



Coastal Douglas-Fir Forests and Wildlife

The survival of wildlife species depends on diverse habitats. In coastal Douglas-fir forests, diverse habitats can be enhanced by using silviculture systems that allow for management of both forest resources and wildlife. These systems can provide landowners with financial return while also protecting wildlife. There is an essential relationship between wildlife existence and the composition of trees, shrubs, and other forest vegetation.

The coastal Douglas-fir forest type is defined as that forest generally found in the Washington and Oregon Cascade and coastal ranges at an elevation of less than 3500 feet. This geographic region corresponds with the majority of the west-side acreage owned by non-industrial private forest landowners

(NIPF) in the Pacific Northwest. Throughout this range, Douglas-fir often occurs in pure even-aged stands (see Glossary). In the south, it associates with ponderosa pine, sugar pine,

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incense cedar, and various oaks. Toward the northerly coastal limits of this region, Douglas-fir gives way to western red cedar and

Sitka spruce. At higher elevations it gives way to the true firs. Common associated species are western hemlock, western red cedar, grand fir, western white pine, big leaf maple, Pacific madrone, and Oregon white oak (Table 1). Red alder, black cottonwood, Oregon ash, numerous willow species, western paper

birch, and cascara are found primarily in riparian areas. Shrub and forb species are very important to the wildlife found in this zone. This vegetation often includes vine maple, thimbleberry, hazel, salmonberry, vanillaleaf, boxwood, huckleberry, rhododendron, fireweed, ocean spray, Pacific dogwood, salal, and Oregon grape.

Forest Diversity

Forest Succession

An important concept in wildlife management is succession. Succession is the orderly, predictable change in the kinds and numbers of plants and animals that inhabit a given place over a long period. Suc-

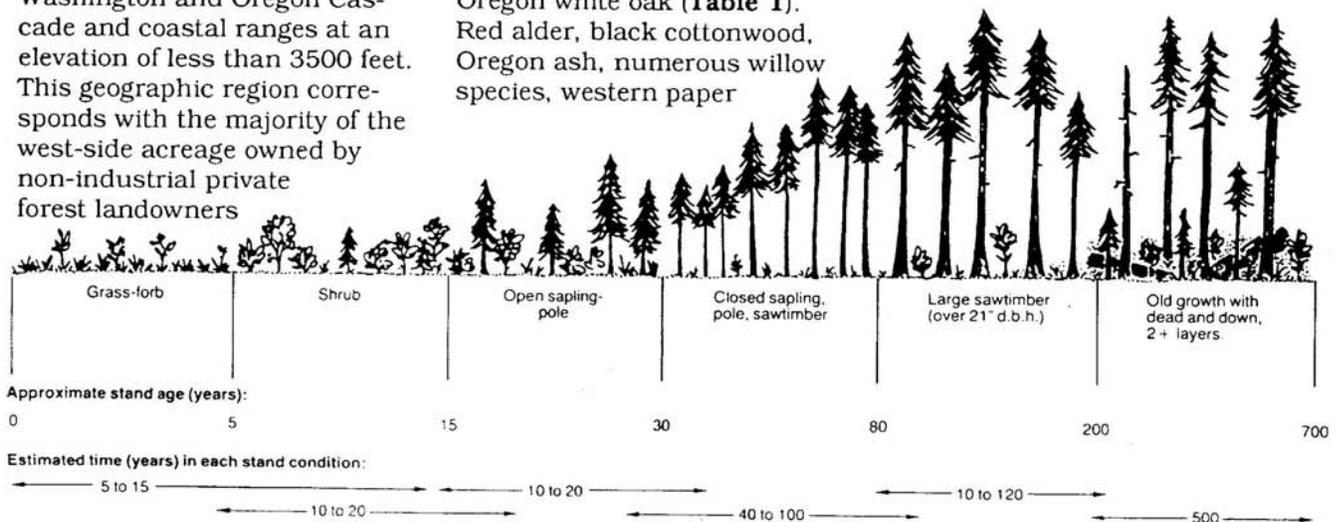


Figure 1. Stand conditions in Douglas-fir forests after even-aged harvesting. From Brown (1985).

cession is tied to habitat disturbance. If you wish to maintain populations of plants and animals typical of the early stages of succession, you must periodically disturb and set back succession, to favor earlier stages. Many animals are "successional" species. They survive only in those stages of succession to which they are adapted. Many successional stages are relatively short-lived, and the presence of the wildlife associated with them is equally short-lived. But periodic disturbances are not beneficial to some wildlife species, such as amphibians, which are slow to colonize disturbed sites. Often a trade-off exists between species habitat requirements.

