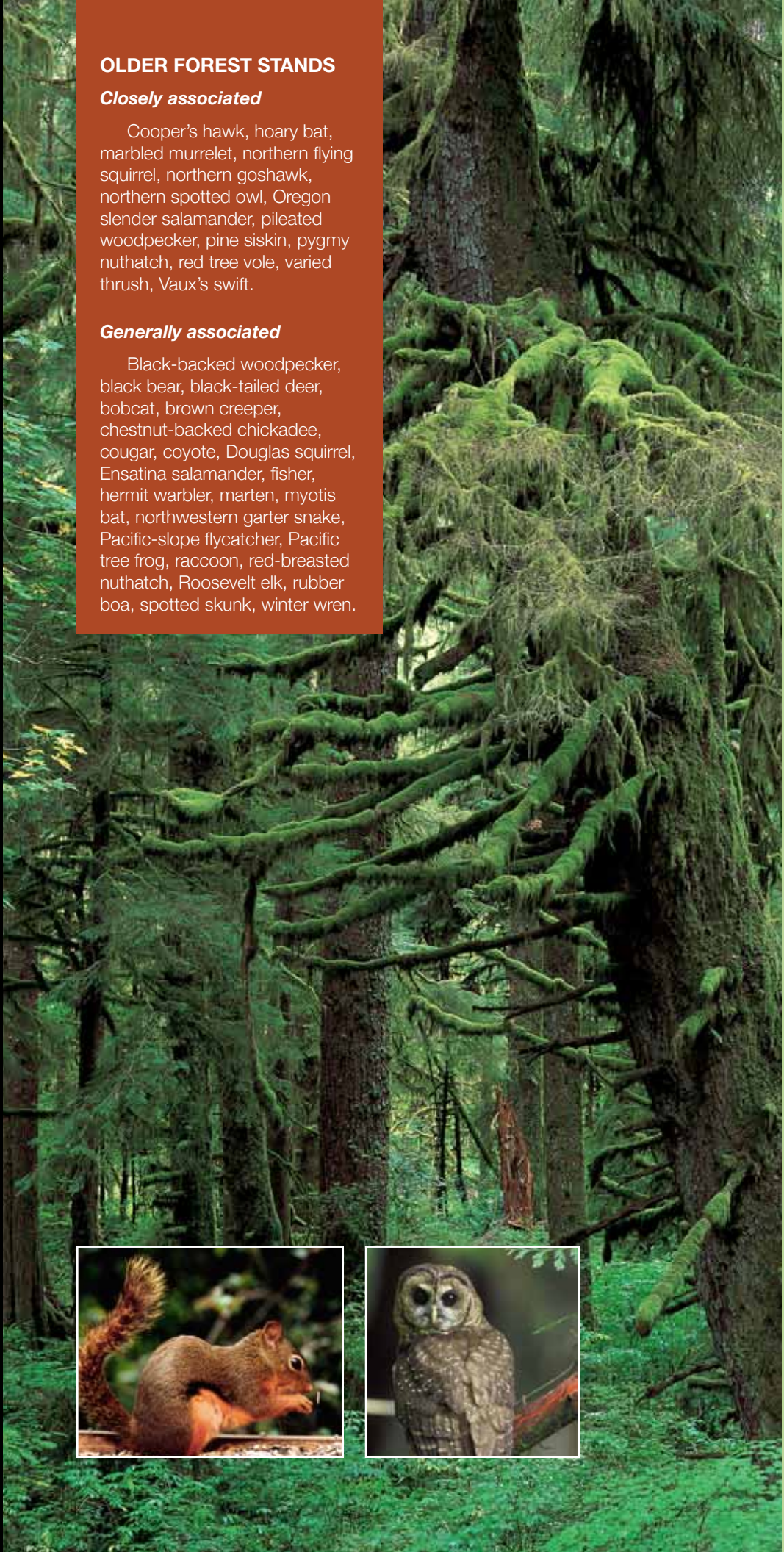
Generally associated

American robin, black bear, black-tailed deer, bobcat, common garter snake, cougar, coyote, dark-eyed junco, Ensatina salamander, long-eared bat, northern alligator lizard, raccoon, red fox, Roosevelt elk, rubber boa, song sparrow.

