III. BIOLOGICAL DOMAIN

A. Vegetation

1. Characterization: *What is the array and landscape pattern of plant associations and seral (structural) stages in the watershed (riparian and non-riparian)? What processes caused these patterns (e.g., fire, wind, mass wasting)?*

Blowout drainage is one of the most productive areas on the Detroit District in terms of biomass growth potential. The deep, fertile soils and favorable climate combine to produce lush coniferous forests.

***Trees*:** Douglas-fir is the most abundant tree species in the area, followed by western hemlock and western redcedar. As elevations increase over 3000 feet, Pacific silver fir and noble fir become more commonplace and at the highest elevations, mountain hemlock becomes a stand component. Other associated tree species include: Pacific yew, western white pine, grand fir, sugar pine and incense cedar.

Many stream channels and wet areas support pure hardwood stands or include a hardwood component in the timber stands. Red alder, big leaf maple and black cottonwood are common in these areas. In upland areas, big leaf maple and golden chinquapin are also important.

***Second Growth of Natural Origin*:** A common assumption is that prior to timber management, all timber stands were old growth. In Divide and Hawkins Creek drainages there are examples of naturally occurring stands of second growth timber. There are a few thousand acres of 70 to 80 year-old stands that were naturally regenerated by fire. These stands tend to be in the lower to mid-elevation ranges and are commonly very dense, single-storied stands dominated by Douglas-fir. Overall in the drainage, about 6000 acres have been naturally regenerated by fire within the last 100 years.

In these stands, generally few trees exceed 12 inches in diameter and understory vegetation is sparse. Some of the stands have remnant Douglas-fir, western redcedar or western hemlock and the western hemlock almost always have severe dwarf mistletoe infestations.

One characteristic of these stands is that self-thinning is minimal. Few trees have much competitive advantage and are competing more or less equally for growing space.

***Shrubs*:** A comprehensive inventory of the shrub and herb layers has not been completed. Common shrub species in the Blowout include: rhododendron, Oregon grape, vine maple, salal, and bear grass, etc.

Plant Associations: Plant communities are useful indicators of environmental factors. In reality these communities and the environmental factors grade more or less continuously across the landscape, but for the sake of practical application they have been artificially grouped into plant associations. Each plant association is a relatively discrete group of plant species, which maintain stable populations over long periods of time and recur across the landscape where the environment is suitable. Normally each *plant association* is named by the major climax species and dominant shrub and herb layers. The *plant association series* is named by the major climax species without mention of shrub and herb layers.

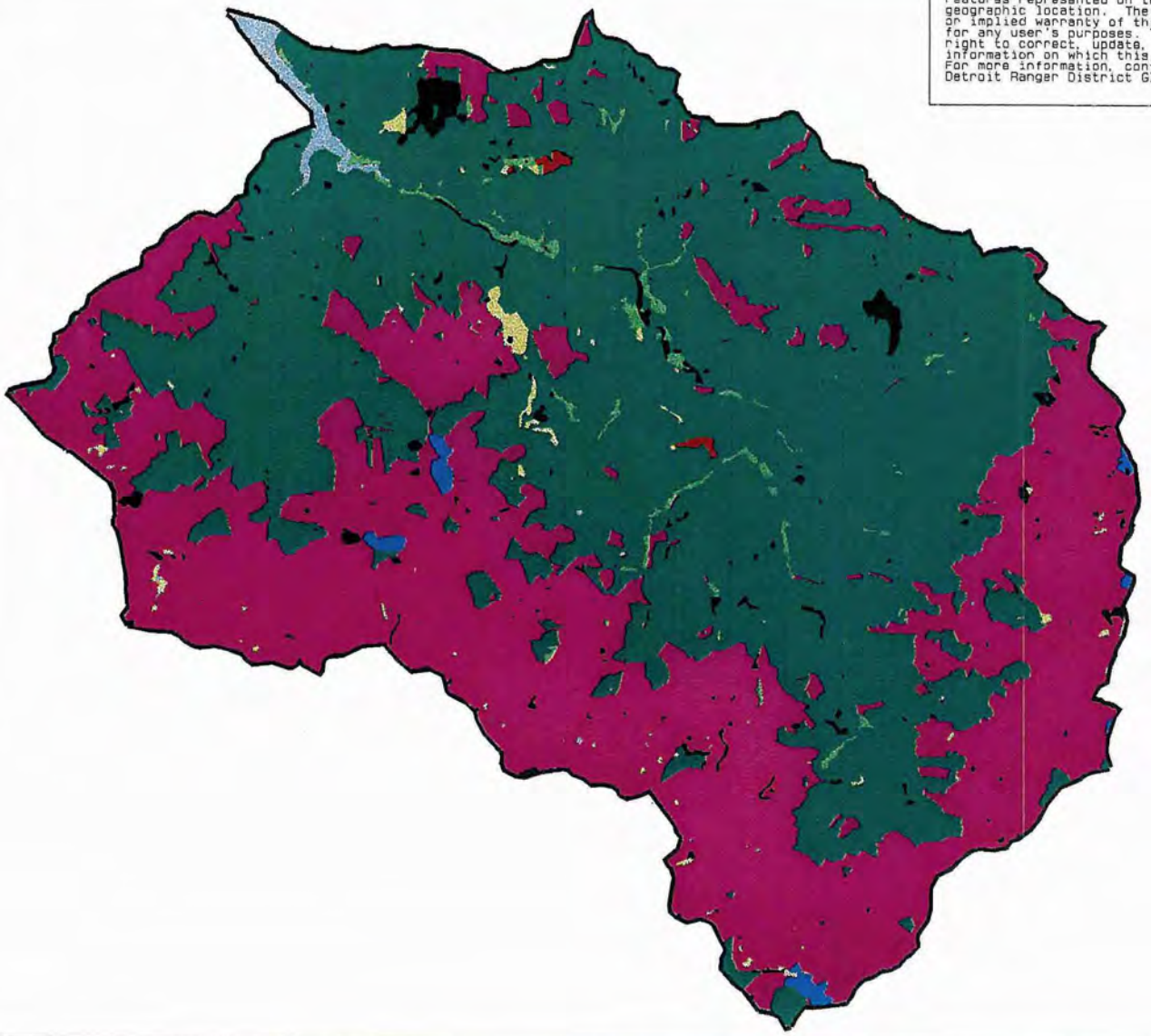
Not all areas of the Blowout have been inventoried for plant associations, so we really only have a good picture of the climax species and not the associated shrub and herb layers. The plant association series represented in this watershed include: Douglas-fir, western hemlock, Pacific silver fir and mountain hemlock. The two maps (# 10 and # 11) that follow depict the major plant association series for the entire Blowout watershed, as well as, major plant association series for the riparian reserves within the watershed. Overwhelmingly, western hemlock and Pacific silver fir associations dominate the landscape. Douglas-fir associations are found in isolated patches at the lower elevations and mountain hemlock associations are confined to a few ridgetop locations.

As seen the chart below, the warmest, low elevation sites tend to support Douglas-fir associations, while the coldest, high elevation sites tend to support mountain hemlock associations. The area in between, which is where most of the Blowout watershed falls, is either western hemlock or Pacific silver fir. The chart also shows that tree growth potential is highest in the lower elevation, warmer sites and decreases as elevation increases and site temperature decreases.

Plant Association Series	Percent of forested portion of watershed	Site Temperature	Elevation	Tree Growth Potential
Douglas-fir	<1%	warm | V cold	low | V high	high | V low
western hemlock	44%			
Pacific silver fir	55%			
mountain hemlock	<1%			

This pattern of plant associations was caused by a variety of physical and biological factors such as soils, climate and microclimate, topographic influences, the distribution and abundance of various plant or animal species, and disturbance history, both natural and human caused.

Blowout WA
Plant Association Series



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Legend

- Douglas Fir
- Western Hemlock
- Pac. Silver Fir
- Mountain Hemlock
- Roads,Rock
- Meadows,Shrubland
- Alder
- Water

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08/28/00

Map # 10

Blowout WA
Plant Association Series in Riparian Reserves

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Legend

- Douglas Fir
- Western Hemlock
- Pac. Silver Fir
- Mountain Hemlock
- Roads,Rock
- Meadows,Shrubland
- Alder
- Water

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Map # 11

Differences in plant associations between riparian and non-riparian areas may vary in degree locally, depending on stream class, topographic features, water availability, air drainage, soils, and other factors. Differences in vegetation from riparian areas and upslope sites may be significant enough to classify adjacent sites in entirely different plant association series or there may be no difference at all. In general, riparian plant associations tend to be wetter and cooler than adjacent upslope sites, but these differences decrease or may disappear completely with intermittent streams. For clarification, Riparian Reserves widths may or may not represent the actual zone of influence that streams have on vegetation. In general, differences in vegetation from the upslope disappear in a shorter distance than that defined by Riparian Reserve widths.

Structural Stages: The structural stages represented in the Blowout watershed today are generally the result of either timber harvest or past fires. There are four structural stages represented in this watershed: stand initiation, stem exclusion, understory re-initiation, and old growth. The following is a brief description of each structural stage:

Stand Initiation Stage - In this stage, stand ages range from 1 to 20 years old depending on site conditions and degree to which the stand has been managed. Most stands in this stage were the result of timber harvest and almost all were planted. Harvest units were planted at a density of about 400 to 600 trees per acre with one or more tree species, generally Douglas-fir, noble fir, and western white pine, depending on site conditions. Commonly, additional tree species seeded into these plantations naturally. At the lower elevations, shade-tolerant species such as western hemlock, western redcedar and Pacific silver fir seeded in, while at the higher elevations mountain hemlock and Pacific silver fir seeded in.

Many of the plantations have been precommercially thinned, leaving the largest, most damage free trees, as well as seedlings under one foot tall, free to grow in the plantations.

Non-tree vegetation is also present in this structural stage, although species and numbers are highly variable. On most sites, species such as rhododendron and vine maple re-sprout after timber harvest and broadcast burning. At higher elevations, beargrass also survives timber harvest and burning and may cause severe competition for planted trees. Invasion of harvested sites by non-sprouting plants is highest at lower elevations, < 3000 feet, and on southerly and westerly aspects. Snowbrush invasion occurs on some sites, especially those with frequent fire return intervals.

The degree of plant species diversity declines with increasing elevation and coldness of site. Many of the sites in the mountain hemlock series undergo very little change in the composition of plant species following fire or logging.

Photo shows Stand initiation at about age 20

Until about 1990 most of these plantations had very few snags, green trees, or significant levels of course woody debris. Almost all were broadcast burned. All harvest units sold after 1990, that are in this structural stage, have met the Willamette National Forest standards and guidelines for snags and down woody material.

Stem Exclusion Stage - This structural stage includes a very large range of stand conditions and includes trees that range in age from about 20 to 150 years, with diameters from 5" to 20.9", depending on site conditions and degree of management. These stands have dense crowns which block out light to the forest floor, and limit additional tree regeneration in the understory. Typically, shade tolerant understory trees that are present, persist but grow very slowly. Intermediate or suppressed trees that do not tolerate shade well, suffer from competition and have a high mortality rate. Shade intolerant shrubs and forbs frequently disappear during this stage.

In natural stands, this stage is typically dominated by one or two tree species. Pre-commercial thinnings, which normally precede this stage, may reduce competition and mortality by favoring the best growers. Commercial thinnings further reduce competition and increase average stand diameter. Shade tolerant understory trees and other plants may benefit from increased light and respond with vigorous growth..

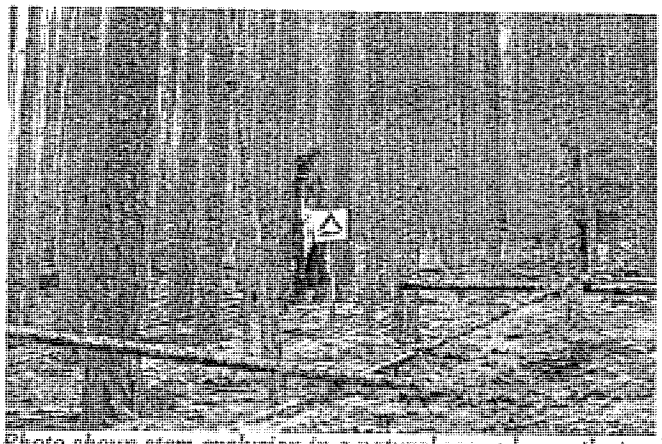


Photo shows stem exclusion in a natural second growth stand

Understory Reinitiation Stage - This stage is characterized by stands as young as 80 years to stands as old as 250 years, depending on site conditions. The vast majority of these stands have not been managed. In this stage, the dominant tree layer begins to break up due to mortality and a second, pole sized, canopy layer generally develops underneath. Although this may simply happen naturally, given enough time. In the, past underburning has created these stands in some areas, by killing sufficient overstory trees to stimulate regeneration underneath. This underburning was more prevalent in the past than has been generally recognized, partially because it was not of intense interest until recently and also because it is difficult to distinguish through querying of databases.

In this watershed, management-induced understory reinitiation has resulted from old salvage logging and more recently, commercial thinnings. These practices have resulted in release of tolerant understory trees that are developing a second canopy layer at a much earlier age than would have developed under natural conditions, especially with fire suppression and a lack of natural underburning.

Photo shows understory reinitiation in a 90 year old commercially thinned stand

Old Growth - These stands are the largest and oldest found in the watershed. They may range from over 200 to over 600 years old in this watershed. While a complete record of stand ages is not available, it is believed that over 90% of the stands, in this stage, date back to the 1600's.

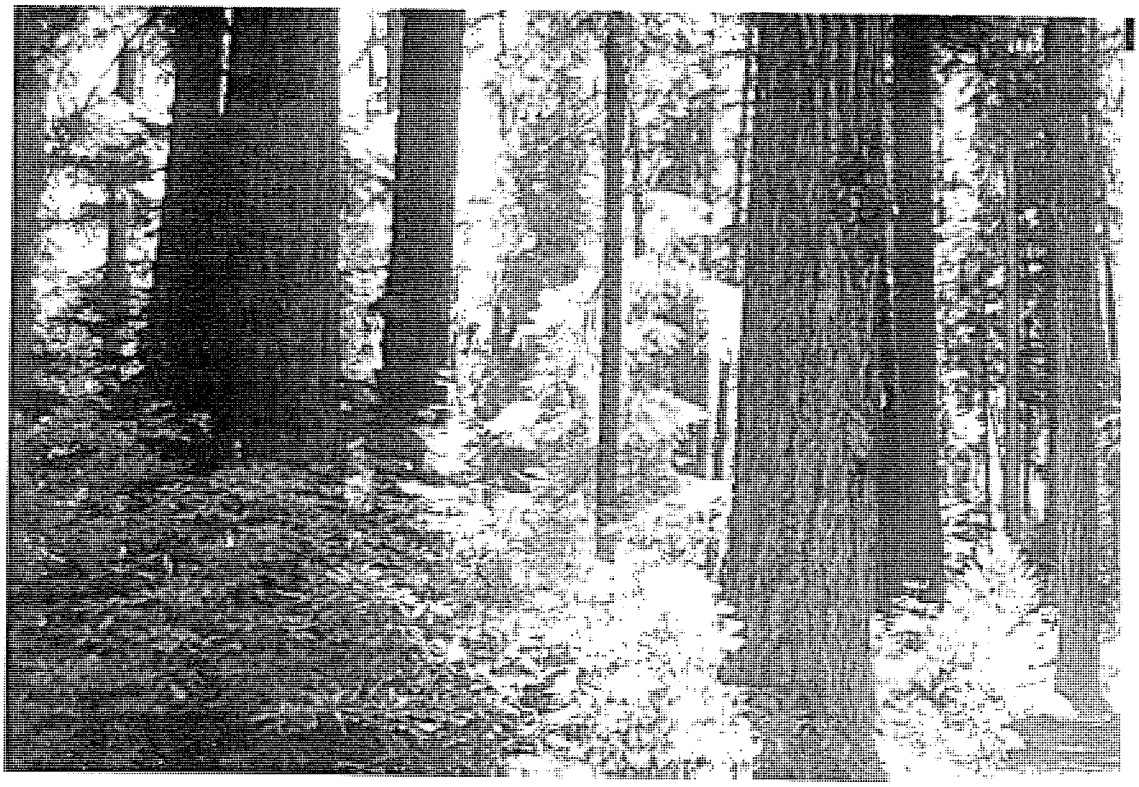


Photo shows old growth - A 375 year old stand in the western hemlock series.

Most of these stands still have a high component of Douglas-fir or other fire regenerated species in the upper canopy layers. Second and third canopy layers are usually well developed with shade tolerant species. Other vegetation, primarily shrubs, may reach high levels because of more open canopies. Diseases such as dwarf mistletoe in hemlocks or true firs, and heart rots and root rots contribute to mortality and bole defects. In the oldest stands, especially those in the upper elevations, mortality and rots may occur at high levels. Heavy competition from rhododendron, other shrubs or beargrass may reduce replacement of mortality, leaving stands more open.

The table below depicts the percentage of area occupied by each structural stage in the various plant association series **for the entire watershed.**

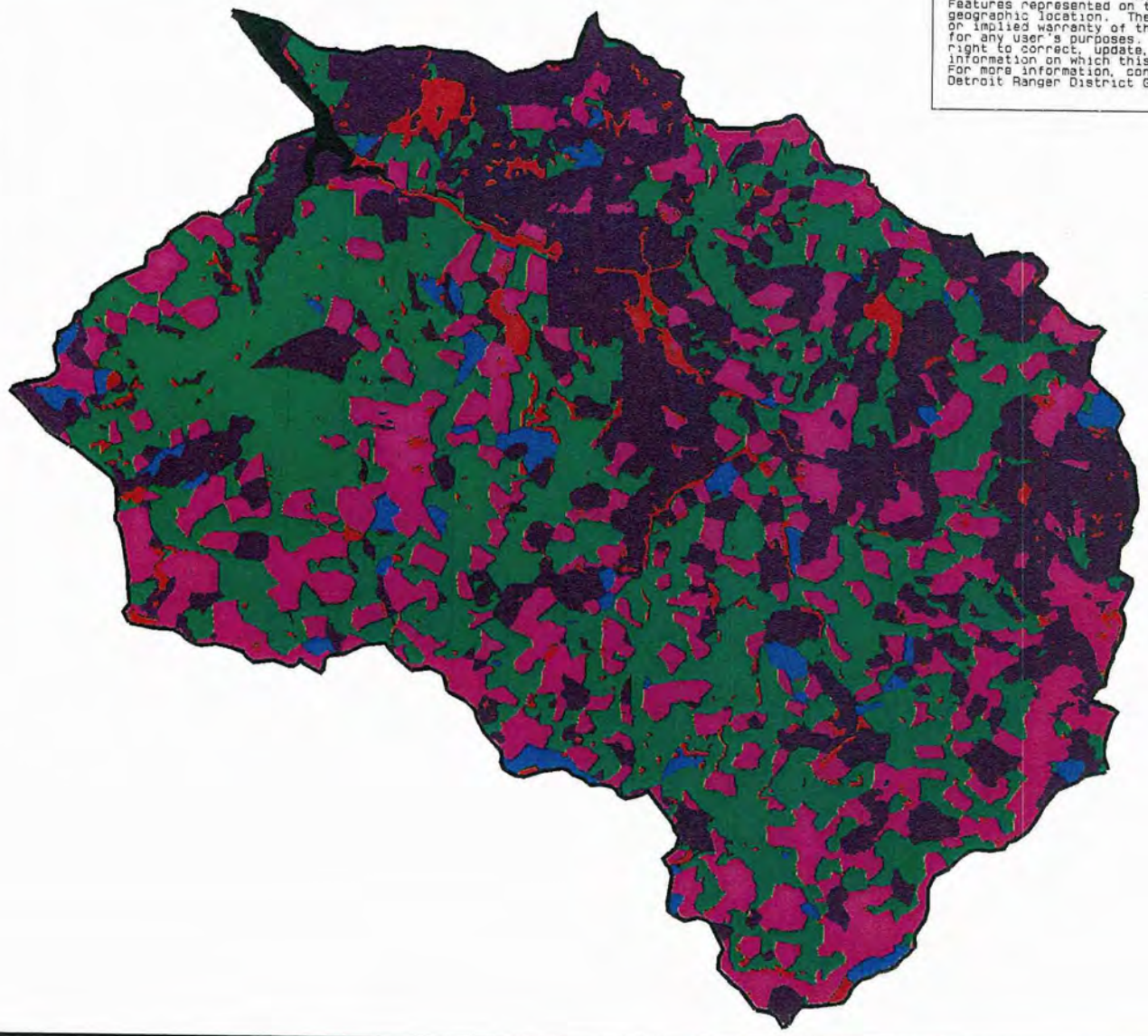
Current Structural Stages By Plant Association Series For Both Riparian And Non-Riparian Areas (entire watershed)		
Structural Stage	***Percent of Area Occupied by Plant Association Series***	
	Western Hemlock	***Pacific Silver Fir***
Stand Initiation	*11*	*17*
Stem Exclusion	*19*	*8*
Understory Re-initiation / Old Growth	*22*	*18*
Non-Forest	*2*	*1*
Totals	*54*	*44*

Map #12, that follows, depicts the spatial distribution of these structural stages across the landscape.