Forest succession develops in distinct communities. Common communities over time include grass-forb-shrub, sapling-pole, pole-sawlog, large sawlog, and old growth. Each one of these successional stages results in different habitat for wildlife species. The composition of wildlife species changes

as the even-aged stands grow through successional stages. For example, pole-sawlog type stands will usually support less than 10 deer per square mile. The deer population will often increase to 60 per square mile about 20 years after fire or logging. Following the 20-year peak, the population declines

"...In this instance, relatively small disturbances of the forest through logging or fire are needed to maintain high deer populations."

rapidly because the growing forest shades out most understory browse species. Eventually after 50 to 60 years, the deer population may fall as low as 4 or 5 deer per square mile. In this instance, relatively small periodic disturbances of the forest through logging or fire are needed to maintain high deer populations.

Age Structure

Douglas-fir forests are usually even-aged. Even-aged stands result from tree harvests or catastrophic events such as wildfires and windthrow.

Figure 1 depicts the development over time of a typical even-aged Douglas-fir forest after clearcut harvesting. Although Douglas-fir can survive for long periods in the shade, growth is most rapid when all trees in a stand are approximately the same age and receive direct sun light. As wildlife habitat, an even-aged stand is low in diversity. Diversity can be increased if the even-aged stands are in small blocks, and if some defective and or dead trees (snags) and some healthy or live trees (green or "recruitment" trees) are left standing. It is beyond the scope of this paper to discuss thoroughly the important contribution that snags, green trees, and large downed woody debris make in habitat diversity, but it is well known that these materials provide beneficial habitats for insects, amphib-

Table 1: Common tree species of the coastal Douglas-fir forest type, and a few of their important characteristics.

Characteristic	White Pine	Douglas-fir	Noble Fir	Western Hemlock	Lodgepole Pine	Western Redcedar	Red Alder	Oregon White Oak	Pacific Yew
	IT = Intolerant; INT = Intermediate; T = Tolerant; VT = Very Tolerant.								
Shade tolerance	INT	INT	IT	VT	IT	T	IT	IT	VT
Competitiveness	INT	INT	INT	T	IT	T	IT	INT	T
Wet site suitability	INT	IT	INT	T	IT	T	T	IT	T
Dry site suitability	IT	INT	IT	IT	T	IT	IT	T	IT
Ease to establish seedlings	MED	HIGH	MED	MED	HIGH	MED	?	LOW	?
Provides browse	NO	YES	NO	NO	NO	YES	NO	YES	?
Response to thinning	HIGH	HIGH	HIGH	MED	MED	MED	?	?	?
Provides thermal cover	MED	HIGH	HIGH	HIGH	LOW	HIGH	MED	LOW	HIGH
Provides hiding cover	LOW	HIGH	HIGH	HIGH	LOW	HIGH	MED	MED	LOW
Easily damaged by wildlife	HIGH	MED	MED	HIGH	MED	MED	HIGH	HIGH	MED

ians, rodents, and birds. Consult a wildlife biologist for more information.

The opposite of even-aged structure is a structure that has three or more age classes. This multi-aged forest is called an uneven-aged structure. Uneven-aged stands are managed by selectively harvesting individual trees or small groups of trees at frequent intervals. This system is best suited to those areas where the dominant tree species are generally shade tolerant, since reproduction must occur under the canopy of older trees. Shade intolerant species cannot compete under these conditions. Coastal Douglas-fir forests are seldom uneven-aged because they are shade intolerant. Uneven-aged management is poorly understood and rarely practiced successfully in these forests.

Vertical Development

Vertical development of Douglas-fir and shrub species is affected by shade tolerance, stocking, site quality, and

Table 2. Stand conditions and related environmental characteristics.
Slightly modified from Brown (1985).

	Stand Type					
	Grass-Forb	Shrub	Sapling	Pole	Sawlog	Old-growth
Plant diversity	MED	HIGH	HIGH	LOW	MED	HIGH
Vegetation height	LOW	MED	MED	HIGH	HIGH	HIGH
Canopy closure	NONE	LOW	MED	HIGH	HIGH	HIGH
Structural diversity	LOW	LOW	MED	LOW	MED	HIGH
Herbage amount	HIGH	HIGH	MED	LOW	LOW	MED
Browse amount	LOW	HIGH	MED	LOW	LOW	MED
Animal diversity	LOW	HIGH	LOW	LOW	MED	HIGH
Woody debris	LOW	LOW	LOW	LOW	MED	HIGH

disturbance factors. As a stand grows over time, natural competition, primarily for sunlight and soil nutrients, influences the height growth of shrubs and individual trees. This difference in height growth responses results in overtopping and the ultimate death of those species that cannot "keep up." This natural mortality can occur rapidly in Douglas-fir stands.

Many wildlife species use these multiple canopy layers by responding to the diversity of plant species and growth forms (Figure 2, Tables 2 and 3). "New Forestry" is a management concept that promotes wildlife habitat diversity through the utilization of these multiple canopy layers.