MIDDLE-AGED STANDS

Generally associated

Band-tailed pigeon, black bear, black-tailed deer, black-throated gray warbler, bobcat, bushy-tailed woodrat, chestnut-backed chickadee, common garter snake, Cooper's hawk, cougar, coyote, Douglas squirrel, Ensatina salamander, gray jay, hermit warbler, long-tailed weasel, long-toed salamander, marten, northern alligator lizard, Pacific-slope flycatcher, Pacific tree frog, raccoon, red-breasted nuthatch, Roosevelt elk, rubber boa, ruffed grouse, sharp-shinned hawk, snowshoe hare, Swainson's thrush, Townsend's warbler, Wilson's warbler, winter wren.



OLDER FOREST STANDS

Closely associated

Cooper's hawk, hoary bat, marbled murrelet, northern flying squirrel, northern goshawk, northern spotted owl, Oregon slender salamander, pileated woodpecker, pine siskin, pygmy nuthatch, red tree vole, varied thrush, Vaux's swift.

Generally associated

Black-backed woodpecker, black bear, black-tailed deer, bobcat, brown creeper, chestnut-backed chickadee, cougar, coyote, Douglas squirrel, Ensatina salamander, fisher, hermit warbler, marten, myotis bat, northwestern garter snake, Pacific-slope flycatcher, Pacific tree frog, raccoon, red-breasted nuthatch, Roosevelt elk, rubber boa, spotted skunk, winter wren.

How different silvicultural strategies create different opportunities for wildlife

It's a good thing for wildlife that not every acre of forest is managed in the same way. Different forest structures provide habitat opportunities for different wildlife species. Forest habitat can be shaped, encouraged and even created with common techniques of forest management.

A standard silvicultural prescription in west-side Douglas-fir forests calls for clearcutting or heavy thinning, coupled with vegetation control through herbicides, mechanical means or prescribed burning, followed by planting seedlings. This sequence creates young, open stands for wildlife that prefer structural simplicity and sun-loving vegetation. Seedlings, saplings and fruiting shrubs provide food and cover for deer and elk, smaller mammals such as foxes and skunks, and songbirds such as goldfinches and western bluebirds. Retained slash and snags offer perches and nest sites for birds, and cover and breeding space for forest-dwelling amphibians and reptiles.

Definitions:

Closely associated: Species most abundant in this habitat or structural condition for part or all of their life requirements.

Generally associated: Species that exhibit a high degree of adaptability and may be supported by a number of habitats or structural conditions.

Landscape-scale considerations

Most of Oregon's forests have the following elements of diversity across the landscape. Landowners should acknowledge and manage these elements for their continued contributions to habitat diversity.

- Young, middle-aged and older forests
- Riparian zones
- Wetlands
- Connective corridors
- Ecotones
- Site productivity differences
- Dry openings
- Rock, cliff, talus
- Special sites (special to something/someone)

Laminated root rot (*Phellinus weirii*) is one of the most serious forest diseases in western North America. This fungus affects almost all commercially important conifer species in Oregon, and it can persist in the soil for 50 years or more. Hardwoods, such as red alder, bigleaf maple and black cottonwood, are immune. Root-rot pockets are good places to diversify the forest and plant broadleaf species (Bottorff et al. 2005).

Prescribed fires

Burning can be a particularly valuable tool for enhancing wildlife habitat. Burning is often prescribed in managed forests to prepare a recently harvested area for planting, but it can bring a host of ecological benefits to both new and established stands. Landowners have to strongly weigh the pros and cons of using fire in regard to risk and smoke management.