The following table depicts the percentage of area occupied by each structural stage in the various plant association series for **riparian reserves** only.

Current Structural Stages by Plant Associations *in Riparian Reserves* (on Federal Land only)		
Structural Stage	***Percent of Area Occupied by Plant Association Series***	
	Western Hemlock	***Pacific Silver Fir***
Stand Initiation	*11*	*15*
Stem Exclusion	*19*	*6*
Understory Re-initiation / Old Growth	*26*	*18*
Non Forest	*3*	*1*
Totals	***59***	***39***

Blowout WA
Structural Stages



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Legend

- Initiation
- Exclusion
- Reinitiation
- Old Growth
- Non Forest
- Detroit Lake

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Scale 1:100000
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Map # 12

The table below depicts the percentage of area occupied by each structural stage in the various plant association series **for the area outside of riparian reserves only**.

Current Structural Stages *Outside of Riparian Reserves* (on Federal Land only)		
Structural Stage	***Percent of Area Occupied by Plant Association Series***	
	Western Hemlock	***Pacific Silver Fir***
Stand Initiation	*11*	*18*
Stem Exclusion	*19*	*10*
Understory Re-initiation / Old Growth	*20*	*19*
Non Forest	*3*	*1*
Totals	***52***	***48***

From the charts above, it appears that structural stages in the riparian reserves are similar to non-riparian areas although there is slightly more understory re-initiation and slightly less stand initiation and stem exclusion in riparian areas than non-riparian areas.

The map (map #13) that follows shows the landscape distribution of stand structural stages within riparian reserves.

Structural stage differences between riparian and non-riparian sites may vary and are influenced both by management activities and by similar factors that influence plant association distribution. Major disturbances such as fire and logging have had a differing level of influence on structural stage development which varies greatly by stream class. Except for early railroad logging in the lower elevations, larger streams were excluded from regeneration harvests. Salvage logging was practiced in these streams but this would not usually be significant enough to alter stand structural stage. Intermittent streams were generally not buffered from logging until the 1970's and many not at all, but may have received some differential yarding techniques.

Past fires tended to burn in intermittent stream valleys as they did in upslope areas and may have burned with even greater intensity where heavy fuel accumulations were present. On larger streams, there was more of a tendency for fires to burn less intensely or to go out entirely. These fires were more likely to leave remnant trees or unburned islands of vegetation. Re-invasion of burned areas may have varied greatly or very little from upslope areas due to factors previously discussed.

Floods and debris torrents may have created significantly different vegetation in localized riparian areas, but overall these differences are probably not significant in the watershed.

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Structural Stages in Riparian Reserves

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Legend

- Initiation
- Exclusion
- Reinitiation
- Old Growth
- Non Forest
- Detroit Lake

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Map # 13

Diversity: Vegetative diversity can be characterized as moderate in the Blowout analysis area with respect to special habitats (SHABs). The number and types of special habitats reflect the unstable nature of Blowout slopes. Rock outcrops, cliffs, talus slopes, and slumps, and the special habitats derived from these land types, predominate in the drainage.

What Is Unique About The Vegetation In The Blowout Watershed?

The special (non-forested) habitats found in the Blowout watershed are mainly represented by rock type habitats including outcrops, vine maple/talus, and scree slopes (e.g., dry rock gardens). Plant diversity within these rock dominated SHAB types is generally low. In contrast, special habitats such as ponds, wet meadows, and moist meadows are relatively well represented in the Blowout watershed, especially in headwater areas, and plant diversity in these types is high.

There is only one known ***sensitive plant species*** within the Blowout watershed, Thompson's mistmaiden (*Romanzoffia thompsonii*). Other Willamette National Forest plant ***species of concern*** found in the Blowout include Virginia grape-fern (*Botrychium virginianum*), large-flowered brickellia (*Brickellia grandiflora*), cliff paintbrush (*Castilleja rupicola*), and the fringed pinesap (*Pleurocospora fimbriolata*).

A few ***survey and manage species*** from Table C-3 of the *Record of Decision (ROD) for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl* have been documented as occurring in the Blowout. These species are mostly associated with late-successional and old-growth forest and have been identified as needing information gathered on status, monitoring, protection, or all three.

The Blowout watershed provides habitat for several ***noxious weed species***. St. John's-wort and Scotch broom present the largest problem, followed by Canadian thistle, tansy ragwort, and bull thistle. Spotted knapweed and diffuse knapweed are currently at very low densities in this watershed.

2. *What Values Are Associated With Vegetation?*

a. Vegetation has economic, life-sustaining, aesthetic recreational and spiritual value (trees and other vegetation provide commodities, many plants provide food/shelter to humans, fish and animals, old growth provides aesthetic and spiritual value, and huckleberries and cedar trees are important to Native American cultures for tribal ceremonies and basket making).

b. Natural species richness and diversity has ecological value. Plants are the oxygen providers and the base of the food chain that allows all other forms of life to exist. A variety of plant species supports a variety of other life forms. Plant/animal interactions can range from a simple indirect association as in the case of carnivores, to very complex interdependencies where neither the plant species nor

the animal species can exist without each other (co-evolution). Animals can use vegetation for food, shelter, camouflage, poisons, and tools.

Without this diversity living systems are simpler, and are more prone to reduction or extinction during stochastic events such as environmental disturbance or disease outbreaks.

3. What Are The Highest Priority Issues Or Resource Concerns Associated With Vegetation?

a. For a variety of reasons, **old growth** is a highly valued component of the ecosystem, so many people do not want to see any more of it harvested. Therefore, management activities that involve harvest of old growth timber, and for that matter, timber harvest of any kind have become very controversial.

b. Fire suppression has been a management goal for many decades, now the issue is whether fire suppression has significantly altered **plant community and structural stage distribution and timber stand conditions** within the watershed.

c. **Land allocations and management goals** are often based on compromise rather than science, so they are not always compatible with historic ecosystem conditions or **dynamic natural systems**. Management goals for land allocations such as late successional reserves, riparian reserves, scenic areas, etc. require that vegetation be managed in ways that may be in conflict with historic ecosystem conditions within the watershed.

d. Recent wind storms, heavy wet snows and floods have resulted in **localized areas of downed timber** in the watershed. This may result in increased bark beetle populations that eventually kill adjacent live trees. Furthermore, accumulations of downed and dead trees increase risk of stand replacing wildfire.

e. **Noxious weeds**, such as scotch broom, and invasive non-native plants are a threat to native plant diversity in the watershed. These species are able to thrive in a new environment because they arrive without the complement of predators, disease, and other ecosystem components found in their native region of the world. Most of these species take advantage of disturbance gaps such as logged units, roads, rock quarries, burned areas, the areas surrounding human structures, and trails. Once established, these populations can serve as a seed source for further dispersal, generally along road and trail corridors.

f. There is a concern about maintaining natural **biodiversity** within the watershed. The occurrence of special habitats (non-forested communities) and their distribution across the landscape is important for biodiversity of plant and animal species. Diversity within this watershed is low, so this increases the importance of these special habitats.

Preserving biodiversity has ecological value, as noted above, but it also has secondary societal value as well. Only a small percentage of plant species have been screened for compounds that may have medicinal, nutritional, or other commercial applications. Plants can be indicators of environmental quality, as in the case of certain lichens that are sensitive to air pollutants. In order to preserve the potential uses of plants, we must protect biodiversity at all three levels: genetic, within plant community, and between plant communities.

Forest Service strategies for preserving and promoting biodiversity at all three levels includes reforestation and revegetation programs that emphasize genetic diversity in plant materials used, protection of within plant community diversity by precluding disturbance of species rich habitats, and maintaining representation of all plant community types across the landscape. The challenge is to find the most effective way to identify the species and areas on which to apply these strategies within the overall framework of forest management.

4. *What Are The Management Direction/Activities, Human Uses, Or Natural Processes That Affect Vegetation?*

a. ***Current Condition***: *What were the disturbance factors that led to the current vegetative conditions in the watershed described in the characterization?*

Fire: Fire has played a very important ecological role in Pacific Northwest Forests. The western Cascades have a high severity fire regime that is characterized by large stand replacement fires which have established a complex, interlocking mosaic of timber stands. The age and shape of these stands have historically been determined by infrequent and severe crown and surface fires that often resulted in total mortality. These large fires have often occurred in drought years, ignited by lightning and driven by east winds.

Accurate fire return intervals have never been calculated in these forests since intervals between fires have been long and may not be cyclic (Agee and Flewelling 1983). Although, it has been determined that higher elevation sites generally have a longer interval between stand replacement fires.

Large fires in *Douglas-fir/western hemlock* plant communities usually result in almost complete tree mortality with the large Douglas-fir being most resistant to fire and becoming the most common remnant species. After a fire, western hemlock seedlings may outnumber Douglas-fir, however, Douglas-fir is usually more robust. Douglas-fir is less shade tolerant so it's early post-fire establishment is critical if it is to later be the dominant species. The understory vegetation is usually similar to a pre-burn old growth forest containing huckleberries, vine maple, sword fern, rhododendron, salal and Oregon grape.

Twenty years after a fire much of the new character of the forest has been defined. Re-sprouting and invading vegetation may inhibit tree regeneration beyond what was already established during the first few years. Plant and animal diversity is very high as the successional forest continues to develop. The canopy closes and natural thinning processes accelerate due to the lack of light. This reduces the shrub and herb populations, thus lowers plant and animal diversity.

The shaded understory which results from the canopy closure favors the regeneration of western hemlock over Douglas-fir. Douglas-fir mortality begins to occur at about 250 years. Douglas-fir mortality continues to increase until the western hemlock would completely dominate the stands. However, a fire usually occurs in the heavy accumulations of fuel before Douglas-fir disappears completely from the stand.

Pacific silver fir/Douglas-fir plant communities occur at higher elevations where temperatures are cooler, growing seasons are shorter, and snow pack is more persistent than western hemlock/Douglas-fir plant communities. Pacific silver fir is the successional species instead of western hemlock. The characteristics of these stands are similar to western hemlock plant associations with the shade tolerant species dominating over time.

Historically fires in the lower fire zones have sometimes extinguished naturally upon entering these higher elevation stands. Throughout many of these stands, Douglas-fir shares early succession dominance with noble fir and western white pine. The ages of these trees has often been used as indicators of past fire disturbance.

Fire is the predominant natural disturbance process in the Blowout Analysis Area. Prior to 1850 and European settlement, fires were a result of lightning with a combination of other environmental factors, and may have been used by Native Americans to manage the land. Most of the current old growth stands in the drainage originated in the early 1600's. It is reasonable to conclude from current information that at least 80 percent of the Blowout Analysis Area burned during this period, and that most of these were stand replacement fires. Stands originating after these fires would not have been considered late-successional until the early 1800's.

Periodic underburning probably occurred in the drainage but insufficient stand information is available to understand the extent or frequency of these types of fires. Underburning tends to create stands dominated by an upper canopy of large fire resistant Douglas-fir, and without significant lower canopy levels for the first few hundred years. Stands in this condition do not currently exist in the drainage due to fire suppression efforts.

Fires since 1850 have occurred on about 6000 acres in the drainage. Almost all of these fires appear to have occurred between 1890 and 1900, primarily in the Hawkins Creek drainage (*see fire history map # 14*). As seen in other watersheds, this period accounts for a large proportion of fires within the past hundred years on the Detroit District. It is assumed that dry conditions and natural factors have contributed to these fires.

The effects of fire history in the area are significant. Large stand replacement fires have occurred in the past as represented in Box Canyon with the upper canyon containing stands that originated before 1800 or between 1850 and 1899. According to the 1901 land classification mapping of the Cascade Forest Reserve with verification based on current information, approximately 140,000 acres out of 318,000 acres, or 44 percent, of the Detroit District was mapped as burned or had less than 2000 board feet of timber per acre. Eighteen percent of Blowout was considered recently burned in 1901.

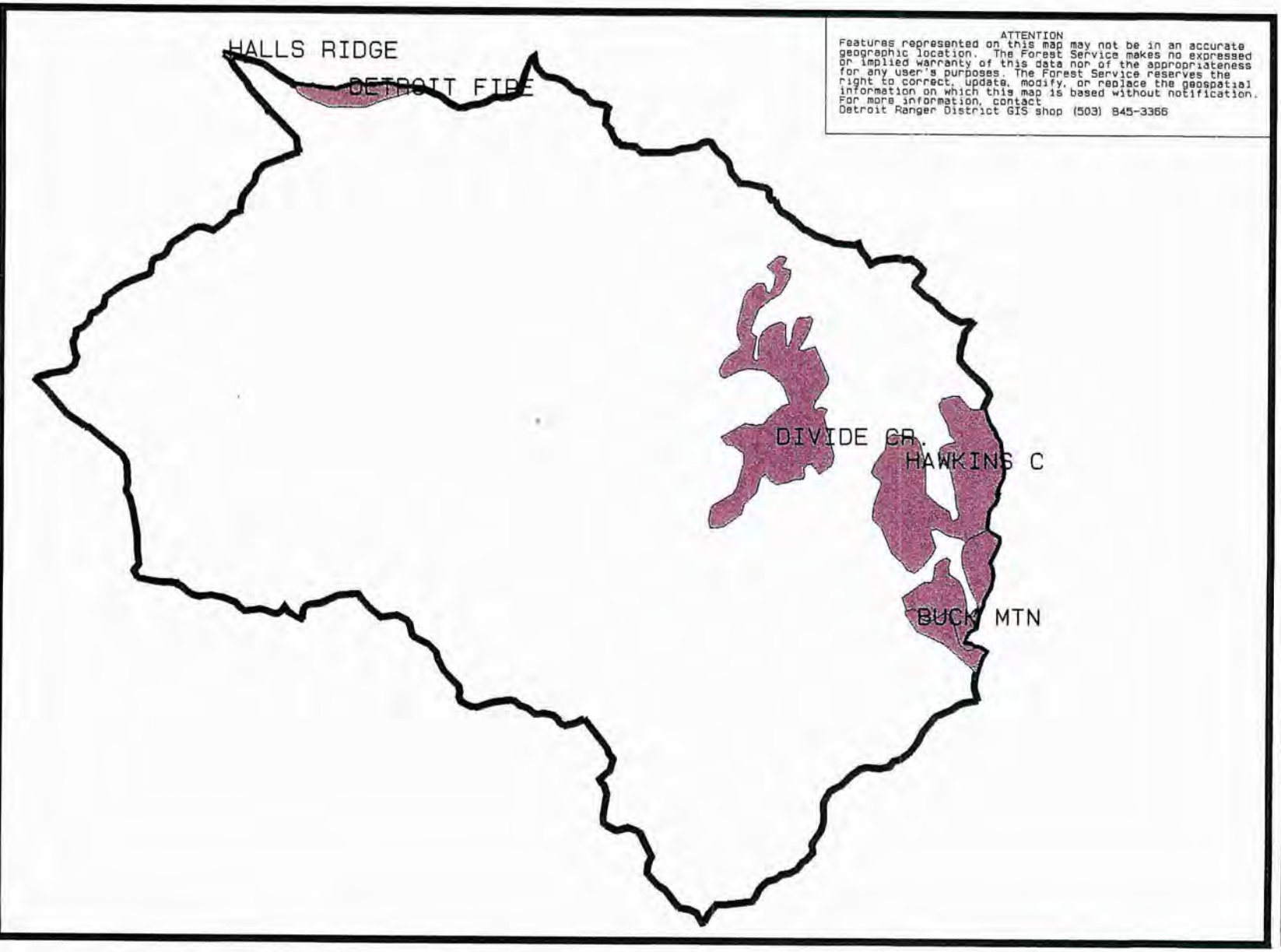
Since the early 1900's through 1966, there are no records of any significant fires in the Blowout drainage. This is probably a result of active fire suppression. The large stand replacement fires that have occurred during this century have been minimal. Fires occurrences in Blowout since 1960 include:

Fire Name	Year Burned	Acres Burned	Cause
Buck Mountain (Blowout portion)	1967	200	Lightning
Lucky Butte	1971	232	Escaped Slash Burn
Box	1979	120	Escaped Slash Burn

Lightning often ignites fires at the higher elevations. When conditions do not promote wide-spread surface fires, patch fires result commonly burning over 10 acres. A variety of small variable aged stands have originated due to these fires.

Special Habitats: The effect of fire on special habitats, non-forested plant communities, is by nature both temporally and spatially variable. Aside from the fact that special habitats in the western Cascades exist in an ecosystem where fire plays a dominant role, some habitat types and some plant species are differentially affected by fire. Dry and mesic meadows can experience tree encroachment without the presence of fire. Fire adapted species will generally drop out of the above ground composition of plant communities without fire but continue to be represented in the soil as seeds or vegetative propagules waiting for the next fire event. The competitive advantage of some species will dwindle if fire is precluded, and the structure, function and composition of plant communities will change through time. Fire can effect insect and disease cycles. Catastrophic fire has the potential to change hydrological patterns within a drainage, and thus change the species composition of those areas affected, at least temporarily.

Blowout WA
Fire History



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Legend

Fire

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Map # 14

The effect fire has on specific species depends on the degree of fire adaptation displayed by that species, and the predisposition of its habitat to fire. Other adaptations may also come into play. A wet meadow species of concern may be protected from small fire events surrounding the meadow until a catastrophic fire razes everything around it. The population's chance of surviving the event may depend on its ability to cope with the increased water levels and siltation that will be deposited in the meadow following surface runoff during the rainy season. *Noxious weed species* will also be differentially adapted to fire. Their habitat, generally continuously disturbed openings adjacent to roads or developments, is less likely to be exposed to fire due to the adjacent fire breaks and easy access for fire suppression crews.