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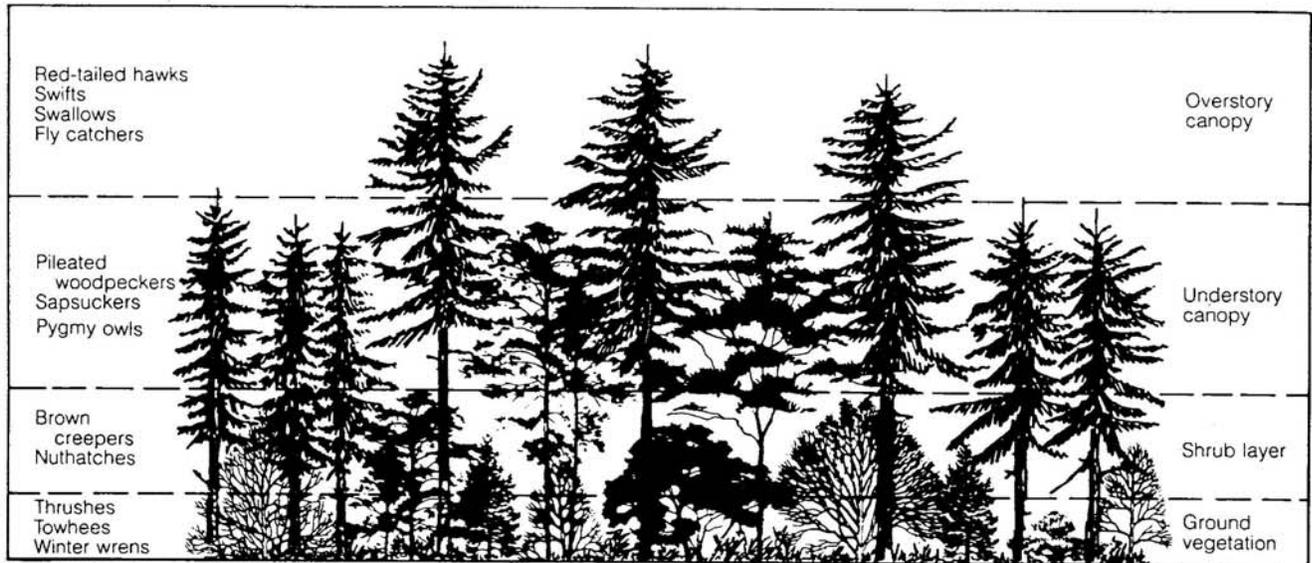


Figure 2. An example of the birds that utilize the vertical diversity in a mature Douglas-fir forest. *From Brown (1985)*

Woodland Fish and Wildlife

Table 3: Wildlife found in the various successional stages of the Douglas-fir type.

Slightly modified from Brown (1985).

Wildlife Species	Grass-forb Stand	Shrub Stand	Sapling Stand	Pole Stand	Sawlog Stand	Old-Growth Stand	Red Alder Stand	Riparian Habitat
F = Feed Only; R = Reproduce Only; X = Both Feed and Reproduce								
Amphibians								
long-toed salamander	F	F	F	F			X	X
Pacific giant salamander				F	F	F	X	X
western redback salamander		X	X	X	X	X	X	X
roughskin newt	F	F	F	F	F	F	F	F
western toad	F	F	F	F	F	F	F	X
pacific tree frog	F	F	F	F	F	F	F	F
red-legged frog	F	F	F	F	F	F	F	F
Reptiles								
western pond turtle 2/	R	R	R				R	X
northern alligator lizard	X	X	X	X	X	X	X	
western fence lizard	X	X	X	X			X	
gopher snake	X	X						
northwest garter snake	X	X						X
common garter snake	X	X	X				X	X
Birds								
American bittern								X
great blue heron					R	R	R	X
turkey vulture	X	X					X	
wood duck					X	X	X	X
osprey 2/					R	R		R
bald eagle 2/	F				R	R		X
sharp-skinned hawk 2/			X	X	X	X	X	X
Cooper's hawk 2/	F	F	F	X	X	X	X	X
American kestrel 2/	F	F			R	R		
peregrine falcon 2/	F	F	F	F	F	F		F
blue grouse	F	X	X	F	F	F		X
ruffed grouse	F	X	X	X	X	X	X	X
mountain quail	X	X	X					
marbled murrelet					R	R		
band-tailed pigeon	F	F	F	F	F	F	X	X
western screech-owl 2/	F	F	F	F	X	X	F	X
great horned owl 2/	F	F	F		X	X	F	X
northern pygmy-owl 2/	F	F	F	X	X	X	X	X
northern spotted owl 2/				F	F	X		
common nighthawk	X	X	F	F	F	F	X	X
rufous hummingbird	F	X	X	R	X	X	X	X
red-breasted sapsucker			F	X	X	X	X	X
hairy woodpecker			F	X	X	X	X	X
pileated woodpecker			F	F	X	X	F	X
olivesided flycatcher			F		X	X		X
northern flicker	F	F	F	F	X	X	F	X
Pacific slope flycatcher					X	X	X	X
tree swallow	X	X	F	F	X	X	F	X
violet-green swallow	X	X	F	F	X	X	F	F
Steller's jay		F	X	X	X	X	F	X
American crow	F	F	X	X	X	X	X	X
black-capped chickadee		X	X	X	X	X	X	X
common raven	F	F	F	F	X	X	X	X
chestnut-backed chickadee		X	X	X	X	X	X	X
red-breasted nuthatch			F	X	X	X		X
brown creeper				X	X	X		X
winter wren			F	X	X	X	X	X

1/ Known species: 460. This table represents those most likely to be found on the lower elevation NIPF lands.