Prescribed burning is being used on public (and occasionally on private) lands in an effort to nudge forests toward ecological patterns more like those of pre-Euro-American settlement times. Often the motivation is to restore habitat for threatened or sensitive wildlife and plants. The pine woodlands east of the Cascades and the oak woodlands of the Willamette Valley are two examples of forests where prescribed burning can greatly benefit wildlife habitat productivity and diversity.

Landscape-scale considerations

If a manager has responsibility for large acreages of forest, he or she has an opportunity to promote a diversity of forest conditions (age, structure and species composition) both spatially across the landscape and through time as forest stands move through their successional stages.[15] Certain ways of attaining heterogeneity – such as varying the sizes and shapes of vegetation patches and clearings, or optimizing the distribution of legacy elements such as snags and down logs – may be more effective when conducted at the landscape scale.

Connective corridors

Connective corridors may be important for species that need to move from one habitat patch to another. For birds associated with older forests, for example, retaining strips or patches of older-forest structure may make a young stand more suitable as habitat (Altman and Hagar 2007). For wildlife with large

15 For a discussion of wildlife management from an industrial-forestry perspective, see the Sustainable Forestry Initiative's publication Biological diversity and wildlife habitat considerations in managed forests (American Forest and Paper Association 2005).

home ranges, connective corridors offer access to patches of habitat that would not otherwise be available. For less-transient species, corridors in the right places may allow populations that would otherwise be geographically confined to mingle and interbreed.[16]

Forest-associated wildlife has a wide range of mobility needs, however, and connective corridors can also have negative effects on the target species and on others as well. Current research is not conclusive enough to generalize about optimum patterns of connectivity, at least for birds (Altman and Hagar 2007). Managers interested in providing connectivity should consider the needs of particular wildlife species in the context of their particular management setting, and design a customized pattern. Currently, connective corridor patterns are often modeled, but very little data exists for field practices.

Ecotones

The transition between two or more vegetation types, such as forest and meadow, is called an **ecotone,** or, more commonly, an "edge." Frequently, both the number of species present and the abundance of individuals are greatest in ecotonal communities (Raedeke et al. 1992). Certain species will flourish in edges when a greater variety of cover types is offered. If only a few types of habitat are present, providing more edges may be beneficial to certain wildlife. However, edge creation can result in fragmentation of larger tracts, negatively affecting species that require large, undisturbed areas and/or species that do not do well when edges are introduced.

Many species flourish in ecotones

Some animals, including deer and elk, like forest edges because they can find food in the clearing and hiding cover in the trees – they are called "edge species" because they can thrive on the edge and benefit by having various habitats near one another. Other animals, such as many neotropical migrant songbirds, thrive in edges for feeding; however, they also need interior forest cover for nesting. Many of these migrants build nests low to the ground, making them extremely vulnerable to predation from crows, hawks and raccoons (Raedeke et al. 1992). They prefer to nest in areas with a lot of canopy and few edges. Edges, for these and other plants and animals, can be dangerous places.

16 City of Medford. Riparian corridors. http://www.ci.medford.or.us/page.asp?navid=2351&Print=True.

Research suggests, however, that the dangerous edges occur when a forest shares an edge with agricultural or suburban development lands, and not when the forestlands remain in forest uses in various stages of successional development. For instance, the edge between an old and young forest is not as much an obstacle as is an edge between a forest and an agricultural field, or a forest and a suburb (OFRI 1999). McWethy et al. (2009) suggest that edge effects for songbirds vary with forest productivity. They analyzed bird response of 75 species to gradients in edge density of open and closed-canopy forests, at both individual-species and community levels. More birds responded to changes in edge density in more productive west-slope Cascade forests than less productive east-side Cascade forests. Data from all sites showed that 25 of the 60 most abundant bird species responded significantly to the interaction between forest productivity and changes in landscape-level edge density.