Present forestry practices have probably had a dampening effect on the fire regime in the Blowout Analysis Area. The large number of roads and managed stands in this area have increased accessibility for fire suppression efforts, and have provided fire breaks throughout much of the area. The size of smaller patch fires has been kept artificially low, and the opportunity for these fires to become large stand-replacing fires under certain environmental conditions (high temperatures, east winds, etc.) has been greatly reduced. Conversely, management has increased the frequency of patch fires in specific areas due to escaped slash burns and increased access to the public which has resulted in human ignited fires. Furthermore, potential intensity of fires has increased due to accumulating fuel loads in areas of fire suppression, and drier and windier conditions expected along created stand edges. The overall effect is a decrease in the probability of large and low intensity fires, an increase in the probability of high intensity fires, and a divergence from the natural fire pattern which existed in this area prior to management. This decrease in the types of fire that occur leads to a decrease in the types of vegetation that respond differentially to fire. The resulting condition probably reflects an alteration in the distribution, composition and extent of plant communities that had adapted to the pre-management fire regime.

It is clear that fire, predominantly stand replacement fire, has been the major disturbance factor creating current natural stands. With the inception of forest fire protection measures, fire has become a decreasingly important disturbance factor in the watershed. Where natural underburning was prevalent, lack of fire generally has resulted in increasing stocking levels of understory trees and fuel loading.

Timber Management: Management activities affecting the landscape started with railroad logging in the early 1900's. Railroads were constructed up the main-stem of Blowout Creek to the confluence of K Creek. By the 1930's the lower watershed was logged from stream to ridgetop. This occurred on both private and public lands. Early lookout photos (1930) show some of the cutting activity. By the 1950's all of the private land was cut and public land cutting had extending up the drainage networks. These were areas of easy road construction.

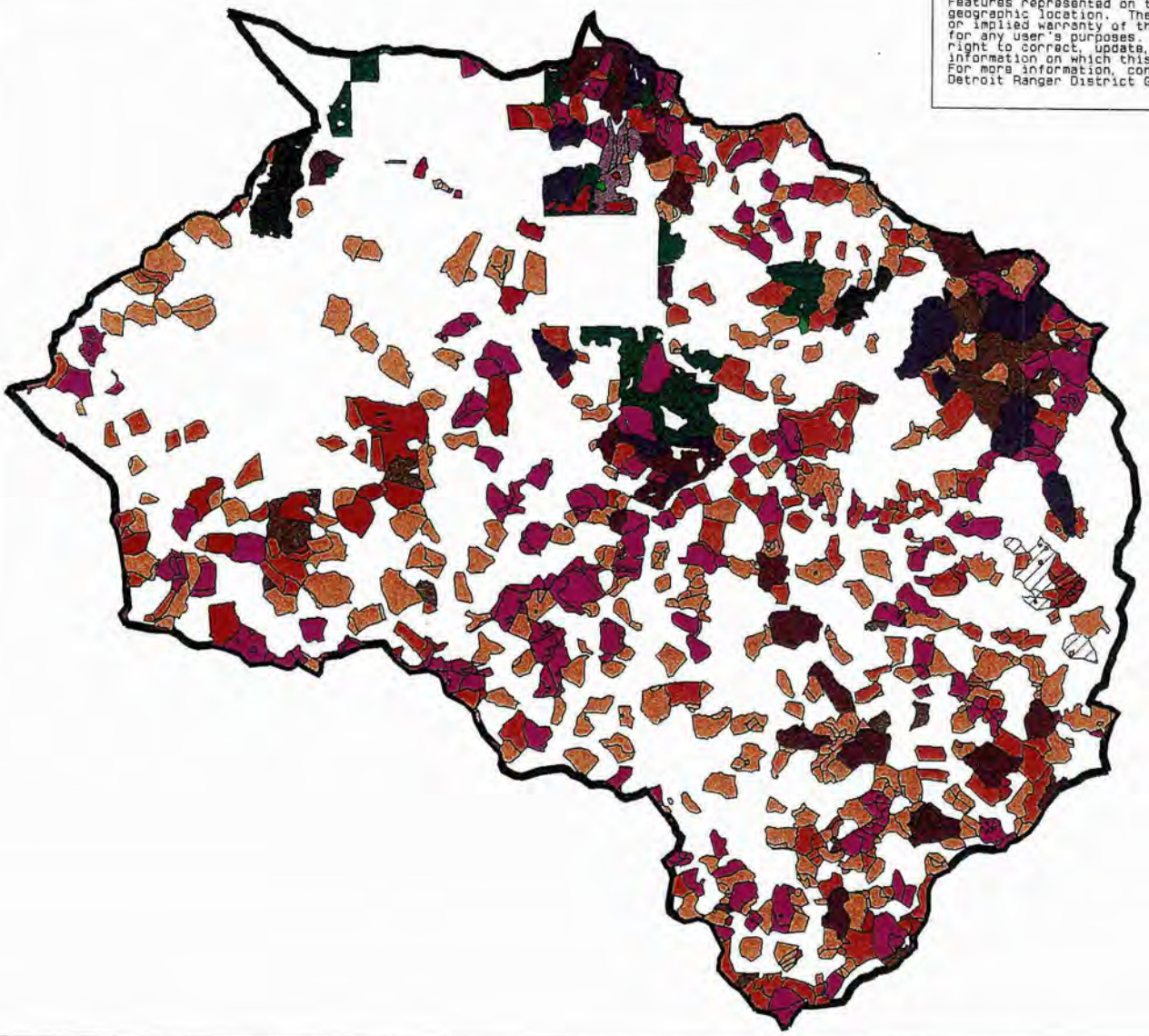
During the 50's and 60's the area was aggressively roaded. The main transportation system was completed by 1975. This includes the main collectors and arterials and locals. The area provided a large portion of the District target during 1940 to 1980. If volume was needed, the Blowout was looked to (*see Harvest by Decade map #15*).

Decade Harvest in the Blowout since 1900	
Years	**Acres Harvested**
1900-1909	669
1910-1919	12
1920-1929	4
1930-1939	125
1940-1949	768
1950-1959	1153
1960-1969	3051
1970-1979	4366
1980-1989	2442
1990-1994	782
Total	13,372

***Vegetation*:** The Blowout is one of the most intensely managed areas on the Detroit Ranger District. Even-aged management, primarily clearcutting, has been the most common harvest method to date. Broadcast burning was prescribed for most harvest units for fuel reduction and site preparation for planting. Plantations date back to the late 1940's. Low elevations and easy access are the chief reasons for the early activities. Fertilization and pre-commercial thinning have been practiced throughout the drainage.

Reforestation: Tree planting has been the primary reforestation method since the 1940's with natural seeding as either a planned or unplanned supplement to stocking. From the 1940's through the mid-1970's, Douglas-fir was almost exclusively planted on the lower to mid-elevation sites. Noble fir and Douglas-fir were commonly planted above 3000 feet elevation. From the late 1970's to the present, additional tree species were added including, Western white pine, Western redcedar, Western hemlock, Pacific silver fir, grand fir, lodgepole pine, sugar pine, Engelmann spruce, and mountain hemlock. A minimum of two species, usually three or four species, are currently planted in each harvest unit.

Blowout WA
Harvest By Decade



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Legend

- Com Thin 1980-1989
- Com Thin 1990 - 1998
- Overstory Removal 1900 - 1909
- 1910 -1919
- 1920 - 1929
- 1930 - 1939
- 1940 - 1949
- 1950 - 1959
- 1960 - 1969
- 1970 - 1979
- 1980 - 1989
- 1990 - 1998
- Partial Cuts 1970 - 1979
- 1980 - 1989

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Map # 15

Natural regeneration in planted harvest units has been a significant factor in adding to the tree species diversity in most units. At lower elevations, Douglas-fir, Western redcedar and Western hemlock are commonly significant stand components due to fill-in seeding. At higher elevations, silver fir and Western hemlock tend to be the most common species. This seeding may occur soon after site preparation and may be added to after pre-commercial thinning opens up the stand.

As an example of how natural seeding has supplemented planted stock, the following was observed from data collected in 1990 from a stand in Divide Creek. The stand was planted in 1962 with pure Douglas-fir and pre-commercially thinned in 1980 to 300 trees per acre. By 1990 there were 1130 trees per acre, and five additional species present. Although Douglas-fir is generally the dominant tree, other species are major components of the upper canopy level of the stand.

The first known reforestation effort appears to be planting in the late 1930's and early 1940's of the railroad logged areas previously mentioned.

Following World War II timber harvest became more consistent and as a result, reforestation became a more sustained program. Both planting, and natural and artificial seeding were options used from the 1940's into the 60's. For example:

> ***Seeding:*** An extensive aerial seeding project was undertaken following the Sardine Fire, in the Detroit Tribs Watersheds to the north, in 1951.
>
> ***Planting:*** Douglas-fir was the preferred species at lower elevations but was not always successful at higher elevations, especially in frost prone areas. Noble fir was a preferred planting species above 3000 feet elevation. Engelmann spruce and ponderosa pine were used on some severe frost pockets where Douglas-fir planting was not successful.

In the 1970's planting became the sole reforestation method due to its reliability and requirements in the National Forest Management Act to assure reforestation within five years after harvest. The shelterwood regeneration method was also used on sites with high frost potential and on warm droughty sites. All seed collected during the 1980's was harvested from trees selected for superior growth. The 1980's saw the addition of most of the indigenous conifer species to the list of species planted. The most notable species was the addition of rust-resistant Western white pine which had been significantly reduced in the watershed due to blister rust. Western redcedar, western hemlock, grand fir, Pacific silver fir, sugar pine, mountain hemlock and lodgepole pine were also planted depending on local site conditions. The use of shade cards was introduced in the 1980's for seedling protection on warm droughty sites. The forest cultivator/subsoiler began operating during this period to help break up old compaction from prior tractor logging and to help reduce vegetative competition. Also The 1990's have added

increased hardwood planting on some local areas, especially in root rot pockets. Increased use of containerized versus bareroot seedlings has resulted in significantly increased survival for certain tree species.

Site Preparation and Fuel Treatment: Throughout the period that timber management has taken place in the watershed, site preparation for planting and fuel treatment have been closely linked. Prior to the 1960's, the record of what fuel treatment was used is not particularly clear but it is generally recognized that the use of broadcast burning was much less than in recent decades and this coincided with less tree planting and therefore less need to prepare sites. Snags were felled for fire hazard reductions from the earliest harvest dates. Utilization standards for timber were relatively low during this period, so a great deal of large material was left following logging and if unburned additional material was left. On gentler slopes, tractor piling was also used with variable effects on soil productivity.

As tree planting became more or less standard practice, along with concern for minimizing fire hazard, broadcast burning became more prominent. During the 1960's most of this burning was done in the fall and was frequently associated with dry conditions, so burning often resulted in hot burns and excessive duff consumption. The 1970's saw the introduction of yarding of unmerchantable (YUM) material off of units. For a few years YUM yarding was used as a substitute for burning. This was a poor substitute for burning because it did not treat the small diameter slash, was less than adequate as site preparation, and didn't set back vegetative competition. Later YUM yarding was combined with broadcast burning to removed fuel to help reduce broadcast burn intensities. This combined with increasing timber utilization further reduced the amount of wood left on site. The broadcast burning season was extended to include late spring and fall and night burning was instituted to take advantage of higher fuel moisture conditions to reduce burning impacts.

In the early 1980's tractor piling of slash was ended due to unacceptable impacts on soil productivity. Broadcast burning was the preferred treatment on most sites. From the late 1980's to the present brought the need to leave green trees, snags and logs on harvest units. This coupled with increasing restrictions aimed at meeting air quality standards, created conditions which necessitated a reduction in the number of acres burned. Grapple piling was also used increasingly on gentler slopes since it provided more flexibility in the timing of burning while minimizing soil damage.

Timber Stand Improvement: Timber stand improvement began in the early 1950's, with pruning and precommercial thinning. Both activities remained at fairly low levels through the 1950's and 1960's and pruning was discontinued by the mid-1960's. Precommercial thinning accelerated during the 1970's and has continued at high levels into the 1990's at a rate of about 500 acres per year for the entire District (precise figures for the watershed alone were not analyzed).

Fertilization began in the late 1970's and has averaged about 500 acres per year to the present. Some stands have had multiple treatments. Pruning was reintroduced in 1989 and has averaged 300 to 400 acres per year on the District. Brush release has been a very minor treatment on the District, with snowbrush, Ceanothus velutinus, pulling being the most common method.

Early pre-commercial thinning tended to leave stocking levels higher than are currently regarded as optimum for acceptable growth. Starting in the early 1970's, fewer trees, generally about 300 per acre were left and this level has continued until the present. Prior to the 1980's Douglas-fir was generally the preferred crop tree at lower elevations while noble fir was favored at higher elevations. Other species were left during pre-commercial thinning if they were among the largest and most healthy trees in the stand. In most cases the other species had not been planted and as a result were smaller and therefore not left as crop trees. Beginning in the 1980's provisions were taken to leave representatives of all species present in the stand when thinning. In some cases this also resulted in additional trees being left after thinning. With the planting of a much wider selection of species, minor species also were in a better position to compete for growing space.

Insects and Diseases

Root diseases: Site specific information on the prevalence of insect infestation and pathogen disease centers is difficult to obtain. A discussion of the dynamics of these vectors, however, can shed light on the effect management has on their spread. In this discussion, the use of the word "pathogen" will focus on the effects of root diseases. It has been estimated that at least 18% of annual conifer mortality volume in the western United States is due to or associated with root disease (Hadfield et al 1986). The three most important fungi responsible for this mortality in the western Oregon Cascades are *Phellinus weirii* (laminated root rot), *Fomes annosus* (annosus root disease), and *Ceratocystis wagneri* (black stain root disease). Of these, *Phellinus* is by far the most prevalent in the Blowout Analysis Area and elsewhere, but the importance of *annosus* and black stain root diseases cannot be underestimated because they do increase in direct response to human activity (Hadfield et al 1986). Host species most susceptible to *Phellinus* damage are Douglas-fir, grand fir, white fir, and mountain hemlock. Since *Phellinus* can survive up to 50 years in stumps and roots and spreads via root contact, an argument could be made that spread is facilitated by crop rotation due to the increase in root contacts and the increased vulnerability of young trees 15-20 years old, as well as, older Douglas-fir plantations. Presumably then, rates of spread of *Phellinus*, and possibly *Fomes* and *Ceratocystis*, have increased from the period prior to intensive management in the Blowout.

Phellinus weirii is common throughout the Blowout. It is easiest to detect in plantations of small sawtimber size. Most infection centers found are 1/4 acre or less in size. Some stands have many small centers that are coalescing into larger infections. A couple of young plantations show mortality that is still standing because the trees are too small to be windthrown.

Commonly, insects and pathogens work in tandem to cause tree mortality. Environmental stress resulting from either physical factors or disease can leave trees vulnerable to insect infestation. Populations of insects can increase in root disease centers, leaving nearby healthy trees vulnerable (Hadfield et al 1986). Stress and mortality caused by physical factors such as drought and windthrow have been accentuated by increased edge effects resulting from previous management practices. Fire suppression allows disease infestation to persist and grow.

White pine blister rust is an introduced fungus that affects five-needled pines such as western white pine and sugar pine, found in this watershed. Blister rust has caused significant mortality plus top kill in all ages of both pines, and has greatly reduced their occurrence in the drainage. Replanting with rust-resistant white pine began in 1983 and has continued with white pine typically comprising from 10 to 30 per cent of most plantations. Resistant sugar pine is not yet available for planting. Some planting with non-resistant sugar pine has occurred in order to bolster the number of trees until resistant stock is available. Some natural resistance is expected.

Dwarf mistletoe is the other major disease found in the Blowout. The majority of mature western hemlock are infected. Pacific silver fir and to a lesser extent Noble fir are infected also. Dwarf mistletoe is more prevalent in mature stands with multiple canopy layers which facilitate spread from the overstory to the understory. Even-aged management has reduced the distribution of dwarf mistletoe, fire suppression promotes conditions for increased spread. Retention of infected green trees in harvest units promotes infection of same species regeneration.

Douglas-fir beetle mortality was seen in several locations, however, it is not considered significant. Beetle activity increased following a windstorm in 1990. *Mountain Beaver* are present but appear to be at low population levels, very little damage has been observed.

Localized populations of *pocket gophers* are found in the drainage but are generally not causing significant damage to plantations.

Special Habitats: The effect of disease (including herbivory) on special habitats takes two forms: if the surrounding forest stand is dying from disease, the loss of cover may expose the habitat to environmental extremes and result in a change in species composition and distribution. Disease can also target certain species

within the special habitat, which might also alter the species composition, or at least relative densities. Forest mortality due to disease can create gaps, and local species composition will change if disease resistant species recruit in. Species of concern will have to be monitored for disease. The battle against noxious weeds often uses disease (herbivorous insects-biocontrol) to control populations.

Other Disturbances

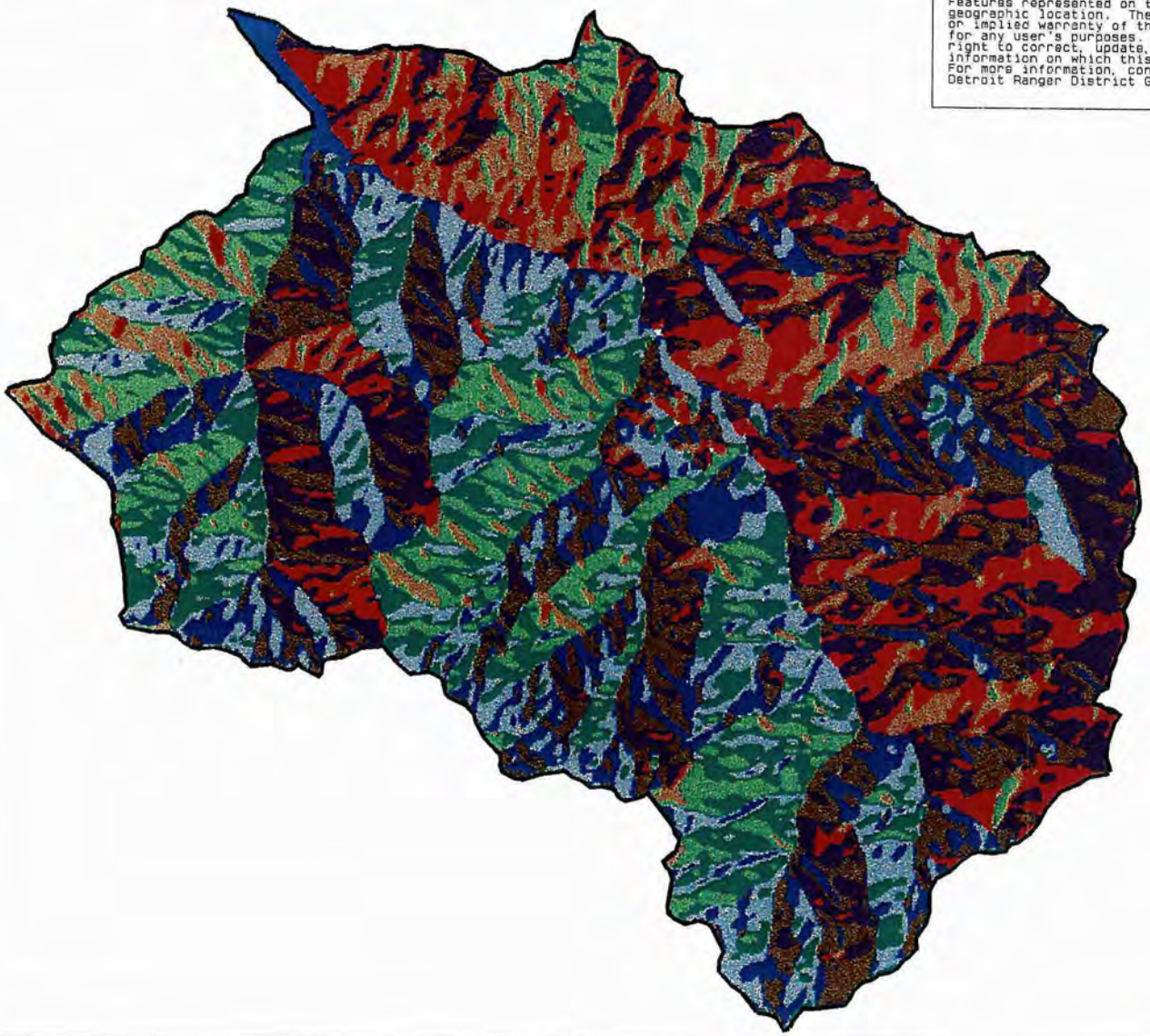
Wind and Snow: Blowdown of trees from windstorms has periodically affected portions of the watershed, especially those that are in wind exposed areas such as south and west aspects (see aspect map #16), and ridgetops. Areas of saturated soils and treelines along existing openings may also be vulnerable. In 1990 a significant portion of the watershed experienced blowdown although an exact estimate is not possible. Several salvage sales were sold as a result of this storm but additional areas were not salvaged due to resource and administrative constraints.