2/ Species requiring special habitat consideration.

Woodland Fish and Wildlife

(Table 3 Continued)

Wildlife Species	Grass-forb Stand	Shrub Stand	Sapling Stand	Pole Stand	Sawlog Stand	Old-Growth Stand	Red Alder Stand	Riparian Habitat
hermit thrush		X	X	X	X	X	F	X
American robin	F	X	X	R	X	X	X	X
varied thrush		F	F	X	X	X	X	X
cedar waxwing		X	F	F	F	F	X	F
Bohemian waxwing		F	F		F	F	F	F
warbling vireo			X				X	X
Nashville warbler		X	X		X	X		F
yellow-rumped warbler		X	X	X	F	F	F	X
black-throated gray warbler		F	X	X	X	X	X	X
Wilson's warbler		X	X	X	X	X	X	X
black-headed grosbeak		X	X	X	X	X	X	X
rufous-sided towhee	F	X	X		X	X	X	X
chipping sparrow	F	X	X		X	X	X	X
fox sparrow		X	X				X	X
dark-eyed junco	F	X	X	R	X	X	X	X
white crowned sparrow	X	X	X				X	X
brown-headed cowbird	F	X	X	R	R	R	X	X
purple finch	F	F	X	X	X	X	X	X
pine siskin	F	F	X	X	X	X	X	X
American goldfinch	F	X	X				X	X
evening grosbeak		F	F	X	X		X	X
Vaux's swift	F	F	F	F	F	X	F	F
Downy woodpecker			F	X	X	X	X	X
western tanager			F	X	X	X	X	X
Mammals								
Pacific shrew	X	X	X	X	X	X	X	X
Virginia opossum	X	X	X	X	X		X	X
vagrant shrew	X	X	X	X	X	X	X	X
Townsend's mole	X	X	X				X	X
broad-footed mole	X	X	X	X	X	X	X	X
coast mole	X	X	X	X	X	X	X	X
big brown bat	F		F		X	R	F	X
silver haired bat	F		F	F	X	R	F	X
coyote	X	X	X	X	X	X	X	X
red fox	X	X	X	X			X	X
black bear	F	F	X	X	X	X	X	X
raccoon	X	X	X	X	X	X	X	X
river otter 2/	X	X	X	X	X	X	X	X
striped skunk	X	X					X	X
long-tailed weasel	X	X	X	X	X	X	X	X
mink 2/	X	X	X	X	X	X	X	X
mountain lion 2/	F	X	X	X	X	X	X	F
bobcat 2/	F	X	X	X	X	X	X	X
elk	F	X	X	X	X	X	X	X
mule deer	F	X	X	X	X	X	X	X
black tailed deer	F	X	X	X	X	X	X	X
mountain beaver	F	F	X	X	X	X	X	X
northern flying squirrel				X	X	X		X
western gray squirrel			F	X	X	X		
Townsend's chipmunk	X	X	X	X	X	X	X	X
Douglas' squirrel			X	X	X	X		X
western pocket gopher	X	X						
beaver 2/		X	X	X			X	X
bushy-tailed woodrat	F	X	X	X	X	X	X	X
deer mouse	X	X	X	X	X	X	X	X
long-tailed vole	X	X	X				X	X
Townsend's vole	X	X	X				X	X
Pacific jumping mouse	X	X	X	X	X		X	X
porcupine			X	X	X			X
snowshoe hare	F	X	X	X	X	X	X	X

Species Composition

Stands that naturally regenerate after harvesting usually have many tree species (Table 1), and this is often beneficial for wildlife. The concepts of species diversity and shade tolerance

apply as well to the major shrub and browse species found in Douglas-fir forests. As tree canopies close, shrubs decrease in abundance. Often it is the abundance of shrubs that is critical to wildlife populations. To maintain habitat for wildlife animals, you may wish to maintain shrubs in your timber stands. The process of maintaining shrubs will require retarding forest succession and opening the canopy. Generally the savory browse species are intolerant of shade. Therefore, to maintain the shrubbery you must create sunlit openings in your stands. These can be as small as half an acre and still be beneficial.

If you wish to maintain a broad array of wildlife on your property, it is desirable to develop diverse stand conditions in terms of succession, age, species, and tree spacing and height. Plant diversity leads to wildlife diversity because diversity provides many different habitat opportunities for wildlife.