Riparian zones

Riparian zones, those areas where water meets land, are habitat hot spots that may be most effectively managed for wildlife at the landscape scale. Riparian habitats occur next to rivers, streams, lakes and ponds at all elevations, on adjacent floodplains and terraces, and in and near intermittent streams, springs and seeps. Riparian zones provide food, shelter, water and breeding space for aquatic mammals, amphibians and other species. **Springs and seeps** are critical riparian habitat for certain amphibians, including Columbia and southern torrent salamanders.

Maintain springs and seeps for amphibians, such as Columbia torrent salamander

Oregon's Forest Practices Act rules require protection of riparian zones in forest operations. Managers who want to go beyond legal requirements may choose to restore riparian-zone habitats on their lands, perhaps with the help of voluntary cooperative efforts and incentive programs, and perhaps in cooperation with like-minded neighbors. Restoration activities supported by these programs include stabilizing stream banks, restoring wetlands, restoring riparian buffers, decommissioning roads, repairing or installing culverts, placing large woody debris in streams to improve fish habitat, and in general restoring the natural hydrology of the stream (Oregon Department of Fish and Wildlife 2005).

Site productivity

Managers of private timberlands and other forests often assume that the causative factors of biodiversity do not vary geographically. This may be due in part to the unbalanced focus of past research toward stand-level effects of forest harvest and within stand structural retention rather than the interaction of structural complexity and the spatial distribution of harvest units across gradients in climate and forest productivity. Using a comparative approach

to test this assumption, McWethy et al. (2010) found that bird response to disturbance intensity varies as a function of site productivity. Consequently, within highly productive landscapes where mid-to-late seral forests are already well distributed across the landscape, community diversity can benefit from relatively high levels of disturbance. In less productive settings, it appears that high levels of disturbance influence conditions limiting species diversity. Because forest management is typically applied across broad gradients in productivity, the finding that species respond differently to disturbance across productivity levels is important.

High productivity site in western Oregon

From the same study sites, McWethy et al. (2009) assessed the relative influence of stand-edge density (a landscape measure of fragmentation) on species abundance in more and less productive forests. Researchers hypothesized that there would be more pronounced differences (both vegetative and climatic) between open- and closed-canopy settings in dense higher-energy forests, in turn leading birds to have a more pronounced response to changes in edge density in those landscapes. Results showed larger differences in vegetation and structural conditions between open- and closed-canopy stands in a highly productive landscape than a landscape with intermediate levels of productivity. Additionally, more bird species responded to changes in edge density in more productive west-slope Cascade forests than less productive east-side Cascade forests. These results provide some of the first evidence supporting the hypothesis that edge effects are more pronounced in productive west-side forests, where higher levels of edge density benefit generalist and open-canopy species while negatively influencing closed-canopy species.

A low productivity site benefits from managers leaving biomass and vertical structure

Forest management of vertebrate diversity would likely be more effective if tailored to abiotic conditions that regulate population processes influenced by landscape-level management. Therefore, in highly productive landscapes, maintaining gradients in forest structural complexity, successional stage and disturbance intensity will likely benefit species diversity. Alternatively, management in less favorable environments might better support species diversity by modifying harvest intensity to maintain biomass where harvests do occur and maintain structural complexity whenever possible.

Research by Verschuyl et al. (2008) measured available energy (i.e., factors related to heat and ecological productivity) and structural complexity in five managed-forest landscapes across the West. The team modeled these factors to determine the relative influence of energy versus structural complexity on species richness of birds (i.e., the number of different species detected) in each landscape. In energy-limited environments such as the east slope of the

Cascades, energy availability explained species richness better than did the complexity of forest structure. In contrast, in the energy-abundant environments in the Oregon Coast Range and western Cascades, forest structure was tied more strongly to species richness, suggesting that, in some landscapes, larger-scale drivers such as energy may be more important than forest structural complexity in explaining biodiversity at the landscape scale.

The authors suggest that managers should customize their strategies for biodiversity management to the site, especially in energy-limited landscapes. They should also consider targeting the highest-energy sites within those landscapes for special wildlife-enhancement measures, because these areas may be critical to maintaining wildlife populations across the whole landscape. In addition, managers should take into account the longer rotations required to maintain long-term ecological productivity within low-energy landscapes.