During the winters of 1996 and 1997 significant snow breakage occurred throughout the drainage as a result of wet, heavy snows. The extent of damage varies from light and scattered to locally heavy. The most significant damage is generally in dense pole to small sawlog sized stands and is characterized by broken tops as well as entire trees pushed to the ground. Riparian areas have experienced a disproportionate percentage of the damage.

Flood: Special habitats most likely to be effected by flood are those wetland types and riparian areas associated with floodplains. Floods have the potential to drastically alter habitat elements by removing and depositing structural, substrate, and plant propagule materials. Flood can change the course of a stream, which may disconnect a wetland from its water source. Likewise, it can introduce water to new areas, creating swamps, bogs, and marshes under certain conditions. The loss of habitat of a species of concern presents a special problem, however, since there is a lesser chance that even if the habitat is created elsewhere that a rare plant would be able to recruit in. For noxious weeds, the newly disturbed floodplain substrate resulting from flood can provide expansion room if a propagule source is nearby.

Assuming the Aggregate Recovery Percentage in the Blowout Analysis Area was higher before management than it is presently, it is fair to say that the area was less flood prone. In vegetation terms, this translates into the likelihood that more swamps, marshes, bogs, and stable riparian plant communities existed prior to large scale management in this area. It also means that we are now seeing more red alder dominated vegetation and other hydric disturbance associations than occurred in the past. The effect of flooding in the Blowout drainage is evidenced by the condition resulting from the 1964 flood. The floodplain and banks of Blowout Creek show little structure (also due to stream "clean-up") and are largely dominated by red alder stands. The effect of management has been to

Blowout WA
Aspects



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Legend

- North
- Northeast
- East
- Southeast
- South
- Southwest
- West
- Northwest
- Detroit Lake

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Scale 1:100000
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Map # 16

accentuate and bias natural processes, which has resulted in a disproportionate increase and concentration of disturbance vegetation at the expense of stable vegetation.

Earthflows: Unstable soils and slow, large scale land movements can create special habitat such as talus and cliff plant communities, alder chutes, rock gardens, and may be involved in aspects of meadow creation. They also have the potential to disrupt these communities, as well as forested plant habitats that occur on these substrates. The situation for plants of concern and noxious weeds is similar to that described in the flood section above.

The Blowout Analysis Area has historically had a lot of unstable soils and features (Blowout and Coopers Cliffs, many talus features and failed slopes), hence the high proportion of vine maple/talus plant communities, alder chutes, and early successional patches in the watershed. In addition to the cliff and talus, avalanche, and disturbance vegetation, land flows can result in an undulating topography with localized wet depressions and hummocky mounds that provide varied habitat for plant and animal species (such as at the base of Blowout and Coopers Cliffs, and elsewhere).

Much in the way that past management has accentuated the effect of flooding, it has also accentuated the effect of erosion and subsequently, land flow. The effect on vegetation is also similar. Disturbance vegetation thrives on recent slope failures. This is not necessarily a detrimental occurrence, since hardwoods may come in and provide varied habitat where only coniferous forest grew before, but again it is a question of degree. Pervasive slope failure or snow avalanches resulting from logging practices can dramatically increase the chances of altering features or vegetation types that we do want to retain, especially those same riparian types discussed in the flood section.

What Is The Current Condition Of Late Successional Habitat?

The oldest stands of trees, for which there is documented information in this watershed, are approximately 400 to 600 years old. There may be older stands than this, but they have not been intensively inventoried. The vast majority of the older stands, found in the watershed, date from the early 1600's when fires burned over most of the watershed. This is consistent with stand ages found throughout the rest of the Ranger District.

The harvest of late successional timber has slowed, in recent years as concerns over the dependence of various species have led to changes in land management allocations.

The Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Related Species requires that provisions be made for retention of old-growth fragments in watersheds where little remains. The standard and

guideline is applied to fifth field watersheds (20 to 200 square miles) in which federal forest lands are currently comprised of 15 percent or less late-successional forest. Within such areas, all remaining late-successional stands are to be protected. Blowout study area contains portions of four fifth field watersheds. The following chart shows the percentage of late successional stands remaining in each fifth field watershed and in each smaller sixth field watershed.

Late Successional Stands By Fifth-Field Watershed				
Fifth Field Watershed	Federally owned Forested Acres in Watershed	Percent Late Successional Stands	Percent Late Successional in Matrix Allocations	Percent Late Successional in non-Matrix allocations
Entire 5th Field Watershed	83,039	34	32	68
Portion of 5th Field Watershed that is within Blowout Analysis Area	34,155	39	39	61

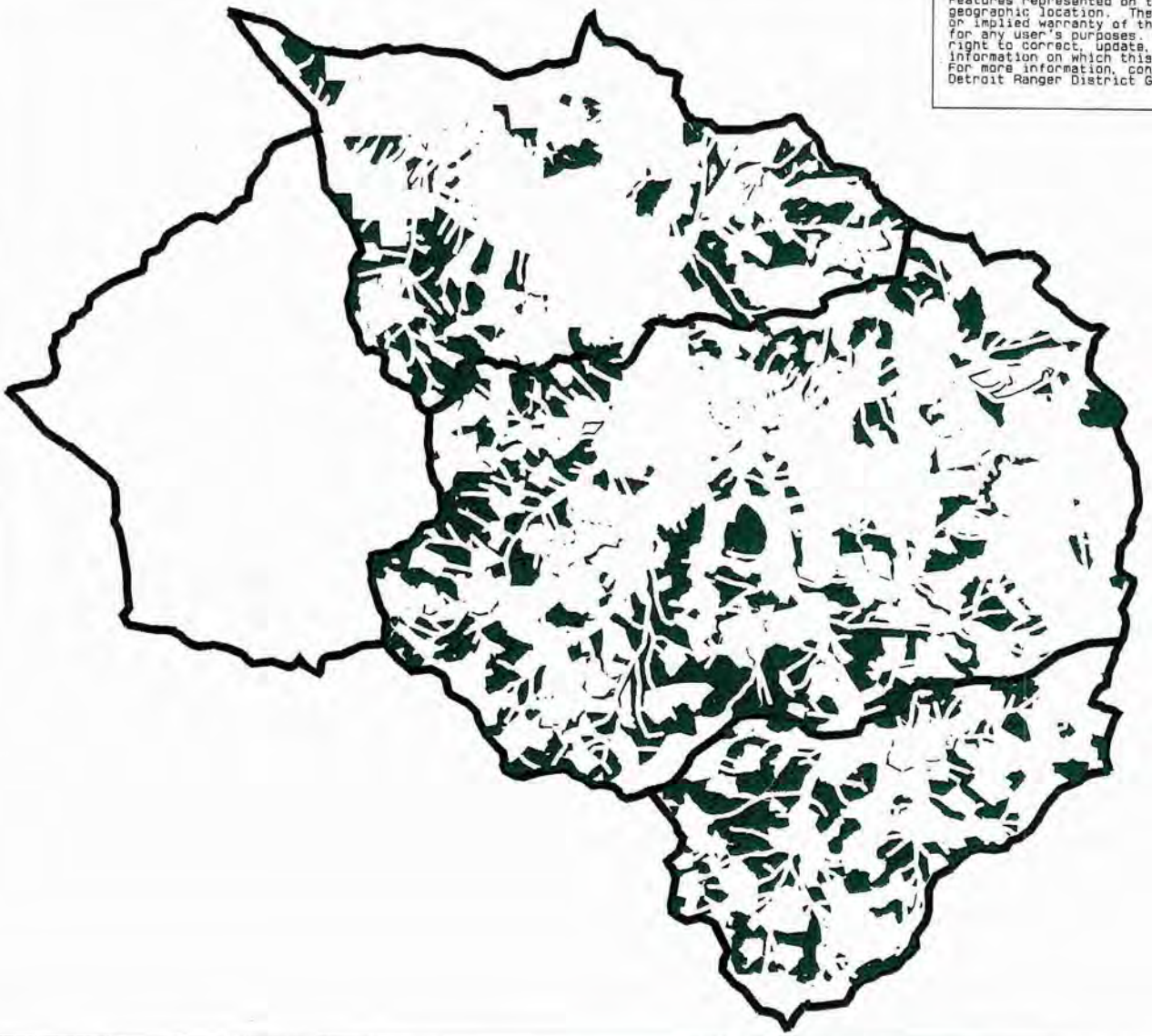
The following map #17 shows late successional stands within matrix allocations.

What is the status of non-native plant species in the watershed? Where are non-native plant populations located? What factors have contributed to their spread?

Most noxious weed and invasive non-native species migrate up from the Willamette Valley through the Canyon via Highway 22. Invasive non-native species that seem to be expanding include the Himalayan blackberry *Rubus discolor* and the white sweet-clover *Melilotus alba* - the latter is found in abundance on the Sweet Home Ranger District.

The table below lists some of the invasive non-native plants found in the Blowout analysis area. The occurrence column indicates which species are most predominant.

Blowout WA
Late Successional Stage in Matrix



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Legend

Late Successional

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Map # 17

Invasive Non-Native Plants Found In Blowout			
Common Name	**Scientific Name**	**Biological Control**	**Occurrence**
ox-eye daisy	*Chrysanthemum leucanthemum*	No	Widespread
chicory	*Cichorium intybus*	No	Isolated
wild carrot	*Daucus carota*	No	Widespread
foxglove	*Digitalis purpurea*	No	Patchy
spotted cat's ear	*Hypochaeris radicata*	No	Widespread
wall lettuce	*Lactuca muralis*	No	Widespread
white sweetclover	*Melilotus alba*	No	Patchy
reed canarygrass	*Phalaris arundinacea*	No	Patchy
self-heal	*Prunella vulgaris*	No	Patchy
Himalaya blackberry	*Rubus discolor*	No	Patchy
evergreen blackberry	*Rubus lacinatus*	No	Isolated
red sorrel	*Rumex acetocella*	No	Widespread
curly dock	*Rumex crispus*	No	Patchy
common mullein	*Verbascum blattaria*	No	Patchy

The table below lists seven established noxious weeds that are found in the Blowout analysis area.

Established noxious weeds found in Blowout			
Common Name	Scientific Name	Biological Control	Occurrence
Canada thistle	Cirsium arvense	Yes	Widespread
bull thistle	Cirsium vulgare	Yes	Widespread
Scotch broom	Cytisus scoparius	Yes	Widespread
spotted knapweed	Centaurea maculata	No	Isolated
diffuse knapweed	Centaurea diffusa	No	Isolated
St. John's-wort	Hypericum perforatum	Yes	Widespread
tansy ragwort	Senecio jacobaea	Yes	Widespread

An *Integrated Weed Management Environmental Assessment* for managing noxious weeds, signed by the Forest Supervisor in 1993, states that each infestation of weeds will be managed according to its classification; new invaders will be eradicated using all control methods available and will have highest priority. The best we can do with established infestations is keep their population numbers in check through biological and manual control methods.

Under the Willamette's integrated weed management program, spotted knapweed populations and other new noxious weed invaders are subject to spot herbicide spraying in order to prevent establishment. This program complies with and meets the intent of the *Region 6 Environmental Impact Statement for Managing Competing and Unwanted Vegetation* and the associated *Mediated Agreement.* Bio-control and manual control efforts focus on tansy ragwort and Scotch broom.

Tansy ragwort, a sunflower family member, releases massive amounts of seed into the wind similar to dandelion and can establish in most any disturbed area. Scotch broom has the tendency to dominate disturbed and semi-disturbed areas due to its size, large seed bank, and its ability to modify the surrounding environment.

Preliminary inventories of noxious weeds on the Detroit Ranger District were conducted in 1992. The inventory was manually recorded on maps and in a computer file. The infestations have been digitized and placed in the GIS data base. We will make comparisons using old and new maps to track the spread of weeds and rates of increase and to determine the effectiveness of control measures.

Presumably, continuous and increasing disturbance associated with road building and maintenance in the Blowout Analysis Area has led to population expansions of noxious weed species and invasive non-natives. Major collector roads host the majority of the infestations.

One threat to biodiversity in this analysis area is the predominance of disturbance vegetation and early successional vegetation (ruderals). This threat can be described by any or all of the following three concerns: 1) the disproportionate amount of area occupied by early successional and disturbance vegetation may effect animal-plant interactions and other ecosystem processes; 2) the particular type of disturbance represented by timber management may change conditions such that the type of natural succession following events like fire and disease is precluded; and 3) the vast road system and other continuously disturbed areas allow for easy establishment and long-term occurrence of noxious weeds and other undesirable ruderal species. The resultant effect of all three concerns is a reduction in the number and extent of various stable native plant communities represented in the landscape.

Without more data and analysis, the significance of concerns #1 and #2 is hard to evaluate. But the effects of concern #3 is evidenced by the results of a recent district road survey of noxious weeds. In the heavily roaded areas on the east side of the analysis area, populations of noxious weeds such as St. John's wort *Hypericum perforatum*, Scotch broom *Cytisus scoparius*, Canada thistle *Cirsium arvense*, and tansy ragwort *Senecio jacobaea* are abundant. It is apparent that these populations serve as propagule sources for further weed invasions of arterial roads. On the west side, where road densities are considerably less, population densities and distribution are much reduced and restricted to just the major road routes. Other noxious weed concerns in this analysis area include small but recent infestations of spotted knapweed *Centaurea maculata*.

What is our current knowledge of Table C-3 (ROD) and Appendix J2 (FEIS) plant species occurrence in the watershed, and what is the current status of survey protocols for survey and manage species (C-3)? What other species of concern are found in the watershed?

A large number of late successional forest plant, animal, and fungal species were identified as needing protection or monitoring in the ROD and standards and guidelines for the Northwest Forest Plan. These species fall under either the category of protection buffer or survey and manage.

The Regional Ecosystem Office (REO) is collecting location information and developing survey protocols. A survey and manage species database has been developed and is ready for field use in 1997. Survey protocols for bryophyte species are now ready for field testing, and all other survey protocols should be ready soon. Survey strategies include the following:

Survey strategy 1: manage known sites;
Survey strategy 2: survey prior to activities and manage sites;
Survey strategy 3: conduct extensive surveys;
Survey strategy 4: conduct general regional surveys.

Activities implemented in 1995 and later must include provisions for known sites if the species is under survey strategy 1. For species under survey strategy 2, activities implemented in 1999 or later must have completed surveys. Survey strategies 3 and 4 are more general and must be underway in 1996. Mitigation measures for these species can be found in Appendix J-2 of the FEIS (Holthausen et al. 1994). The following table lists species documented on the Detroit District.

ategory	pecies	ocation on the Willamette N.F.	urvey Strategy
Mosses	*Antitrichia curtipendula*	Forestwide	4
	Rhizomnium nudum	Hanks Lake-DE	PB-1,3
False truffle	*Rhizopogon albietis*	Breitenbush watershed	3
Rare false truffle	*Alpova alexsmithii*	Mt. Jefferson Wilderness	1, 3
	Gymnomyces abietis	Mt. Jefferson Wilderness	1, 3
	Hydnotrya inordinata	Mt. Jefferson Wilderness (Jefferson Park)	1,3
Chanterelles	*Cantharellus cibarius*	Forestwide	3,4
	Cantharellus subalbidus	Forestwide	3,4
	Cantharellus tubaeformis	Forestwide	3,4
	Gomphus clavatus	Forestwide	3
	Gomphus floccosus	Forestwide	3
Rare Chanterelles	*Polyozellus multiplex*	Battle Ax Cr-DE	1,3
Uncommon Gilled Mushrooms	*Catathelasma ventricosa*	Regionwide	3
Rare Cup Fungi	*Gelatinodiscus flavidus*	Park Ridge-DE	1,3
Tooth Fungi	*Hydnum repandum*	Forestwide	3
	Hydnum umbilicatum	Forestwide	3
Parasitic Fungi	*Sparassis crispa*	Forestwide	3
Nitrogen-fixing lichens	*Fuscopannaria leucostictoides* *	Detroit, Blue River Ranger Districts	4
	Lobaria oregana *	Forestwide	4
	Lobaria pulmonaria *	Forestwide	4
	Lobaria scrobiculata *	Forestwide	4
	Nephroma bellum *	Forestwide	4
	Nephroma helveticum *	Forestwide	4
	Nephroma parile *	Forestwide	4
CONTINUED…	*Nephroma resupinum*	Forestwide	4

Category	Species	Location on the Willamette N.F.	Survey Strategy
Nitrogen-fixing lichens (cont.)	*Peltigera collina*	Forestwide	4
	*Pseudocyphellaria * anomala*	Forestwide	4
	Pseudocyphellaria anthraspis	Forestwide	4
	*Pseudocyphellaria * crocata*	Forestwide	4
Rare Nitrogen-fixing lichens	Lobaria hallii	Forestwide	1,3
	Nephroma occultum	Forestwide	1,3
	Fuscopannaria rubiginosa	Detroit R.D.	1,3
	Pseudocyphellaria * rainierensis	Forestwide	1,2,3
Rare Rock lichens	Pilophorus nigricaulis	Detroit R.D.	1,3
Aquatic lichens	Hydrothyria venosa	Little North Santiam	1,3
	Leptogium rivale	Opal Creek	1,3
Rare Oceanic Influenced Lichens	Hypogymnia oceanica *	Forestwide	1,3
Vascular plants	Allotropa virgata *	Forestwide	1,2

The species locations that are documented on the Detroit District are from herbarium collections, the ecoplot data set, and incidental sightings. Most of the lichen locations come from regional air quality monitoring plots. Appendix J2 of the FSEIS (Holthausen et al. 1994) provides descriptions of the habitat and range of many of these species. Vascular plants that are on both the C-3 list and the Region 6 Sensitive Plant List suspected or documented to occur on the Willamette National Forest (*Botrychium_minganense* and *Botrychium montanum*) have been subject to survey during the normal course of field work. To this date, habitat descriptions for most C-3 plant and fungal species are not specific enough to determine probable locations with existing data.