Often it is the abundance of shrubs that is critical to wildlife populations.

and Oregon can continue to produce both timber and wildlife. Most wildlife habitat management on both large and small acreages is carried out in coordination with timber management. Because of the relationship

between an animal and its environment, wildlife management should be based on the principle of

habitat management. Table 4 and Figure 3 summarize the recommended silvicultural practices for use by landowners with small parcels. Clearcutting is a harvest system in which all trees, regardless of size and species, are removed at one time. The shelterwood method removes approximately one-half of the trees at two entries to the stand over a 5 to 10 year period. In the shelterwood system, sufficient trees are removed to provide approximately half sunlight and half shade on the forest floor. The strongest and most vigorous trees should be spared in the first cutting. A patch clearcut is a small harvesting operation with the explicit purpose of providing sunlight to the forest floor. Small patch diameters should be approximately twice the height of adjacent trees, or usually less than one acre.

A common silvicultural practice conducted in immature stands is thinning. The removal of some of the trees provides additional light and nutrients to those that remain. Most commonly the trees that are cut are the suppressed, smallest, or defective ones in the stand. In



Clearcut Harvest...



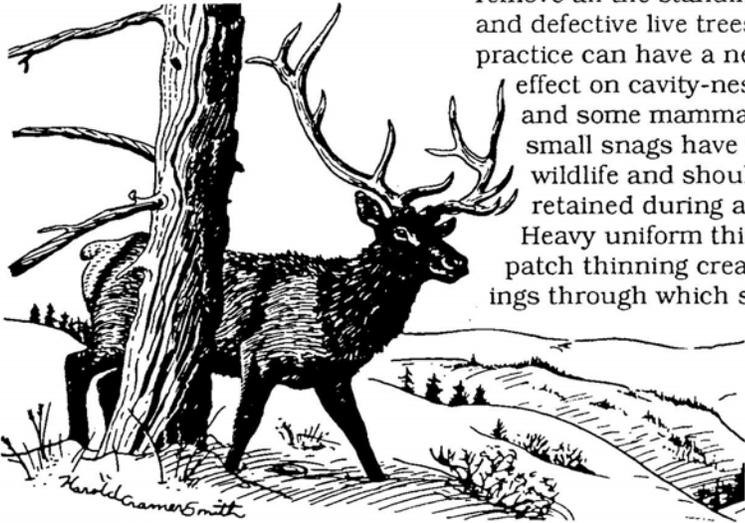
Shelterwood Harvest...

Figure 3. Silvicultural systems used in coastal Douglas-fir forests by landowners with small parcels. From Hanley et al. (1987)

Management Practices for Small Acreages

The highly productive coastal forests of western Washington

patch thinning, immature trees are removed to provide very small openings in the canopy.



Patches are small in size, no larger in diameter than the height of adjacent trees. Do not remove all the standing dead and defective live trees, as this practice can have a negative effect on cavity-nesting birds and some mammals. Even small snags have value for wildlife and should be retained during a thinning. Heavy uniform thinning and patch thinning creates openings through which sunlight

can reach the ground. Grasses and shrubs

thrive in the openings and increase forage for grazing and browsing animals. Black bears are sometimes troublesome in thinned areas because they are capable of damaging young, vigorous trees.

The Edge Effect (Ecotones)

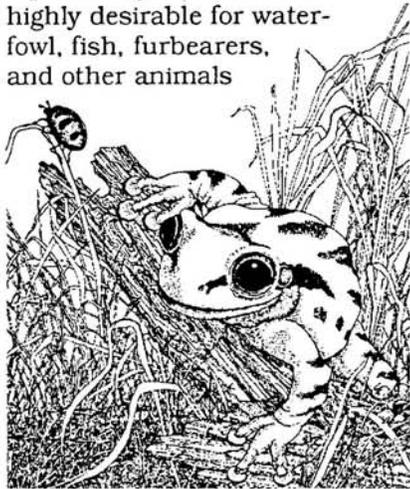
The transition between two or more environmental types, such as forest and cropland, is called an ecotone or more commonly an "edge." Frequently, both the number of species present and the abundance of individuals are greatest in the ecotonal community. This phenomenon is called the "edge effect." Knowing that to a

Table 4: Silvicultural practices often used in the coastal Douglas-fir forest type, by stages of development and management objectives.

Management Action	Stand Types			
	Douglas-fir/shrub	Red Alder/shrub	Hemlock-cedar/shrub	Douglas-fir/wrc-wh
TIMBER MANAGEMENT OBJECTIVES				
Harvest System	Clearcut	Clearcut	Clearcut or shelterwood	Clearcut or shelterwood
Commercial thinning	Low thinning	High thinning	High or low thinning	Low thinning
Precommercial thinning	Low thinning	?	Low thinning	Low thinning
Regeneration action	Plant or natural	Natural regeneration	Plant or natural	Plant
WILDLIFE MANAGEMENT OBJECTIVES				
Harvest system	Patch clearcut or shelterwood	Clearcut	Shelterwood	Shelterwood or patch clearcut
Commercial thinning	Low thinning	High thinning	High thinning	Selective thinning
Precommercial thinning	Low thinning	?	High or low thinning	Patch thinning
Regeneration action	Interplant redcedar, hemlock or white pine	Natural regeneration	Interplant redcedar, hemlock in openings	Interplant redcedar, hemlock or white pine

large degree certain types of wildlife will flourish in edges, the wildlife manager can expect to increase the variety and abundance of many wild creatures by supplying a greater variety of cover types, thus providing more edges. This is particularly true where only a few types of habitat are present.