A Douglas-fir tree peeled and felled by beavers

Black bear damage on a ponderosa pine

Wildlife Damage

Wildlife contributes to our enjoyment of nature and, often, outdoor recreation, but it can also have a down side including damage to property and natural resources. There are times when a landowner wants to merely discourage wildlife from damaging behavior, yet some treatments to improve forest viability and value can also attract damage. Such young-stand silvicultural treatments as thinning, fertilization and pruning can alter the chemistry of trees and make them more prone to damage by bears (Kimball et al. 1998, Nolte et al. 1998), which regard young trees as a readily available food source, particularly early in the spring before other food sources become available. Likewise, American beaver populations, once subject to intense trapping, have increased markedly in forested watersheds. Because one of their primary food sources is the cambium layer just under the bark of woody plants, beavers can cause significant damage and jeopardize timber resources (Wildlife Services 2011). Their natural instinct to create aquatic habitat by plugging culverts under roads with residue from damaged trees and vegetation can cause a great deal of damage to roads and stream environment.

For example, the Oregon Forest Industries Council annually conducts voluntary animal damage surveys of their members to evaluate the scope and value of damage by the state's wildlife. In 2010 there were more than 1,000 reforestation unit complaints with moderate or severe deer and elk damage, covering over 66,000 acres. (Mike Dykzeul, OFIC, personal communication).

Once problems with wildlife develop, resolving them can be both costly and complicated. In addressing the conflicts between wildlife and people, wildlife managers and landowners must thoughtfully consider not only the needs of those directly affected by wildlife damage but also a range of environmental, sociocultural and economic factors. This publication does not make specific recommendations to control or minimize wildlife damage, but recognizes that landowners promoting wildlife habitat diversity can at times experience higher costs than desired benefits. It is recommended that landowners who encounter wildlife damage and need assistance contact the Oregon Department of Fish and Wildlife and/or the Animal and Plant Health Inspection Service (APHIS) (see sidebar).

Monitoring

Dedicated forest landowners and managers in Oregon who have chosen to actively enhance wildlife habitat in the course of their forest management activities find that having a written management plan, one that includes monitoring actions, is quite beneficial. Having a plan for wildlife enhancement projects will lay out the vision to anyone who will be interacting with the forestland, such as technical professionals, contractors and family members. A plan may be required to receive funds from a cost-share program. There are many different management plan templates available, but four elements are essential in any plan:

- a statement of goals and objectives
- a description of the property
- a description of what the landowner intends to do on the property to reach goals and objectives
- a plan to monitor or measure success

Monitoring is an essential element of successful plan implementation. Understanding the breadth of activities occurring, the outcomes they have produced and the effectiveness of those outcomes allows a landowner to adapt to changing conditions and new knowledge. There are numerous ways to monitor a wildlife project. Selecting a method will depend on the landowner's

Wildlife damage assistance

Wildlife is a valuable public resource. Federal and state governments are responsible for maintaining healthy, stable wildlife populations. Accordingly, when wildlife causes property damage, government has an obligation to manage that damage. Wildlife-damage management responsibilities and authorities fall to different agencies depending on the species, type of problem and location. Cooperative agreements provide for the management of various species, including management for the purpose of reducing and preventing damage, caused by wildlife. Wildlife Services – a unit of the U.S. Department of Agriculture (USDA) APHIS – assists in solving problems that are created when species of wildlife cause damage and it provides federal leadership and expertise to resolve wildlife conflicts to allow people and wildlife to coexist.

Wildlife Services conducts program delivery, research and other activities through its regional and state offices, the National Wildlife Research Center (NWRC) and its field stations, as well as through its national programs.