Uncommon Plants: Uncommon plants have no special management status in Region 6. Their distributions are monitored on the Willamette National Forest because we want to prevent having to list species on the Regional Forester's List. One of the monitoring questions in the *Willamette National Forest Land and Resource Management Plan* (LRMP) has the Botany program responsible for a Forest Concern List--those species rare enough to track for purposes of maintaining biodiversity and for helping determine whether populations are increasing, decreasing or stable statewide. Four uncommon plants are found in the Blowout Analysis Area:

Uncommon Plants in Blowout Analysis Area		
Latin Name	Common Name	Occurrences
Botrychium virginianum	Virginia grape fern	1
Brickellia grandiflora	Large-flowered brickellia	1
Castilleja rupicola	Cliff paintbrush	1
Pleuricospora fimbriolata	Fringed pinesap	Many

Populations of uncommon plants are tracked by an informal database. Inventories have been developed opportunistically during sensitive plant survey. It should be noted that like sensitive plants, most of these uncommon plants are found in special habitats. The first three occurrences are protected by virtue of special habitat designation. Fringed pinesap occurs in coniferous forest, and has no such protection.

What Threatened, Endangered, or Sensitive (TES) plant species occur in the watershed, and what is the current condition of these populations?

Sensitive Plants: Plants on the Region 6 sensitive plant list are afforded protection by the Regional Forester by authority of Forest Service Manual (FSM) 2670. The purpose is to avoid having to list the plants as threatened or endangered due to losses incurred as a direct or indirect result of management activities. *Romanzoffia thompsonii*, Thompson's mistmaiden, is a Region 6 sensitive plan that is found at one location in the Blowout Analysis Area. The habitat for this plant is always rock gardens; sites where bedrock is close to the soil surface, where there is minor to no soil development, and where herbaceous species such as mosses and forbs predominate.

Sensitive Plants in the Blowout Analysis Area			
Latin Name	Common Name	Location	Occurrences
Romanzofia thompsonii	Thompson's mistmaiden	Beard Saddle	1

Past timber management has not had a discernible impact on this one population of *Romanzoffia thompsonii*, although its habitat is surrounded by a stand only 40 years old. A road does bisect this habitat, however, and the segment of the population below the road does appear to have been impacted by sidecast gravel from the road.

What types of special habitats (rock outcrops, seeps, bogs, meadows, talus slopes, etc.) occur in this watershed?

Special Habitats: The occurrence of special habitats and their distribution across the landscape is important for biodiversity of plant and animal species (*see Special Habitats map #18*). Forest Plan standard and guideline FW-211 directs us to protect these habitats and their ecotones. The Special Habitat Management Guide lists special habitats by plant associations and the wildlife that use them. The guide provides a methodology for inventory, mapping and databasing information as well as providing management prescriptions.

The largest number of non-forest plant communities (special habitats) in this analysis area are represented by dry rock gardens, wet meadows, and vine maple-talus patches. Dry rock gardens occur on the major peaks and ridges, including Coffin Mountain, Pinnacle Peak, Lucky Butte, Cub Point, and Blowout and Coopers Cliffs.

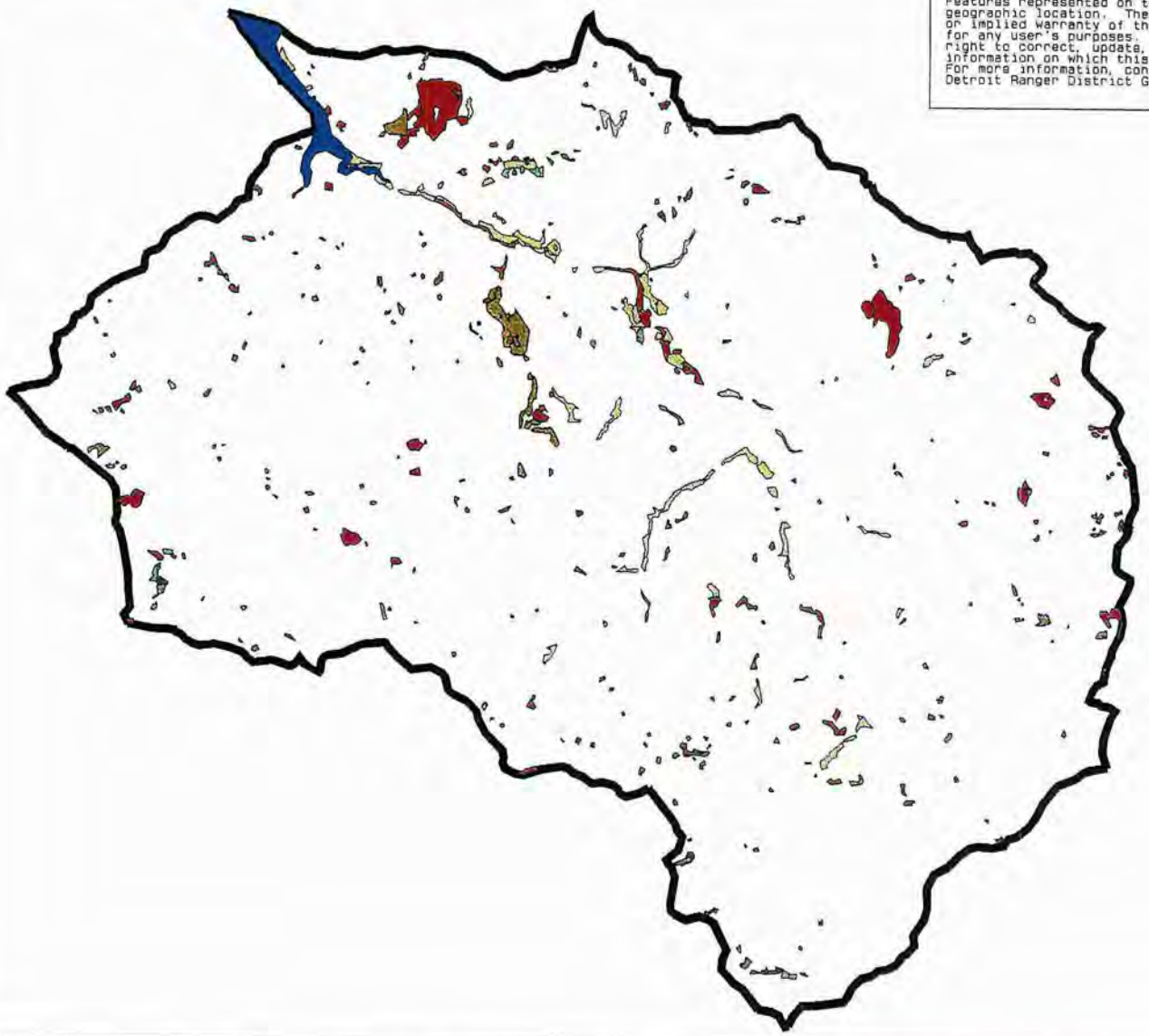
Various wet meadow/bog/pond special habitats occur at the headwaters of Blowout and Box Canyon Creeks and their tributaries. Many of these types are surrounded by recent harvest activities, some are not.

Vine maple-talus patches are distributed throughout the analysis area and attest to the predominance of unstable soils in both Blowout and Box Canyon watersheds. Wet and seepy tag alder patches with associated vegetation are distributed along the upper rims of these Analysis Areas. A notable wet rock garden is located on a slope near Beard Saddle, and a beautiful spring wildflower display that includes the sensitive *Romanzoffia thompsonii* (Thompson's mistmaiden) occurs there.

A few mesic meadow types can be found at mid-elevations in the Blowout area, but are nonexistent in the Box Canyon area.

Beaver ponds and sag ponds, sedge meadows and hardwood swamps predominate in the lower elevation second growth stands. The formation and/or current condition of many of these latter sites have probably been influenced by past harvest activities.

Blowout WA
Special Habitats



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Legend

- Wet Meadows
- Moist Meadows
- Dry Meadows
- Alder
- Shrubs
- Rock /Cinder/ Talus
- Water

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Map # 18

Special Habitats in the Blowout Analysis Area

Type of Special Habitat	Number of Habitats*	Condition of Special Habitats							
		Special Habitat is within/ or bordered by Harvested Unit,		Special Habitat is Bisected by Road		Special Habitat is Bordered by Road		Invasive weedy Plants found within special habitat**	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
Dry rock gardens	26	2	8			3	12	2	8
Vine maple - talus	22	2	9			2	9		
Wet mdws	19	13	68	1	5	10	53	2	11
Pond	12	5	42			5	42	2	17
Mesic mdws	10	2	20	1	10			2	20
Cliff	9					1	11		
Sitka Alder	9			1	11	1	11		
Swamp: hardwoods	8					1	13		
Sedge mdws	6	2	33			2	33	1	17
Talus	3			1	33				
Bog	3	1	33						
Vine maple - rocky soil	3	1	33						
Moist rock gardens	2	1	50	1	50			1	50
Dry mdws	1								

* (approx. number of habitat types out of 133 identified by photo or in field)

** (based on 54 habitats inventoried in 1994)

b. Reference Condition: What is the historical array and landscape pattern of plant communities and seral (structural) stages in the watershed (riparian and non-riparian)? What processes caused these patterns (e.g. fire, wind, mass wasting)?

The reference date is set at approximately 100 years ago because there was little human influence at that time and because of an active fire period at about that time period. Some of the discussion regarding reference conditions is interspersed in the current conditions section of this document.

Columns 2 and 3 of the following table are from a Sub-Regional Assessment done for the entire Willamette and Siuslaw National Forests. Its purpose was to estimate the range of natural conditions for each plant association series. It determined the percentages for each structural stage using information from fire studies on the Blue River Ranger District and in the Mount Jefferson Wilderness. The period analyzed was from 1600 to 1850. The values used in the tables below represent the mid-range given in this report. The Assessment figures given here are for the entire North Santiam subbasin.

Columns 4 and 5 of the following table shows the structural stages by plant association for the 1895 period. Figures were derived from a variety of sources, estimates and maps of historic burns, old photography, records of harvest activity, and on the ground knowledge of the area. A high degree of accuracy is not possible in this watershed without more extensive field examination.

Columns 6 and 7 represent current conditions, for comparison.

The distribution of plant associations throughout the watershed was previously discussed in the Characterization. The predominant factor affecting stand structure in pre-European settlement times was fire. Other disturbance factors such as wind or flooding may have had significant impacts in localized areas but not approaching the scale of large wildfires. Insects and diseases also effect stand development but knowledge of specific large scale impacts are not known for this watershed.

The table shows there are some significant changes in percentage of each structural stage between reference and current conditions.

Historical Compared to Current Structural Stages by Plant Association Series (on Federal lands)						
Structural Stage	Sub-Regional Assessment by Plant Association Series (**1600-1850**) for the **North Santiam Subbasin**		**1895 Structural Stages** by Plant Association Series for **Blowout Watershed**		Current Conditions	
	Western Hemlock	Pacific Silver Fir	Western Hemlock	Pacific Silver Fir	Western Hemlock	Pacific Silver Fir
	%	%	%	%	%	%
Stand Initiation	18	18	12	6	20	39
Stem Exclusion	22	27	-	-	35	18
Understory Reinitiation/ Old Growth	60	55	85	91	41	41
Non-Forest	-	-	3	3	4	2
Totals	100	100	100	100	100	100

What was the historical relative abundance and distribution of plant species of concern (ROD, TES, others) and the condition and distribution of their habitats and other special habitats in the watershed?

Although there is no data regarding the status of these species 100 years ago, inferences can be made based on habitat. Indications are that late-successional forest habitat was far more prevalent a century ago than today. Timber management and large scale fires have substantially reduced the current amount of these habitat types. Survey and manage species (Table C-3, ROD) associated with late-successional habitat should have had correspondingly larger population sizes and distributions.

Formation and development of special habitats (SHABs) is mostly a function of changing geomorphology, in which changes are measured in millennia. The more important comparison to make to a 100 year reference point is changes in SHAB structure, function, and species composition.

III. BIOLOGICAL DOMAIN

B. Animal Species and Habitats- Aquatic

1. Characterization: *What is the relative abundance and distribution of species of concern that are important in the watershed (e.g., threatened or endangered species, special status species, species emphasized in other plans)? What is the distribution and character of their habitats?*

The Blowout Creek drainage currently supports three species of salmonid fish: rainbow and cutthroat trout and kokanee salmon. Rainbow trout are very common in the drainage and are generally found in Blowout Creek and the lower reaches of many of it's tributaries. Cutthroat trout, another common species, are primarily found in the tributaries and upper reaches of Blowout Creek. Kokanee salmon are generally found in Detroit Reservoir but they ascend Blowout Creek in the fall to spawn. In fact, they were observed spawning in the lower section of Blowout Creek in 1999. Their numbers vary from year to year, depending on past spawning success and survival in the Reservoir.

Non-game fish found in the drainage include black-sided dace, long-nosed dace and sculpin. The dace are primarily found in the main stem of Blowout Creek while sculpin are found throughout the drainage.

Habitat for salmonid fish is fair to good within the drainage although currently habitat in the lower reaches of Blowout Creek may be better suited for dace than for salmonid fish. Past management activities and flood flows that have widened and shallowed the stream, have increased stream temperatures and reduced channel complexity. Detailed surveys and reports on habitat condition in the Blowout Creek Watershed are on file at the district.

Threatened and Endangered Species: At this time there are no known threatened or endangered fish or aquatic insects in the Blowout Creek drainage.

Sensitive Species: The Regional Forester's sensitive species list does not include any aquatic species that are known to exist in the Blowout watershed.

Survey and Manage Species: There are no fish or aquatic insects on the Survey and Manage list at this time.

2. *What Values Are Associated With Aquatic Species And Habitats?*

a. Species and habitats have aesthetic, economic, recreational, and spiritual value.

There is an inherent aesthetic value to viewing quality aquatic habitat whether it be a stream or a lake. The placement of a fish, especially a wild salmon or steelhead, within this context greatly increases that value.

There is recreational value to aquatic species and habitat as evidenced by the number of people who gravitate toward water to recreate and/or fish, although the actual monetary value is not always easy to quantify.

Prior to Euro-American settlement in Oregon, native Americans may have harvested fish within this watershed, probably near a waterfall that was located about two miles upstream from the mouth of the Blowout. Food gathering areas, such as this, had high spiritual value to the Native Americans.

b. Habitat components necessary to sustain the variety of species indigenous to the area has ecological significance.

c. The native wild gene pools that have developed over thousands of years are valuable in providing species with the resilience to survive a wide range of natural conditions and disturbance regimes.

3. *What Are The Highest Priority Issues Or Resource Concerns Associated With Aquatic Species And Habitats?*

a. Fish habitat quality has been reduced due to past fires, floods and management activities such as *road construction, cutting and yarding of trees, removal of down wood from streams and riparian zones, and slash treatment.* Habitat quality has been affected in the following ways:

- Large woody material was removed from the channel and the associated riparian zones.

- The lack of large wood in the channel reduced pool quality and numbers, reduced hiding cover, and widened and shallowed the channel.

- The lack of good stream-side cover and the widening and shallowing of the channel have increased stream temperatures to the point that State Water Quality standards for salmonid producing streams are being violated during summer low flows. The increased summer temperatures may be increasing competition between non-game species such as dace and cutthroat and

rainbow trout. In 1997, lower Blowout Creek had a seven day average temperatures in the high 60 degree range.

- The amount of roading in the Blowout is contributing sediment to stream channels and may be reducing pool volume and lowering spawning success of salmonids.

b. The placement of instream large wood, as part of restoration programs, may conflict with recreation use such as kayaking.

c. Native fish and wildlife play an important role in shaping the function of ecosystems they are a part of. For example, in a stream with historical runs of spring chinook salmon, large numbers of dying and decomposing fish would have released a significant amount of nutrients to aquatic and riparian habitats. When these fish no longer inhabit the stream, the loss of nutrients can affect the overall productivity of the stream. Lower Blowout and Box Canyon Creeks may have been affected this way.

4. *What Are The Management Activities/Direction, Human Uses, Or Natural Processes That Affect Aquatic Species And Habitats?*

a. **Current Conditions:** *What are the current habitat conditions and trends for species of concern identified above?*

The following information is from USFS Surveys 1990-1993, Pre-1996 Flood.

Pool quality is low throughout most of the Blowout watershed. The weighted average for all reaches is about 10 pools per mile.

Hiding cover for fish ranges from 5 to less than 20 percent. Boulder substrate was identified as the dominant type of hiding cover that fish were using during 1990-1993 survey. This was also the case in a 1982 survey by Oregon Department of Fish and Wildlife in which deep pools and boulders were found to be providing the majority of cover at that time as well.

Riffle habitats comprise a range of 51 to 86 percent of the surface area throughout the surveyed stream reaches.

Large woody material is shown, by research, to be an essential component of fish habitat. It provides hiding cover, nutrient and insect sources and hydraulic control for pools and micro-habitats as it dissipates stream flow energy. However, large wood greater than 24 inches in diameter was found at rate of less than 35 pieces per mile in most of Blowout Creek.

The ratio of bankfull width:depth is variable in the drainage. It's fairly high in much of Blowout Creek and moderately high in some other areas of the watershed.. This may indicate a loss of structure, mostly from a lack of large wood and large trees, to confine or narrow the active channel during flood events. Bankfull flows are relatively unrestricted, with high erosive energies, and are transporting large amounts of bedload.

Canopy and shade cover averages 24 percent and ranges from 0 to 60 percent on surveyed streams..

Water temperatures have been monitored on seven stations on the main stem and 13 stations on five tributaries since the summer of 1980. Eight years of data have shown temperatures in excess of 58° F in Blowout Creek, with many days exceeding 70° F. Divide and Ivy Creeks have also shown temperatures consistently exceeding 58° F but to a lesser degree. Analysis of monitoring and survey data and observations suggest broad riffles, with low cover on the main stems of these three streams may be the major reason for the increased temperatures.

Existing fish habitat condition has been influenced to a large degree by management activities along with at least two major flood events (1964 and 1996). Road building, timber harvest and stream cleanout increased sediment loading, reduced stream cover, increased temperature and removed large trees that would have contributed to aquatic habitat complexity. Past management activities probably exacerbated the flood affects by causing more scouring of channels and reducing complexity more than might have occurred without management activities.

Direct human use has probably changed current condition very little compared to management activities. Fishing, hunting and other recreation use has probably had minor effects on aquatic habitat when compared with past roading and timber management activities.

Threatened and Endangered Species: Spring chinook and winter steelhead, which are presently listed as threatened, were eradicated from the drainage in 1953 when Detroit and Big Cliff dams were completed. There was a recent proposal by Oregon Department of Fish and Wildlife to reintroduce spring chinook into Blowout Creek in the fall of 1998. They proposed to use surplus adults from the hatchery that were ready to spawn. The proposed re-introduction did not take place. Current habitat conditions for these species is less than optimal because of high temperatures, low habitat complexity and lack of pool habitat for hiding cover.

Sensitive Species: Trends for sensitive aquatic insect species in the Blowout are unknown. No detailed studies have been done to assess this information. It is likely that populations are increasing as habitat recovers from past activities and flooding. Adherence to the direction in the Northwest Forest Plan should maintain this upward trend.