Changing an environment to benefit one wildlife species may hurt another species. Building a pond may create habitat highly desirable for waterfowl, fish, furbearers, and other animals



that use aquatic habitats. But it may also result in a loss of brushy cover needed by small mammals, deer, or grouse during the winter. Thus, by increasing the variety of habitats, the landowner can expect to increase the variety and general abundance of wildlife. However, edge creation frequently results in fragmentation of larger tracts. This can negatively affect species that require large, undisturbed areas and/or species that cannot do well when edges are introduced.

Stand Recommendations

If your goal is to provide for the broad needs of a variety of wildlife species, you should try

to attain a mix of as many as possible of the six stand conditions depicted in **Figure 1 and 4**. Be sure to take into account the habitat provided by land adjacent to yours. General recommendations follow which will allow you to maintain and improve stand conditions. Specific species recommendations are best obtained from references listed at the end of this article.

Grass-forb: If your property already contains some open land, you can maintain a healthy mixture of grasses and forbs by seeding, periodic burning, grazing, or mowing. This habitat can be created by making openings in existing stands using small clearcut patches and seeding the disturbed area with a grass/

legume mix. Prescribed burning can be used to maintain grass stands but is strictly regulated and should be carried out only with the assistance of a professional forester. Wildflowers are often abundant in this vegetative community, providing a colorful bonus!

Shrub: To fulfill the habitat needs of most species throughout the year, a variety of

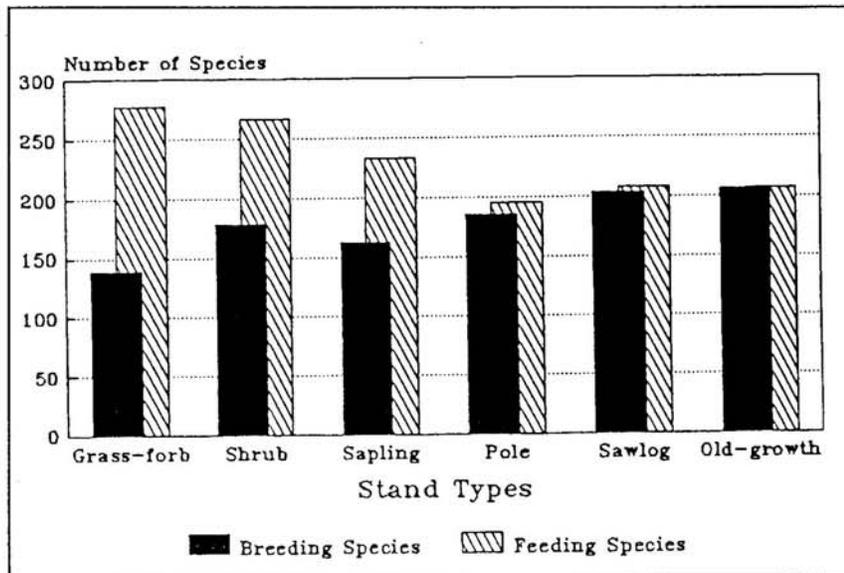
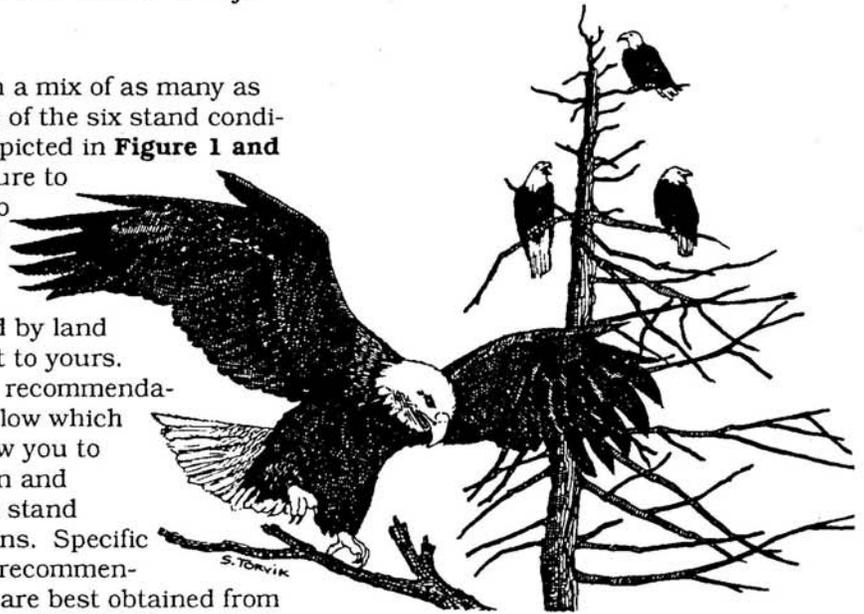


Figure 4. Number of wildlife species found within each stand type.