APHIS contact information: http://www.aphis.usda.gov/wildlife_damage/index.shtml or 1-866-487-3297

The Oregon Department of Fish and Wildlife (ODFW) also works with private landowners to prevent and reduce wildlife damage to agriculture and timber crops. The ODFW Wildlife Division and local offices are helpful resources for landowners to find out about permit options, wildlife control operators and assistance programs.

ODFW contact information: http://www.dfw.state.or.us/wildlife or 503-947-6002

Case Study:
Peter Hayes, Hyla Woods

Hyla Woods is a showcase of successful restoration, enhancement and monitoring activities

Peter Hayes' objective for his family's 780-acre Hyla Woods is to rebuild the ecological complexity of a long-managed Coast Range forest. Careful monitoring helps him get there faster.

Hyla Woods' three parcels are composed of 780 acres of second-growth Douglas-fir–dominated forest with generous components of grand fir, cedar, bigleaf maple and oak. The company has a portable sawmill and solar-powered dry kiln. Besides logs and raw lumber, Hyla Woods produces finished goods such as window and door trim and flooring, which Hayes markets to Portland builders and woodworkers.

For Hayes, Hyla Woods' president, managing for ecological values is simply the family's philosophy. "Our focus from the beginning has been restoration and enhancement," he says. "And we're very pragmatic about it. Our attitude is, 'We work for them and they work for us.'" For example, cavity-nesting birds and bats play an important role in controlling insects, and a diverse understory helps keep the forest resilient in the face of change.

Hayes uses a suite of variable-retention thinning strategies, developed over the family's 25-year tenure, to encourage a multi-age, multi-species forest. "We integrate monitoring with our silviculture, so we have a basis for evaluating which approaches give us the best bang for the buck," he explains. Experts from the OSU College of Forestry helped Hayes develop monitoring protocols, and volunteers from The National Audubon Society and other conservation groups help conduct periodic surveys.

Lessons learned from monitoring have prompted Hayes to adjust his management. For example, he's shifted his silvicultural focus from a finer to a coarser geographic scale – defining larger management units and leaving larger patches: "We found that the finer-scale approach was costly, because it's expensive to get the big trees out without clobbering the little ones." He's also taking more care to minimize invasive weeds by reducing ground disturbance.

Hayes promotes cavity-nesting birds such as the chestnut-backed chickadee

"Monitoring has been essential to our being able to manage adaptively," Hayes says. "Without it, we'd be like a pilot flying blind."

interest, resources, time and comfort in collecting data. Monitoring efforts often vary by landowner property size and available resources. Monitoring can range from keeping a journal, taking photos, setting up smoke plates or field cameras, completing transects and establishing databases to establishing long-term research projects. One efficient method uses measurements of living and dead vegetative ecosystem components, drawing inferences for wildlife occupancy from tables that relate species to different habitat conditions (see section on monitoring).

It's up to the landowner to identify the goals to be monitored and the indicators to use to measure success or failure. An indicator is simply a unit of information measured over time that documents changes in a specific condition. A good indicator is measurable, precise, consistent and sensitive to changing conditions. Some questions to consider when establishing indicators and monitoring goals:

- What is monitored? For example: strategy species, indicator species, strategy habitats, ecological functions, limiting factors?
- Are they relevant for the site and treatment?
- Are they sensitive to change within a given time frame? For example, creating a multi-structured forest stand for woodpecker habitat can take 10 to 70 years.
- Are they measurable with available methods and time?
- How is it done? What is the level of experience identifying or seeing a target species? Is it easier to record associated calls, scat, nests, cavities or tracks?
- Are individual indicators integrated so that the entire suite of indicators provides a reasonable picture of change?
- What are ways to work with current efforts? Is data already collected on or near the property with current research? What is the current research on species and habitats?[17]


Neighbors monitoring for birds on family forestland

Sometimes unexpected results can occur, such as a storm, pest outbreak or attraction of unwanted invasive species. Not every project is successful, of course, and if unwanted changes are experienced, it is also important to be able to adjust management practices. However, when wildlife habitat is enhanced, monitoring the species response and interactions are often very rewarding and can be passed on to succeeding generations.