Other Species: ***Rainbow trout***: No detailed surveys have been done for many years. Dace may be competing with rainbow trout for space and food in the lower reaches of Blowout and Box Canyon Creeks, while cutthroat trout are likely competing with them in the tributaries.

Cutthroat Trout: Trends are generally unknown. No detailed surveys have been done for many years. Rainbow trout are likely competing with cutthroats for space and food in the lower reaches of tributaries and the upper reaches of Blowout Creek.

Dace: Trends are generally unknown. No detailed surveys have been done. A short section of Blowout Creek near the mouth of K Creek was sampled in 1998 and long nosed dace seemed to be abundant. Black sided dace were mentioned in older surveys but none were identified in the 1998 survey.

Sculpin: Trends are generally unknown. No detailed surveys have been done. Sculpin seem to be fairly common in all streams surveyed in 1998. Samples of sculpin were collected from several streams in the Blowout system in 1998.

Where are the year-round cold water sources areas for the streams in the Blowout watershed, and where can their contribution be identified as important to the maintenance of cool stream temperatures?

There are no known significant cold water sources within this watershed. Temperature moderation may be a function of stream morphology and stream side vegetative cover. Prior to logging in the tributaries, these shaded cooler streams may have been significant in maintaining cooler water temperatures in the lower reaches of Blowout Creek. The water temperature in lower Blowout Creek in mid July of 1938 with an air temperature of 84° F was 53° F. More recent temperatures have been in the high sixties, reaching up to as high as 70°F.

What is the condition of the riparian reserves in the watersheds and the distribution of those conditions with regard to fish habitat?

The condition of riparian reserves varies across the watershed. Presence or absence of large woody material or standing large trees is greatly dependent on past road building, timber harvest, salvage logging, fire history, and major storm events. Historical conditions have been altered in this watershed by management activities and major storm events. Detailed surveys are available at the Detroit Ranger District.

Where and how did recent flood events affect fish habitat in the watershed?

Major flow events that carry large amounts of bedload and large woody material can be detrimental to fish survival and spawning success. Kokanee salmon from Detroit Reservoir spawned in lower Blowout Creek in the fall of 1995. If these eggs or alevins were still in the gravel when the flood happened, it is likely they would not have survived the disturbance.

While from one stand point these events are tearing things down, on the other side they are providing the streams with the building blocks for new habitat. They provide new large wood to the channel from debris flows and from undercutting of trees along the channel. They also provide new substrate from channel changes and debris flows to recharge and form new spawning areas. The short term impacts of these events can be detrimental but long term they can be generally good. This is especially so in drainages with healthy intact riparian areas that have the replacement components a stream needs to maintain complexity and productiveness.

What and where are existing fish habitat improvements in the watershed?
Habitat improvement activities, in the form of log and boulder structures, have taken place in Blowout Creek and lower Ivy Creek. These structures were constructed prior to the 1996 flood event. Some faired well in the storm event and others were completely washed out by the high water. The structures in Ivy Creek held up the best. This was likely due to the smaller stream size. A specific review of 17 structures in Blowout Creek showed that over 60 percent of the wood and 45 percent of the boulders were moved from the structure sites by the flood.

b. Reference Conditions: *What was the historical relative abundance and distribution of species of concern and the condition and distribution of their habitats in the watershed?*

Blowout Creek was known as Volcano Creek in the 1890's. Maps from 1892 indicate an area called Volcano Lake starting at approximately river mile two on Blowout Creek. A survey in 1938 by the Bureau of Fisheries indicated that rainbow trout fingerlings were abundant in Blowout Creek below a falls about

two miles upstream from the mouth (McIntosh 1993). It's likely these two sources are talking about the same barrier and also likely the fish seen in 1938 were rearing winter steelhead. There is no indication of a lake being present in 1938. This site is presently inundated when Detroit Reservoir is at full pool.

Cutthroat trout were not found during the 1938 survey, but may have been present in the upper parts of Blowout Creek and its tributaries as they are presently found throughout the drainage (Heller 1974, Skeesick 1988, USFS Surveys 1990-93, and 1998, Wetherby 1982).

The aquatic habitat probably contained complexes of large woody material, which stored large quantities of sediments and diversified riparian and aquatic habitats. Shade over the streams in the watershed was probably much more abundant in the past, prior to logging activities.

A survey by the Bureau of Fisheries in 1938 showed water temperature in Blowout Creek to be 53° F at a point approximately two miles up from the mouth. The temperature was taken on July 18th in mid afternoon with an air temperature of 82-84° F. Although this is only one temperature, at one time during the summer it still may be an indication that historically, prior to logging, salvage and stream clean-out, Blowout Creek was a much cooler stream. This also may be an indication that with recovery of vegetation, stream temperatures will lower significantly.

Threatened and Endangered Species: There is historic habitat for two fish species that are listed as threatened under the Endangered Species Act. These are spring chinook salmon and winter steelhead. The first 1.5 miles of Box Canyon Creek and the lower 2.0 miles of Blowout Creek may have historically supported these fish prior to the completion of Detroit and Big Cliff dams. Barriers present at these two points likely kept them from moving higher in the drainage.

Bull trout that are listed as threatened under the Endangered Species Act may also have used habitat in Blowout Creek but it is unlikely it would have been considered preferred habitat for bull trout.

No known aquatic insects listed under the Endangered Species Act historically lived in this drainage.

Sensitive Species: The same aquatic insect species present now were also most likely to be present historically. See writeup in current condition for information on abundance, distribution etc. Management activities may have changed habitats enough to slightly effect abundance and distribution of some species but not enough to remove them from their historical habitats.

Survey and Manage Species: None

Other Species: Rainbow and cutthroat trout, blacksided and long nosed dace and sculpin are now common in the drainage. Historically dace may not have been as abundant due to colder water conditions.

Historically, cutthroat trout may have dominated more of the drainage than they currently do. Rainbow trout may have been confined more to the areas below the barriers in Blowout and Box Canyon Creeks. This would have reduced competition between the two species and allowed cutthroat to be more widespread.

Habitat for salmonid fish was probably in good to excellent condition prior to the beginning of timber harvest and road building within the drainage. Habitat in the lower reaches of Blowout Creek was cooler and may not have been as well suited for dace allowing rainbow trout (likely winter steelhead) to better compete for space and food with any dace that may have been present.

c. Table: Comparison of Current and Reference Conditions: *What are the natural and human causes of change between historical and current species distribution and habitat quality for species of concern in the watershed?*

What is the change between historical and current species distribution?	What was the natural or human cause of change?	What is the change between historical and current habitat quality?	What was the natural or human cause of change?
Threatened and Endangered Species			
Bull trout, spring chinook salmon, winter steelhead - Listed as Threatened under the ESA - Historical range may have included the lower end of Blowout and Box Canyon Creeks but now with the dam in place the reservoir covers up the barriers and allows access to upper areas of the drainage	Building Detroit and Big Cliff dams.	Historical habitat was probably higher quality than at present. Management activities have added sediment to streams, removed wood from channels, removed canopy cover and increased water temperature.	Timber harvest, road building, and to a lesser extent, flood events.
Sensitive Species			
Aquatic Insects (See earlier list) -- Species distribution may have changed some from historical times. As habitat changed due to removal of wood from streams, reduction of canopy and increases in sediment then, organisms more tolerant to these changes may have become more dominant in areas with the greatest change.	Management Activities, including timber harvest, road building, the dams, and to a lesser extent major flood events.	Historical habitat was probably higher quality than at present. Management activities have added sediment to streams, removed wood from channels, removed canopy cover and increased water temperature.	Timber harvest, road building, Detroit Dam, and to a lesser extent, flood events.

Other Species (Game fish)			
What is the change between historical and current species distribution?	**What was the natural or human cause of change?**	**What is the change between historical and current habitat quality?**	**What was the natural or human cause of change?**
Rainbow trout -- Historically rainbow trout may have been restricted to the lower reaches of Blowout Creek and Box Canyon Creek due to waterfall barriers. At present, due to Detroit Dam , the reservoir backs water above the barriers at full pool and fish are able to pass above these points.	The change was due to the construction of Detroit Dam.	See aquatic insects above.	See aquatic insects above.
Cutthroat Trout - Historical and existing distribution are probably fairly similar. Competition with rainbow trout since the completion of Detroit dam may have reduced the present range slightly.	The construction of Detroit Dam.	See aquatic insects above.	See aquatic insects above.
Dace - Similar to discussion for rainbow trout above.	The construction of Detroit Dam.	Habitat for dace may have improved as management activities increased stream temperatures.	See aquatic insects above.
Sculpin - Not sure how distribution of sculpin may have changed in the last 100 years. The change in habitat from flowing water to a reservoir in lower Blowout and Box Canyon Creeks may have displaced a complete population of sculpin.	The construction of Detroit Dam.	See aquatic insects above.	See aquatic insects above

III. BIOLOGICAL DOMAIN

C. Animal Species and Habitats - Wildlife

1. Characterization: *What is the relative abundance and distribution of species of concern that are important in the watershed (e.g., threatened or endangered species, special status species, species emphasized in other plans)? What is the distribution and character of their habitats?*

Sensitive Species:

Peregrine Falcon (Falco peregrinus anatum): The peregrine falcon was recently removed from the endangered species list and is now considered on the Region 6 sensitive species list. There is one known peregrine falcon eyrie and 5 potential sites within the Blowout Watershed. There is an active eyrie adjacent to the watershed boundary. The falcons using this site probably utilize a portion of the Blowout watershed for foraging.

Several cliffs and rock outcrops exist in the Blowout. Falcons feed primarily on small birds above the forest canopy and in openings. Blowout's diverse landscape, consisting of a patchwork of forested areas interspersed with openings, provides the habitat for the birds that peregrines prey upon. This landscape also provides numerous foraging opportunities for falcons.

The goal for the Peregrine Falcon Management Unit, which includes this watershed, as well as, the rest of the Willamette National Forest, is two stable pairs of falcons. In 1998 there were 12 established peregrine falcon pairs on the Willamette National Forest and this number has been increasing yearly. This is well over the established goal of two stable pairs.

Threatened Species:

Northern Bald Eagle (Haliaetus leucocephalus): Bald eagles generally prefer stands of large trees, near substantial bodies of water, for nesting and foraging. Most of the larger streams in the Blowout watershed have sufficient amounts of this type of habitat, adjacent to them, to be useable by bald eagles. There have been sightings of bald eagles along Blowout Creek and scattered throughout the watershed, however, there are no known nesting sites in this watershed.

The Willamette Basin Bald Eagle Management Zone (Zone 12), which includes the Detroit Ranger District and Blowout Watershed, has a recovery population goal of 25 breeding pairs and a habitat management goal of 42 pairs. There are currently 12 occupied sites on the Willamette National Forest in this zone.

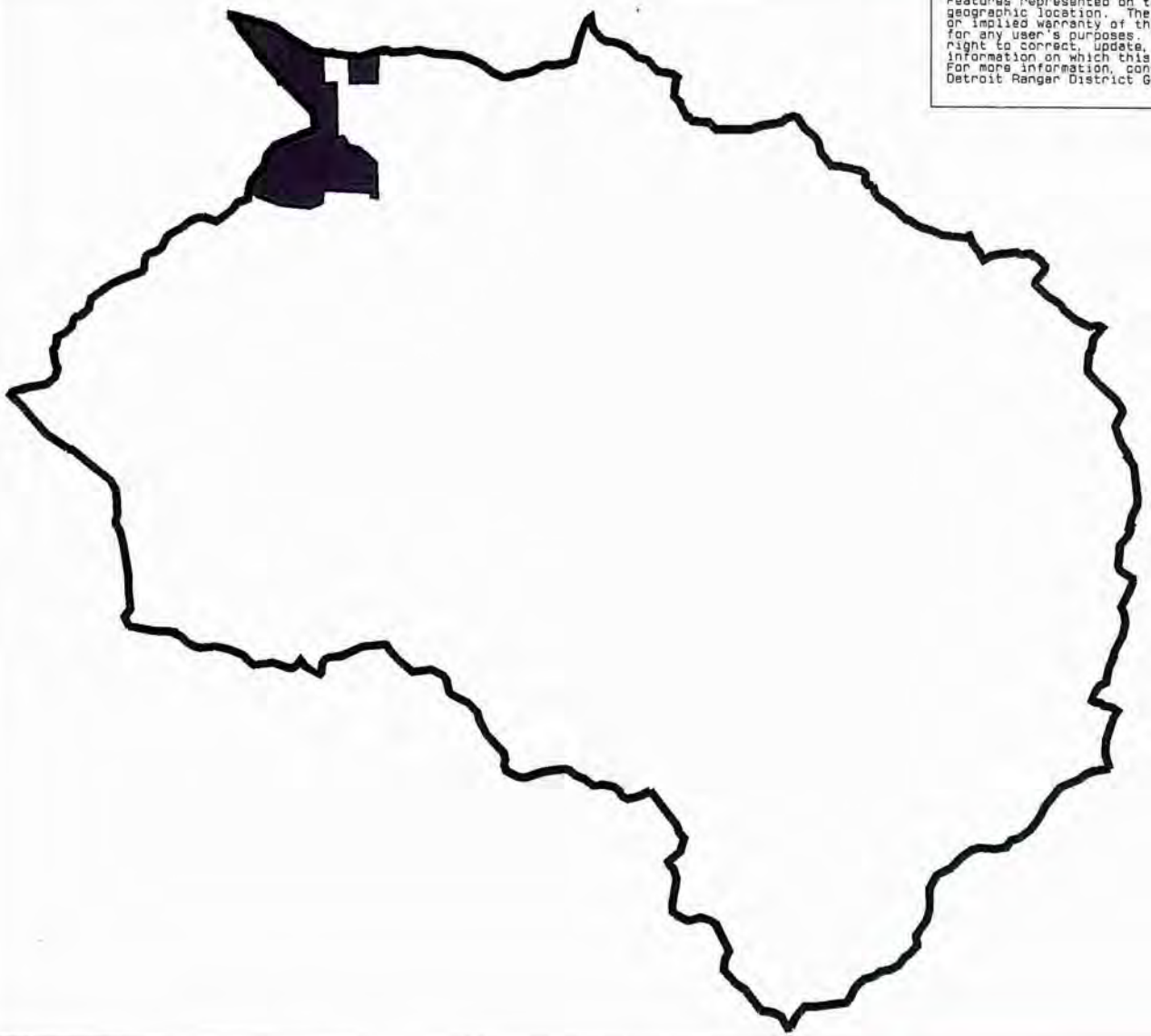
Two of the Forest's twelve bald eagle sites are located on the Detroit Ranger District, no nest sites are located in Blowout watershed, but approximately 600 acres of the Detroit Reservoir Bald Eagle Management Area lies within the watershed. (Map #19)

Northern Spotted Owl: There are 14 known pairs of spotted owls and five resident singles whose activity centers are located within the Blowout Watershed. An additional four pairs and one resident single on the Detroit R.D. have home ranges that overlap into the watershed. Of the pairs and resident singles whose activity centers are located entirely within or overlap into the watershed, 18 are considered in a "take" situation.

Generally suitable nesting, roosting and foraging habitat is highly fragmented within the eastern half of the watershed. In contrast, the western half of the watershed has a large, nearly contiguous areas of nesting, roosting and foraging habitat that is located in the Box Canyon subdrainage. (Map #20)

Box Canyon is part of a larger Late Successional Reserve #R0213 designated by the Record of Decision for the Northwest Forest Plan. A little more than half (56%) of this subdrainage is suitable nesting, roosting and foraging habitat.

Blowout WA
Bald Eagle Management Area



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Legend

Bald Eagle Management Area

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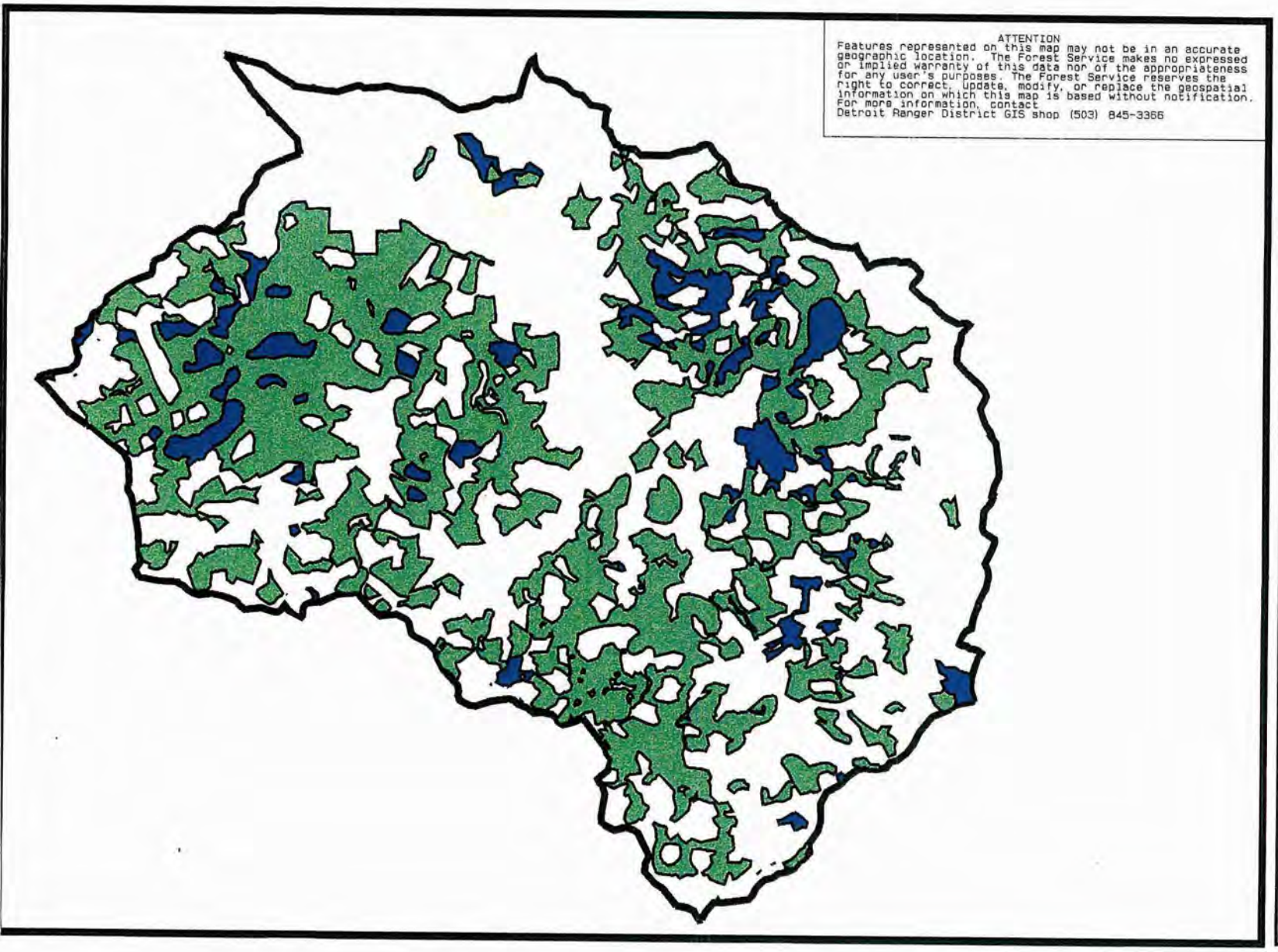
Map # 19

Blowout WA
Spotted Owl Habitat



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Nesting

Foraging

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Map # 20

Suitable Nesting, Roosting, and Foraging (NRF) Habitat			
Remaining within Home Range Pair Name	**Habitat acres within 0.7 miles**	**Habitat acres within 1.2 miles**	**Take Yes or No**
Box Canyon	698	1792	N
Low Blow	313	1008	Y
Lower Kay	344	993	Y
Blowout SOHA	531	1443	N
Bonk	457	1617	Y
Mustache	630	1504	N
Rainbow **	366	795	Y
Blowout Creek	359	980	Y
Pinhead	338	982	Y
Lucky	373	840	Y
Tomboy **	300	436	Y
Buck Mountain **	182	492	Y
Cub Point	435	930	Y
Lost Creek	287	869	Y
Bagel	743	1615	N
Cliff Creek	408	1257	Y
Kay Kapers	397	879	Y
Divide	287	739	Y
Sauer **	267	359	Y
Lucky Butte	504	1338	N
Heater	556	1554	N
Swinger *	446	1082	Y
Heater Creek * **	177	583	Y
Blowout Cliff *	37	330	Y

* New pair or resident single since 1994.
** Activity Center outside of watershed, Home Range overlaps into watershed.
Acres do not include privately owned lands.