From Brown, (1985).

shrub habitats should be maintained. Shrubs provide wildlife food, cover, and shelter. For example, the winter food and cover needs of a ruffed grouse are far different from its needs during the heat of summer. Grouse, as well as all other wildlife, need cover, food, and water available within a normal home range. You can meet the shrub cover needs of wildlife by leaving existing brushy areas



unplanted or by thinning the tree canopy to stimulate shrub growth. Desired shrubs often require direct sunlight. Shrubs can also be planted to create habitat; specialized nurseries have appropriate planting stock.

Sapling-Pole: Thin these stands periodically to maintain a healthy, vigorous condition. Given ample room to grow, Douglas-fir, western hemlock, and western redcedar will develop a thick crown cover. Patch thinning is highly recommended in older stands to provide more light to the forest floor. Take care to leave some standing dead and defective live trees as well as den or nest

trees. Unfortunately, wildlife diversity in these monetarily valuable timber stands is often low.

Sawtimber: These stands can be harvested using clearcut or shelterwood methods. Each of these methods provides light to the forest floor, allowing forbs and shrubs to regenerate. Retain several broken-topped trees or snags, which will soon become wildlife havens. Dead and decaying trees will be used by insects, squirrels, woodpeckers, songbirds, and other small mammals. Leave cull logs to provide downed woody habitat and small openings. To retain the benefits from downed logs, we recommend that you leave at least two logs per acre during harvesting. The logs should be at least 20 feet long and 12 to 15 inches in diameter. Log quality is not important, so cull logs may be left to serve this purpose. If possible, fell logs into brushy patches since protected logs will be used by a variety of birds and small mammals. Downed logs in shady riparian areas are often used by salamanders and other amphibians.

Old Growth: Pristine Douglas-fir forests have supported substantial populations of wildlife, including tree mice, owls, flying squirrels, martens, and fishers. Harvesting and fires have altered habitats, improving conditions for elk, deer, snowshoe hare, mountain beaver, black bear, robin, grouse, and other species adapted to early successional stages. As old-growth forests were converted to young stands, early successional species flourished. But the progressive loss of old-growth habitat has

caused some wildlife species to decline; two such species are the marbled murrelet and the northern spotted owl. Specific habitat requirements for wildlife species found in these forests are best determined on a site-by-site basis by a competent wildlife habitat specialist, and may require consultation with the U.S. Fish and Wildlife Service.

General Considerations

If possible, minimize the period of disruption to wildlife by limiting timber management activities to small areas and complete them in a short time.

When possible, avoid simultaneous logging of adjacent drainages. Maintain non-activity zones adjacent to active operations to provide wildlife a place to hide. Avoid harvesting or thinning during periods of nesting or calving. Keep roads out of riparian areas. Include



legumes in seeding mixes for firebreaks, skid trails, and cut/fill slopes. Maintain vegetative cover along roads and in riparian areas and in areas generally deficient in cover. Maintain cover within known wildlife travel routes. Provide a travel route of continuous cover between forested areas.

Slash

Retain several dead or defective standing trees per acre for perching, nesting and insect-feeding wildlife. Retain woody debris and logging slash for wildlife cover on at least 10 percent of harvested area. Leave cull logs unyarded. Slash should be treated to minimize wildfire risk and create habitat for wildlife. Small quantities can be lopped and scattered to recycle nutrients back into the soil. Crush it so that it is less than two feet off the ground, to facilitate wildlife travel. Larger quantities generated after a harvest can be treated by piling and burning in the fall on a cold, wet day with permits from appropriate state organizations. This burn will consume only the fine fuels, thereby leaving the rest to provide hiding cover for small mammals such as shrews, mice, and hare. Small mammals will in turn attract owls and other birds of prey. Slash piles also provide sources of insects for birds.

WHERE TO GET HELP

There are many sources of useful information. County Cooperative Extension, as a representative of the land grant universities, Washington State

University and Oregon State University, is a good place to start. So are the Washington Departments of Natural Resources and Wildlife as well as the Oregon Departments of Forestry and Fish & Wildlife.

The USDA Soil Conservation Service maintains field offices throughout the region for management planning assistance. The references listed at the end of this circular are sources of general information.

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Much of the information contained in this publication is based on these sources:

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GLOSSARY

Age Class: All trees in a stand within a given age interval, usually 10 or 20 years.

Clearcut: A harvest and regeneration technique which removes all the trees (regardless of size) on an area in one operation. Clearcutting is commonly used with Douglas-fir, which requires filtered to full sunlight to reproduce rapidly and grow well. Clearcutting produces an even-aged stand.

Climax Community Type: The final stage of forest succession, which may develop after many years in the absence of disturbances.