17 Portals of information are available at Oregon Explorer, http://oregonexplorer.info/

Monitoring meets technology

Using technology to assist with monitoring efforts

Effective data management is a component of many monitoring programs. The Northwest Habitat Institute (NHI) is a nonprofit scientific and educational organization that focuses on developing products and tools that assist landowners and land managers who conserve native species and habitats. NHI's mission is developing and implementing inventorying and monitoring programs, and coordinating and facilitating activities (e.g., habitat restoration, land-use planning and management objectives) that promote the conservation and management of our natural resources. Vegetative Management Software (VEMA) is a free Microsoft Access relational database that helps record, calculate and report vegetation performance based on user-determined performance thresholds. The database was designed around a vegetation monitoring protocol developed by a team of agency and academic plant ecologists and expert practitioners, to provide an efficient tool for monitoring and increasing the knowledge base on the effectiveness of different restoration treatments. The database allows users to document and record vegetation data at reference sites for the purposes of helping develop vegetation mitigation and restoration plans as well as subsequent vegetation performance criteria and thresholds. VEMA will provide vegetation performance reports for any site where vegetation data is collected as percent cover and/or woody stem counts. A VEMA mobile application is also available at no cost. Download at: http://www.nwhi.org/index/publications#Vegetation Management Software

Summary

Wildlife habitat has been altered across Oregon's forests since the beginning of time – first by nature alone and then for at least the past 13,000 years by nature augmented by human activities. Nevertheless, opportunities abound to create and enhance habitat productivity and diversity now and in the future. Indeed, many forest landowners are already improving wildlife habitat while managing for their primary objective, whether it's commercial timber harvest, aesthetic and recreational values, or something in between. Managing for important structural and compositional characteristics can go a long way toward improving wildlife habitats in managed forests.

The sequence of activities that makes up each harvest method effectively sculpts the forest to create a pattern of structure and plant composition. Each pattern appeals to a distinct suite of wildlife species. Managers can enhance wildlife habitat diversity, attracting a richer diversity of species, by paying special attention to habitat features such as large trees, snags and other dead wood in various decay stages, hardwoods and shrubs, riparian areas, patch-and-gap configurations, and the needs of rare species. At the landscape level, where possible, they can manage for a diversity of features in forests of various successional stages to provide a wider range of habitat opportunities.

By becoming aware of and systematically improving the particular habitat features on their forestlands, consistent with management objectives, forest owners and managers can make valuable contributions to wildlife habitat productivity and diversity in their forests and across the landscape.

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Where to Get Help

Footnotes in previous sections identified key sources of information and assistance. Here are a few others:

Several federal, state and private programs offer support and financial assistance for habitat enhancement. For a list, please see Oregon Conservation Strategy Appendix III, pp. a26-a33. Worth singling out are the programs of the Oregon Department of Fish and Wildlife (http://www.dfw.state.or.us/lands/whcmp/) and the Oregon Watershed Enhancement Board (OWEB) (http://www.oregon.gov/OWEB/).

Oregon State University Extension Service offers technical assistance, research papers and how-to publications. See http://forest-owner.forestry.Oregonstate.edu/wildlife; follow the Facts and Resources/Publications link.

OFRI also has many helpful publications on all aspects of managed forests; see http://oregonforests.org/FactsAndResources/Publications.html. You might start with *Guide to Oregon's Forest Wildlife* and *Identifying Priority Plants and Animals.*

The landowner who wants to be part of a larger effort should check out OWEB's watershed councils, citizens' organizations such as the Applegate Partnership (http://www.roguebasinwatersheds.org/SectionIndex.asp?SectionID=3), and nonprofit land-conservancy organizations such as The Nature Conservancy (http://www.nature.org/wherewework/northamerica/states/oregon/). Conservation groups such as Defenders of Wildlife (http://www.defenders.org) and the National Audubon Society (http://www.audubon.org/about-us) may also be of interest.