The **Endangered Species Act (ESA)** directed the U.S. Fish and Wildlife Service to establish *Critical Habitat Units* (CHU) for the northern spotted owl. The Critical Habitat Units are areas where physical and biological features have been identified as essential to the conservation of the species and that may require special management considerations or protection. They were established to play a role in maintaining a stable and well-distributed population of northern spotted owls over their entire range.

A *critical habitat unit (CHU OR-14)* is located in the Blowout analysis area and was established along the western edge of the Western Cascade Province to provide essential nesting, roosting, foraging, and dispersal habitat for owls. The U.S. Fish and Wildlife Service needs to be consulted for all planned activities within the critical habitat unit.

Areas of Concern for management of the northern spotted owl were identified in the **Final Environmental Impact Statement on Management for the Northern Spotted Owl in the National Forests** (January 1992). These areas encompass portions of the northern spotted owl's range that pose a high risk of isolating owl populations, or that act as critical links or barriers between populations. A small portion of the *Santiam Pass Area of Concern* passes through the southern part of CHU OR-14 in the Blowout analysis area. This area was identified because of deficiency in habitat connectivity, poor distribution and quality of existing nesting, roosting, and foraging habitat and a high level of fragmentation. For these reasons, the importance of maintaining and improving owl nesting habitat in CHU OR-14 in this area is elevated.

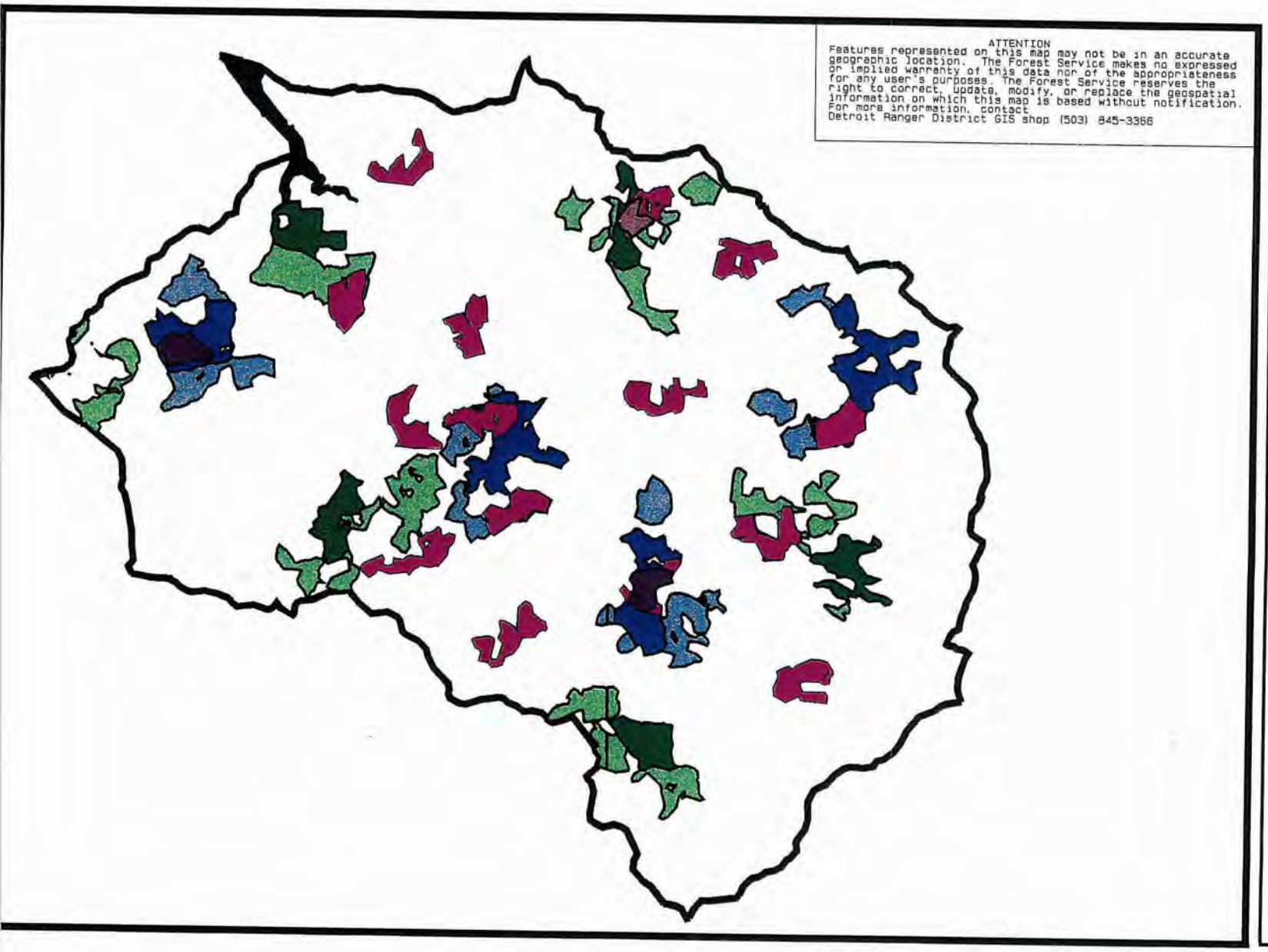
The **Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl** (1994) also included a *Riparian Reserve system* that was designed in part to benefit terrestrial species, including the northern spotted owl. The specific issue intended to be addressed in these areas for the spotted owl is the retention of adequate habitat conditions for dispersal.

When adequate dispersal habitat is not yet available in the riparian reserves, it could eventually be attained through riparian manipulation to develop desired dispersal characteristics. Until the desired characteristics are attained, however, some alternate dispersal habitat has to be made available. Areas that have been delineated, such as pileated and pine marten areas, can be retained for use as dispersal habitat in some areas while the 11-40 rule, which was established by the Interagency Scientific Committee's Conservation Strategy for the Northern Spotted Owl, can be implemented in other areas. (Map #21)

The 11-40 rule was established to assure that adequate dispersal habitat and options to apply adaptive management are available in the forest matrix land. The rule states in every quarter township, timber harvest shall be permitted only when 50% of the forest landscape consists of forest stands with a mean diameter breast height (dbh) of 11

Blowout WA

Pileated Woodpecker, Pine Marten and Spotted Owl Areas



Legend

- Marten Foraging
- Maren Core
- Pileated Woodpecker Foraging
- Pileated Woodpecker Core
- Spotted Owl Core
- Overlap of Spotted Owl and Marten Cores
- Overlap of Spotted Owl and Pileated Woodpecker Cores

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Map # 21

inches and a canopy closure of 40 percent. All land-use allocations on forest lands within the quarter township count toward meeting this rule.

The Blowout watershed encompasses all or portions of 11 quarter townships. With the exception of two of these quarter townships that fall below the 50% threshold, the rest exceed the 50-11-40 rule.

Survey and Manage/Protection Buffer Species

Survey and manage measures apply within any land allocation within the range of the Northern Spotted Owl. The Northwest Forest Plan provides standards and guidelines that will provide benefits to amphibians, mammals, bryophytes, mollusks, vascular plants, fungi, lichens, and arthropods. The survey and manage provision for each species will be directed to the range of that species and the particular habitats that it is known to occupy. Standards and guideline are listed in Appendix C-5 of the Northwest Forest Plan and Table C-3 at the end of Appendix C shows the entire list of species covered by the standards and guides. As of the date of this Watershed Assessment, few surveys have been accomplished in the Blowout watershed because of the limited number of ground-disturbing projects implemented in the short time since the standards and guides were to have taken effect. As surveys are done for survey and manage species whose ranges overlap the Blowout Watershed, more information will be known about their occurrence and abundance in the watershed. A small amount of information is known about the red-tree vole as described below.

Red-tree Vole (*Arborimus longicaudus*) – Survey and Manage

The size of the population of the red tree vole in the Blowout watershed is unknown at this time. The vole is an important prey species for the spotted owl, as well as, other raptors, martens, and fishers. It tends to be more abundant in mature and old-growth stands, which provide optimum habitat. Fragmentation of old-growth is a concern for this species.

The red tree vole is a Table C-3, category 2 species, which directs the agency to survey prior to initiating habitat disturbing activities and manage sites. A forest-wide assessment was completed in October, 1996 and concluded that the fifth field watershed, which encompasses the Blowout analysis area, had suitable red tree vole habitat in 57% of the area. Because of the amount of habitat available, a decision was made at the Forest level that surveys for the red tree vole would not be required and no mandatory management requirements would exist.

Court interpretations now direct the agency to conduct surveys when suitable habitat will be affected.

Canada Lynx – Protection buffer and Scientific Analysis Team recommendations.

Habitat Components - Lynx were discovered to occur on the Willamette National Forest after sampling efforts during the summer of 1998. More extensive surveys in 1999 detected only bobcats in Oregon. Very little is known concerning their habitat use patterns in Oregon. Lynx are expected to occur above 3500' elevation and to be associated with snowshoe hare populations. Habitat modeling and survey techniques are currently being developed to learn more about the species. Surveys for 1998, 1999 & 2000 were designed to meet survey and manage requirements as defined by the Northwest forest plan.

Lynx Analysis units are being developed with the U.S. Fish and Wildlife Service at this time. These areas will be managed to provide habitat components used by Canada Lynx. The eastern and southeastern edges of the blowout watershed is within a proposed Lynx analysis unit.

Mollusks – Survey and Manage

Habitat Components - Four species of mollusks listed as survey and manage species are suspected to occur on the Detroit ranger district. Determining habitat preferences and ranges of these species is a component of survey and manage requirements. These species are expected to occur in conifer forests with hardwood components. Mosses, leaf litter especially near hardwood logs, ferns and areas under shrubs are key features used by these mollusks. Survey protocols have been developed for terrestrial and aquatic mollusk species. More detailed expected habitat requirements for these species are listed in the protocol.

Survey Requirements: Table C-3, Survey Strategy 2 - Survey prior to ground-disturbing activities. Extensive surveys have not been conducted in the Blowout watershed.

Great Gray Owl - Survey and Protection buffers

Habitat Components - Their main prey items in the western U.S. are primarily voles and pocket gophers. Great grays tend to forage in meadows and other openings, including human created openings which contain prey. Great grays nest in mature or old growth conifer forests or forests with remnant older trees or snags. Nest stands typically have >60% canopy cover with an open understory.

Survey Requirements: Survey suitable habitat within 1.2 miles from all potentially disturbing or habitat altering activities. Suitable habitat has 4 components for Northwest forest plan ROD requirements: 1) Within the range of the northern spotted owl. 2) At elevations above 3000 feet. 3) Within mature stands (80+ yrs) with greater than 60% canopy cover: and 4) Within 1,000 feet of a natural meadow larger than 10 acres.

Coffin mountain and the headwater area of Blowout and Straight Creeks are the only areas in the Blowout drainage with habitat as defined above.

Other Species (Game Species, etc.)

Big Game: Wisdom Model analysis was done for habitat conditions within the Blowout Watershed. The analysis was done individually for each Big Game Management Emphasis Areas in the watershed. The suitability of habitat for big game is affected not only by the vegetation that exists but also by the topography. The topography of the Blowout watershed varies greatly from flat to very steep slopes and cliffs. Steeper slopes are utilized less by big game. Topography is not taken into account by the Wisdom Model.

Current HE Values for Management Emphasis Areas Within the Blowout Watershed

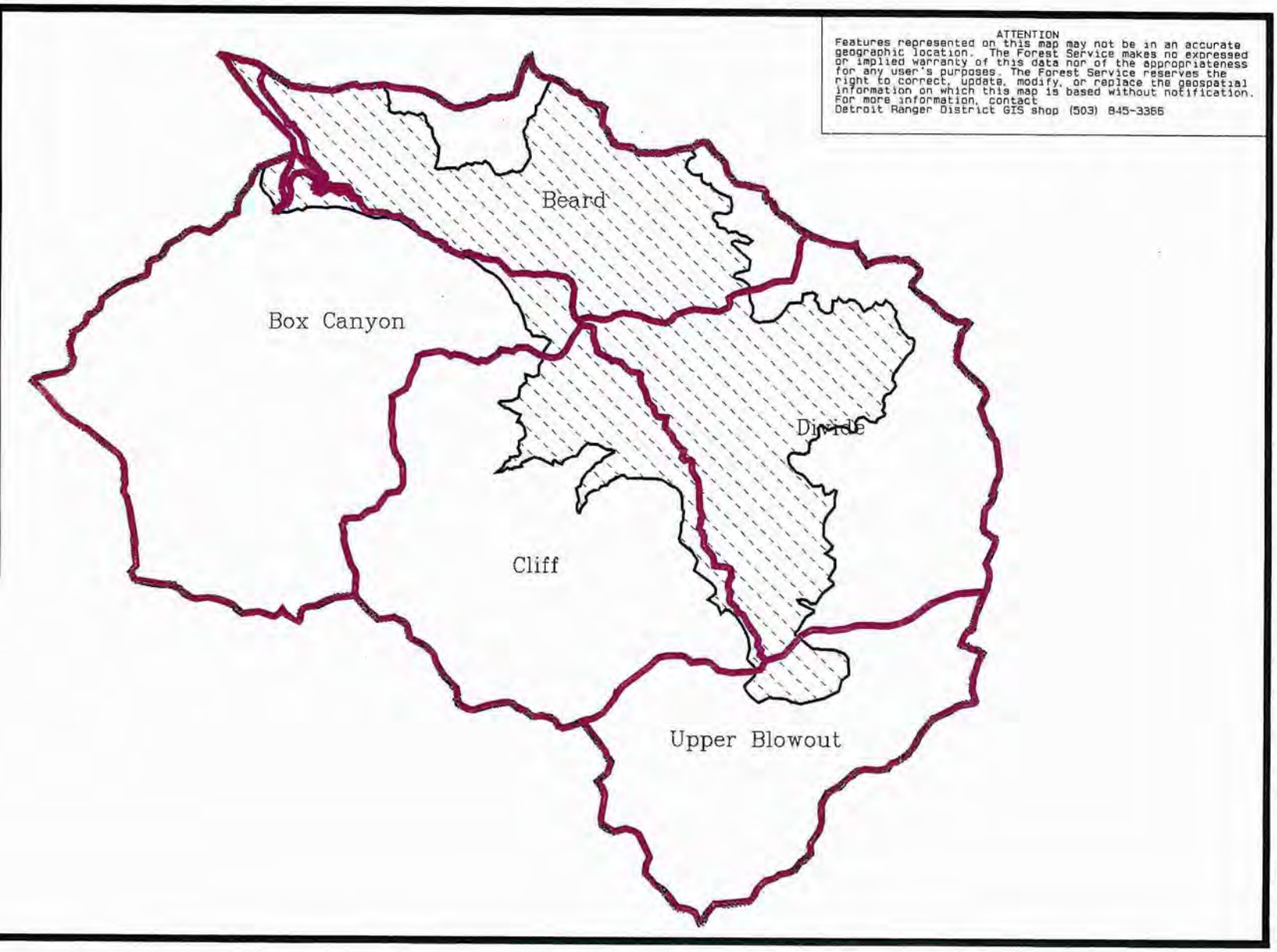
Management Emphasis Area		Objective HE Value	Current HE Values				
			HEs Size and Spacing	HEr Road Densities	HEc Cover	HEf Forage	HEI Overall
Beard	Winter Range	>0.6	0.95	0.28	0.35	0.34	0.42
	Entire Area	>0.6	0.95	0.25	0.34	0.36	0.41
Box Canyon	Winter Range	>0.6	0.66	0.45	0.29	0.05	0.26
	Entire Area	>0.4	0.90	0.44	0.49	0.31	0.50
Cliff	Winter Range	>0.6	0.84	0.26	0.25	0.42	0.39
	Entire Area	>0.4	0.94	0.34	0.41	0.35	0.46
Divide	Winter Range	>0.6	0.91	0.23	0.38	0.48	0.44
	Entire Area	>0.4	0.94	0.29	0.34	0.44	0.45
Upper Blowout	Winter Range	>0.6	0.97	0.46	0.52	0.18	0.46
	Entire Area	>0.6	0.96	0.26	0.34	0.36	0.42

1.0=Optimal, 0.6-0.9=Highly Viable, 0.4-0.5=Viable, 0.2-0.3=Marginal

The spatial arrangement of the various habitat types (foraging, hiding cover, and thermal cover) is important, juxtaposition and size of the habitat types affects the suitability of the habitat for use by big game. The physical arrangement of habitat types, in the various Management Emphasis Areas (MEA's), is excellent in all except winter range in Box Canyon and Cliff MEA's, although these are still above the objective values established in the Willamette National Forest Land Management Plan Standards and Guidelines. (Map #22)

Blowout WA

Elk Emphasis Areas with Summer and Winter Range



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Summer Range

Winter Range

Big Game Management Areas

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Map # 22

Road densities are high in all of the Management Emphasis Areas. Open roads are a source of disturbance for calving cows and does, and affect how big game utilize an area when feeding. Current road densities are above those recommended in the Forest Plan Standards and Guides. Open roads also increase the pressure on big game from hunters, because many areas more easily accessed.

The availability and proximity of cover affects how big game utilize an area. Cover comes in two types; hiding and thermal. Hiding cover is needed year round to minimize the effects of disturbance. Thermal cover is of particular importance during the winter to provide the animals protection from snow, wind and low temperatures. The analysis for cover does not differentiate between these two types in the model. With the exception of Cliff and Box Canyon MEA's, all areas are marginal with respect to the amount of cover they provide.

Forage tends to be a major limiting factor for big game. All areas, with the exception of Divide MEA, are significantly below standards. Notably, Box Canyon (Winter Range) and Upper Blowout (Winter Range) are below even the marginal range for forage.

The overall HEI values for these management areas tends to be below standards and guidelines with the exception of Cliff (Entire), Box Canyon(Entire), and Divide (Entire). Generally, the HEI values fall in the marginal range.

Others

The following is a list of species, not previously mentioned, that have potential habitat within the watershed. An * next to a species denotes species seen in the watershed through observations by District personnel.