Crown Class: A relative designation of tree crowns. Four categories are defined: Dominant - trees with crowns above the general level of the canopy. Codominant - trees with crowns forming the general level of the canopy. Intermediate - trees with crowns below the general level of the canopy. Suppressed - trees much shorter than the general level of the canopy.

Ecotone: The area of transition or edge between two different community types, such as between meadow and forest.

Even-aged Management: Management designed to remove (harvest) all trees at one time, or over a short period, to produce even-aged stands.

Forest Type: A group of tree species which, because of their environmental requirements, commonly grow together. Examples of forest types are the Douglas-fir/hemlock type or the spruce/fir type. Also, a descriptive term used to group stands with similar composition and development characteristics.

Overstory: That portion of the trees in a stand forming the upper crown cover.

Riparian Zone: That area adjacent to, or on the bank of, lakes, rivers, and streams. Identified by vegetation, wildlife, and other characteristics unique to these locations.

Selection: Harvesting individual trees or small groups of trees at periodic intervals (usually 8 to 15 years) based primarily on their vigor and age. Selection harvesting perpetuates an uneven-aged stand.

Shelterwood: Harvesting all trees in a stand in a series of two or more operations. Harvests are usually 5 to 10 years apart, yielding an even-aged stand. New seedlings grow and become established in the partial shade and protection of older trees.

Silviculture: The art, science, and practice of establishing, tending, and reproducing forest stands with desired characteristics, based on knowledge of species characteristics and environmental requirements.

Species Composition: The mixture of tree species comprising an individual stand.

Stand: A recognizable area of the forest that is relatively homogeneous and can be managed as a single unit. Stands are the basic management units of the forest.

Stand Types: *Even-aged* - A stand in which trees are essentially the same age (within 10 to 20 years). *Uneven-aged* - A stand which supports trees of several age classes (technically, more than two ages classes). *Fully stocked* - A forest stand where trees effectively occupy all growing space. *Mixed* - A stand which has more than one species in the main tree canopy.

Overstocked - Tree-to-tree overcrowding in a stand which reduces tree and shrub vigor. *Pole* - A stand in which most trees are in the pole size (diameter of approximately 5 to 9 inches). *Pure* - A stand in which at least 80% of the trees belong to a single species. *Residual* - The stand which remains after cutting. *Sawtimber* - Most trees in the stand are large in diameter (usually 10 to 12 inches d.b.h. or larger). *Understocked* - A stand in which crop trees do not effectively occupy the growing space.

Succession: The predictable change of forest communities over time and the resultant change in the kinds and numbers of plants and animals found in those communities.

Thinning: Tree removal in a forest stand that reduces tree density and tree-to-tree competition. Thinning encourages increased growth of fewer, higher-quality trees. Thinning may reduce vertical habitat diversity.

Thinning types: *Crown thinning* - A thinning which removes the dominant and codominant trees. *Low thinning* - A thinning which removes the smallest, suppressed trees. *High thinning* - A thinning which removes the dominant trees that are of undesirable species or form. *Commercial thinning* - Any thinning of merchantable trees. *Precommercial thinning* - Any thinning of nonmerchantable trees, often called PCT.

Uneven-aged Management: Managing a forest by periodically removing some trees of all ages to maintain an age distribution. The manager maintains a greater number of trees in each younger age class than in the next older class, up to some maximum age. This type of management is not common in the Pacific Northwest. See Selection.

Our Purpose...

This leaflet was written by Donald Hanley and David Baumgartner, Extension Foresters, Washington State University, and Kenneth Raedeke, Wildlife Biologist, Raedeke and Associates, Seattle.

The Woodland Fish and Wildlife Project is a cooperative effort among the World Forestry Center, Oregon State Department of Forestry, Washington State Department of Natural Resources, Oregon State University Extension Service, Washington State University Cooperative Extension, University of Washington Center of Streamside Studies, Oregon Association of Conservation Districts, Oregon

Small Woodlands Association, Washington Farm Forestry Association, Oregon Department of Fish and Wildlife, Washington Department of Fisheries, Washington Department of Wildlife, Oregon Soil Conservation Service, Washington Soil Conservation Service and the USDA Forest Service. The World Forestry Center serves as the coordinating organization for the project.

The Woodland Fish and Wildlife Project was initiated to provide information on fish and wildlife management to private woodland owners and managers. It is the intent of the organizations involved in this project to produce publications that will serve as practical guides to

woodland owners.

Each publication is intended to be complete in itself. Users may find it convenient to collect all publications in this series in a three ring binder to form a permanent reference file. Woodland Fish and Wildlife Project publications range from an overview of fish and wildlife opportunities on woodland properties to specific publications concerning techniques for managing individual species.

These publications can be obtained from any of the cooperating organizations or by contacting the World Forestry Center, 4033 SW Canyon Road, Portland, OR 97221, (503) 228-1367.

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**World Forestry Center
4033 SW Canyon Road
Portland, Oregon, 97221**

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Woodland Fish and Wildlife Project Publication