Selected Research Programs

College of Forestry Integrated Research Project (CFIRP) (http://ir-dev.library.oregonstate.edu/handle/1957/7883). Initiated in 1989. Three replications of three alternative harvest treatments in 80- to 130-year-old Douglas-fir stands on College of Forestry Research Forests.

Demonstration of Ecosystem Management Options (DEMO) (http://www.cfr.washington.edu/research.demo/). Studies in 70- to 200-year-old stands on ecological, physical and social effects of green-tree retention on public and private lands in western Oregon and southwest Washington.

Oregon State University Fish and Wildlife Habitat in Managed Forests Research Program (http://www.cof.orst.edu/coops/fishandwildlife/index.htm). Provides new information about fish and wildlife within actively managed forests through research, technology transfer and service.

Wildlife biologists research the presence of cavity nesters in created snags

Young Stand Thinning and Diversity Study (YSTD) (http://www.fs.fed.us/pnw/research/lsse/young-stand.shtml). Research on 35- to 55-year-old stands in the Willamette National Forest to determine how various thinning and underplanting treatments could accelerate the development of habitat structure and features typically found in late-successional forests.

The National Council for Air and Stream Improvement (NCASI) (http://www.ncasi.org/default.aspx). An independent, nonprofit research institute that focuses on environmental topics of interest to the forest industry. One of NCASI's major research areas is the Wildlife Program, whose mission is "to provide sound technical information that objectively characterizes relationships between forest management activities and wildlife communities, and supports innovative, cost-effective management strategies that benefit wildlife." NCASI staff scientists cooperate with others to conduct research on selected wildlife species and to validate and improve research models and protocols.

Sustainable Forestry Initiative (SFI) (http://www.sfiprogram.org/index.php). An independent, nonprofit organization that maintains a certification system for forest management. Many North American forest-industry companies are certified under SFI standards. SFI member companies support ongoing research to strengthen SFI's forest management standards. Projects including studies on protecting habitat for endangered, threatened and sensitive wildlife species and incorporating wildlife-friendly practices into natural resource management.

Forest Stewardship Council (FSC) (http://www.fsc.org). FSC is an independent, nonprofit organization established to promote the responsible management of the world's forests. FSC applies the directive of its membership to develop forest-management and chain-of-custody standards, deliver trademark assurance and provide accreditation services to a global network of committed businesses, organizations and communities. The FSC monitoring and evaluation program promotes and looks into independent case studies and research papers conducted by universities, research institutions and other organizations.

USDA National Wildlife Research Center (NWRC) is the federal institution devoted to resolving problems caused by the interaction of wild animals and society (http://www.aphis.usda.gov/wildlife_damage/nwrc/). NWRC applies scientific expertise to developing practical methods to resolve these problems and maintain the quality of the environments shared with wildlife. The NWRC field station in Corvallis, Ore., is the only federal research unit dedicated to understanding and developing strategies to reduce wildlife damage to forest resources (http://www.aphis.usda.gov/wildlife_damage/nwrc/research/forest_resources/index.shtml).

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Matt Hane, Weyerhaeuser, page 26 (lower)
Kate Holleran, Metro, page 14
Keven T. Karlson, page 8
AJ Kroll, Weyerhaeuser, pages 3, 11 (upper), 16 (lower), 23
Dave McWethy, page 23 (upper)
Bruce Newhouse, page 7 (upper)
Oregon Fish and Wildlife, pages 9 (upper), 28 (lower)
OFRI, cover inset, pages 17 (lower), 19
Tim Salzman, page 15 (lower)
Tom Smithburg, page 11 (lower)
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Nicole Strong, OSU, pages 2, 7 (lower), 10, 26 (upper), 27
Merlin D. Tuttle, page 16 (upper)
U.S. Fish and Wildlife, pages 17 (center), 19 (lower right)
Jake Verschuyl, NACASI, page 23 (lower)
Julie Woodward, OFRI, page 28


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