Region 6 Sensitive Species which occur on the Willamette National Forest

Red-legged Frog*	Townsend's Big-eared Bat
Northwestern Pond Turtle	White-footed Vole
Harlequin Duck*	Invertebrates
Greater Sandhill Crane	Spotted Frog
California Wolverine	Peregrine Falcon*

Management Indicator Species

Northern spotted owl*	Peregrine Falcon*
Pileated Woodpecker*	Deer and Elk*
Pine Marten	Cavity Excavators*
Bald Eagle*	

ODFW Sensitive Species List (December 1997)

-CRITICAL-

Oregon Spotted Frog	Western Pond Turtle
Northern Goshawk	Ferruginous Hawk
Flammulated Owl	Northern Pygmy Owl
Common Nighthawk	Lewis' Woodpecker
White-headed Woodpecker	Three-toed Woodpecker
Black-backed Woodpecker	Purple Martin
Yellow-breasted Chat	(Oregon) Vesper Sparrow
Sage Sparrow	Western Meadowlark
Townsend's Big-eared Bat	Fisher

-VULNERABLE-

Cascade Seep Salamander	Tailed Frog
Western Toad	Northern Red-legged Frog
Foothill Yellow-legged Frog	Cascades Frog
Western Rattlesnake	Greater Sandhill Crane
Great Gray Owl	Pileated Woodpecker
Olive-sided Flycatcher	Willow Flycatcher
Western Bluebird	Loggerhead Shrike
Fringed Myotis	Pallid Bat

-PERIPHERAL OR NATURALLY RARE-

Black Swift	Black Rosy Finch

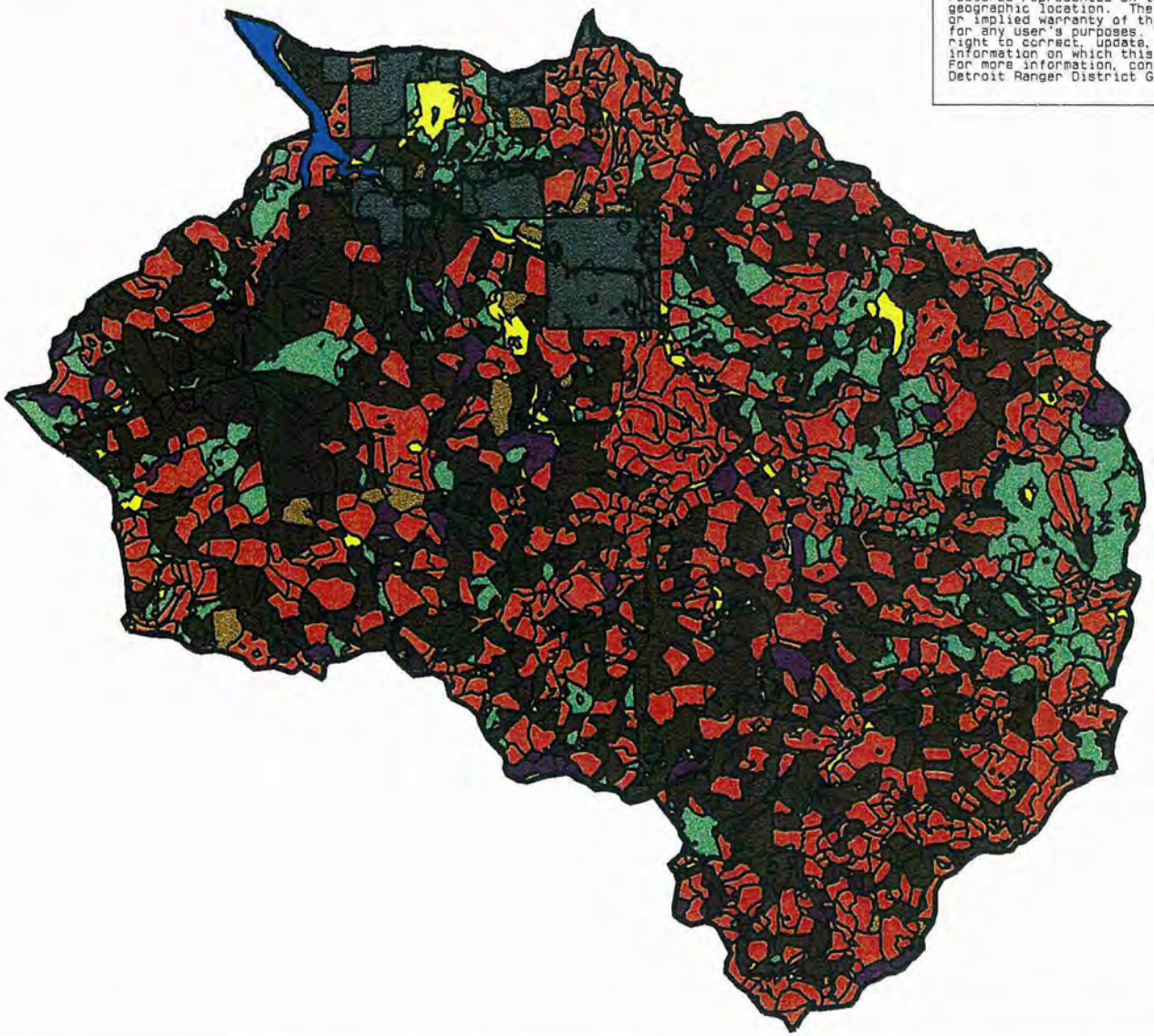
-UNDERTERMINED STATUS-

Oregon Slender Salamander	Northern Red-legged Frog
Harlequin Duck	Barrow's Goldeneye
Bufflehead	Mountain Quail
Boreal Owl	Bank Swallow
Silver-haired Bat	Western Small-footed Myotis
Long-eared Myotis	Long-legged Myotis
Western Gray Squirrel	White-footed vole

Snags and Down Woody Debris

Snag densities vary by sub-basin in the Blowout Analysis Area. Variation occurs mainly because of past fire history, fire prevention strategies, timber harvest and windstorms. In the past, snags were felled because they were considered hazards because they were susceptible to lightning strikes. In addition managers left few or no snags in harvest units. Furthermore, Occupational Health and Safety Administration (OSHA) requirements to fall snags that pose a hazard to workers resulted in reduced snag levels in harvest units. Finally, the windstorm of 1990 caused catastrophic blowdown which decreased snag levels, but increased down woody debris levels.

Blowout WA
Snag Levels



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Legend

- High
- Medium High
- Medium
- Low to Medium
- Low
- Non Forest
- Private
- Detroit Lake

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Map # 23

Standard and Guideline FW-122 states that "habitat capability for primary cavity excavators shall be maintained to provide for at least 40% or greater potential populations". Using the Snag Model, it was determined that six out of nine sub-basins within the Blowout Analysis Area are below recommended levels of this standard and guideline.

Standards and Guidelines also specify down woody debris prescriptions for different plant associations. In the past there were no standards to maintain down wood in harvest units, so many older harvest units are devoid of down woody debris. Only logs that were classified as "cull" were retained. Recruitment of down woody debris within these units currently occurs around the harvest unit perimeter, in areas where there is timber of sufficient size and maturity (Map 24). In mature, natural timber stands, down woody debris recruitment occurs on an on-going basis so there is an almost continuous supply. Past heavy salvage has resulted in the local losses of the down woody debris habitat component in areas such as roadsides, older harvest units, and on easily accessible terrain. Roadside gathering of firewood may further reduce down woody debris where there is not currently excess down woody debris to meet standards and guidelines. .

2. What Values Are Associated With Wildlife Species And Their Habitats?

a. Species and habitats have aesthetic, economic, recreational, and spiritual value.

b. Native wild gene pools have ecological value.

c. Native species have value to ecosystem function.

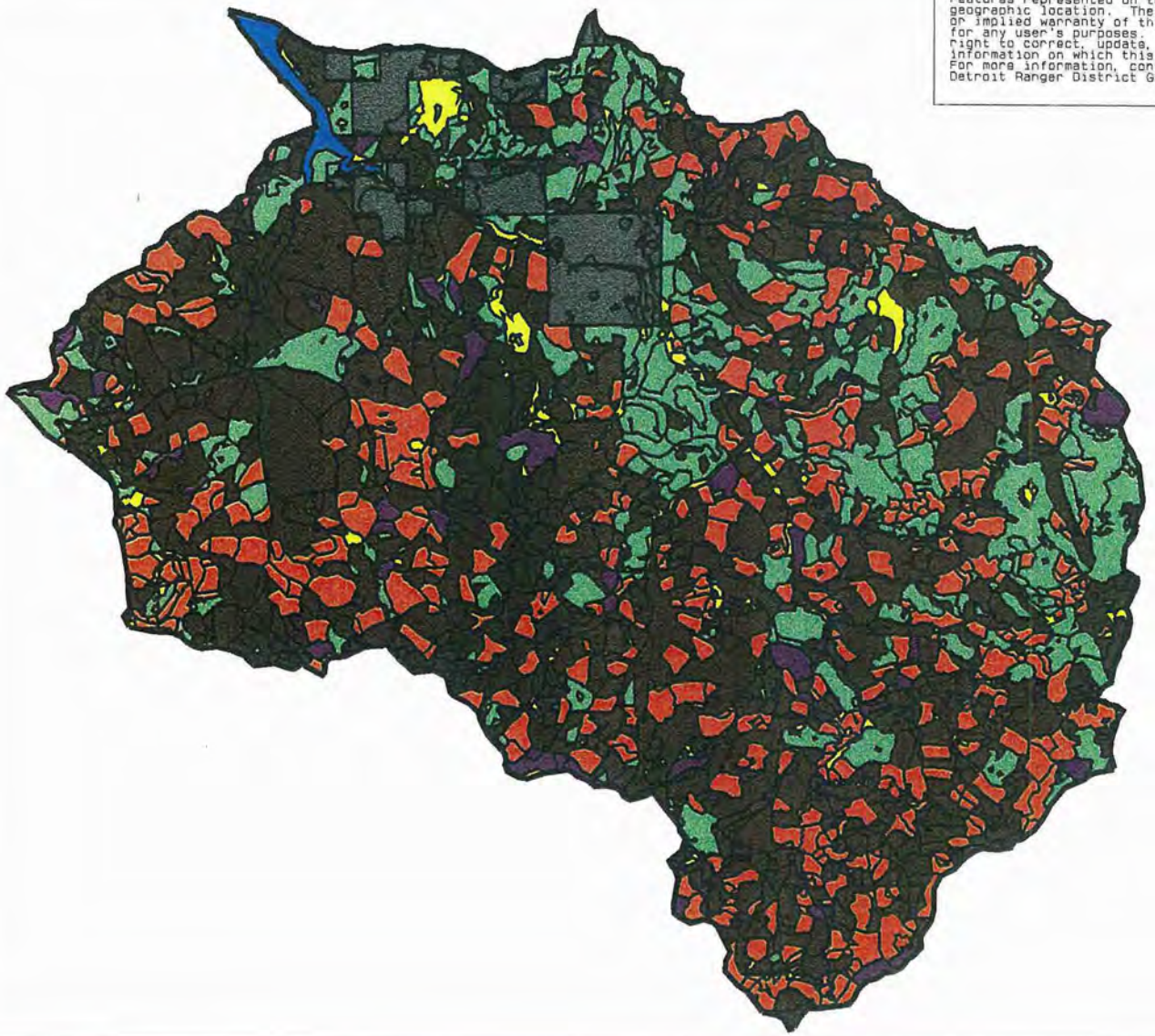
d. Habitat components necessary to sustain the variety of species indigenous to the area has ecological values (i.e. habitat distribution, connectivity, etc.)

3. What Are The Highest Priority Issues Or Resource Concerns Associated With Wildlife Species And Their Habitats?

a. Having habitat components necessary to sustain a variety of species native to the area.

b. Conflicting habitat needs for various species (i.e. big game and spotted owls).

Blowout WA
Down Wood Material Levels



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Legend

- High
- Medium High
- Low Medium
- Low
- Non Forest
- Private
- Detroit Lake

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Scale 1:100000
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Map # 24

4. What are the management direction/activities, human uses, or natural processes that affect wildlife species and their habitats?

a. Current Conditions: *What are the current habitat conditions and trends for species of concern identified above?*

Threatened Species

Northern Spotted Owl: Currently, approximately 39% of the Blowout Watershed is in suitable nesting, roosting, or foraging habitat for the northern spotted owl. Past harvest practices have resulted in a fragmented landscape with stands of suitable owl habitat being isolated from each other in the eastern portion of the watershed, but habitat is more contiguous in the western portion of the watershed.

Population trends are uncertain, it appears that there is a decrease in the numbers of spotted owls in matrix lands over historic levels.

Northern Bald Eagle: Habitat for this species is adequate along Blowout Creek.

Past management activities, such as timber harvest, have reduced the amount of habitat available for this species. Construction of Detroit and Big Cliff dams has eliminated the anadromous fish runs that provided a larger prey base for this species. Removal of vegetation that shades the streams reducing their suitability as fish habitat may have also affected the available of prey base.

Flood events may have rearranged the coarse woody debris in the stream courses, thus impacting fish habitat. Flood events could also, in the short term, decrease the shading effect of streamside vegetation. In addition, fires can remove those stand structures used for nesting, roosting, and perching.

The population of bald eagles has been increasing and should continue to do so, although the prey base will be a limiting factor.

Sensitive Species

Peregrine Falcons: Current habit conditions are good. Habitat is limited primarily by the number of cliffs and rock outcrops that have suitable nesting ledges. Habitat for prey species appears to be satisfactory.

Management activities have likely affected peregrine foraging opportunities. Openings from harvest units interspersed within patches of standing trees may have increased habitat conditions for prey species.

Other human use has had little effect on habitat condition.

Weathering affects the cliffs and rock outcrops that are used for nesting by creating or removing ledges. Fire and flood events could remove the habitat utilized by prey species.

This species has been showing an increase in it's population locally and throughout it's range. Currently it is being considered for de-listing.

Survey and Manage Species

Red Tree Vole: Currently there is more than an adequate amount of habitat available for this species in the watershed.

Management activities, such as timber harvest for commodity production, have reduced the amount of habitat available for this species, but not to a critical level. Management direction is to not further reduce the amount of available habitat.

Stand replacing fires can also reduce the amount of habitat. These types of fires seem to be limited in this watershed.

Trends for this species are currently unknown.

Habitat – Late Successional Reserve (LSR)

Approximately 20% of the Blowout watershed is comprised of the Quartzville Late Successional Reserve, identified as LSR-R0213 (see the Mid-Willamette Late Successional Reserve Assessment, August 1998).

Current Condition description: Current vegetation conditions within the Quartzville LRS are: 5% non-forest, 23% early seral, 15% early-mid seral, 5% mature, and 48% old growth. Late-successional forest, which includes the mature and old growth seral states represents 53% of the Quartzville LSR with 30% of the LSR considered to be interior forest habitat. There has been approximately a 32% decrease in late-successional forest in the area of the Quartzville LSR compared with conditions in the mid- 1900's. Currently, about 49% of the Quartzville LSR is considered to exhibit low fire risk, 49% moderate, and 1% high.

Objective: The objective is to maintain existing connectivity and interior forest. Aggregate treatments to promote large patches of developing late seral forest.

Treatment Recommendations: Any stand that appears to be on the right trajectory to reach potential late-successional forest habitat should not be treated. Priority for treatment would be in the early and early-mid seral stands to maintain existing dispersal habitat and connectivity within the block. A mix of treatment options should be used in this block. Multiple entries may be necessary to maintain canopy coverage in early to mid-seral stands. Treat no stands exceeding 80 years in age. Assess and protect mid-seral stands that are functioning as connectivity habitat. Buffer interior forest when doing commercial thinning treatments.

Other Species (Game, etc.)

Big Game: Current habitat conditions are below Forest Plan standards and guidelines.

Timber harvest, road construction and fire suppression have affected big game habitat. Tree harvest has resulted in the removal of thermal and optimal cover while increasing the amount of forage, in the short term. Over time, forage converts to hiding cover and given enough time, back to thermal cover. Many of the harvest units in the Blowout have grown out of the forage stage and back into hiding cover, so now forage is a limiting factor, as well as, thermal cover.

In addition, fire suppression has reduced the acreage burned over natural conditions, thus affecting the amount of available forage as well.

Road access to harvest units, has resulted in a transportation network that is beyond recommended road densities for big game. Traffic as a result of the roads, affects disturbance of big game. This is especially important during the critical winter months when the extra energy exerted by the disturbed animal cuts into its reserves for the winter ahead. In an attempt to reduce big game disturbance, many of these roads are closed to public access during winter months and some are closed year round.

Current conditions were likely not heavily influenced by natural processes.

Big game populations appear to be relatively stable now.

b. Reference Conditions: *What was the historical relative abundance and distribution of species of concern and the condition and distribution of their habitats in the watershed?*

Sensitive Species:

Peregrine Falcon: Most likely there was a larger population of peregrine falcons than currently exists. With more birds around, they probably occupied

more of the potential habitat than is currently occupied. Because of the nature of nesting habitat required by peregrines, overhangs and rock ledges, the quantity of habitat has changed very little over time.

Threatened Species:

***Northern Spotted Owl*:** There was probably a larger population of northern spotted owls in the past than currently exists and their distribution across the landscape was likely different because of fires and without the influence of timber management.

The character of spotted owl habitat was similar to current conditions, in that they utilized late successional stands with multi-layered canopies, but the distribution of the habitat was most likely in larger patches of suitable nesting, roosting and foraging habitat separated by large patches of unsuitable habitat that had been removed by fire events.

Northern Bald Eagle: The bald eagle was most likely more abundant and more widely distributed in the major watersheds in the past due to availability of prey species. Without dams to block fish migration, more anadromous fish were available as a food source. It could be that habitat conditions were a factor as well.

Survey & Manage Species:

***Red Tree Vole*:** It is uncertain whether the relative abundance of red tree voles is different now than in the past. It is likely that there were more voles in the past than currently exist. The character of their habitat was probably similar to current habitat character, although it would have occurred in larger patches than it does now. Fires would have influenced habitat distribution.

Other Species (Game, Etc.)

Big Game: Historic abundance of big game is uncertain. Depending on who you talk to the populations of big game were either higher or lower than current levels. The character of habitat was probably different than currently exists. Unlike today's habitat character with many smaller openings, resulting from timber harvest, that are fairly evenly distributed across the landscape, there were probably fewer, larger fire-created openings occasionally interspersed with larger blocks of intact forest.

c. Comparison of Current and Reference Conditions: *What are the natural and human causes of change between historical and current species distribution and habitat quality for species of concern in the watershed?*

What is the change between historical and current *species distribution?*	What was the natural or human cause of change?	What is the change between historical and current *habitat quality?*	What was the natural or human cause of change?
Threatened Species			
Spotted Owl – likely decrease in populations and distribution of species from historic levels.	- loss and fragmentation of nesting, roosting and foraging habitat due to timber harvest.	- similar type of habitat used but distribution was different. Historically habitat patches were lager in size and were separated by patches of unsuitable habitat that had been removed by fire events.	- timber harvest increased fragmentation. - fire suppression affected size of patches between suitable habitat blocks.
Bald Eagle – decrease in distribution from historic levels.	- loss of prey species due to dam construction - reduction of habitat by timber harvest.	- loss of large trees adjacent to water. - fewer large fish, especially salmon and steelhead as food source.	- timber harvest - dam construction
Endangered Species			
Peregrine Falcon – Decreased in populations and species distribution from historic levels.	- chloro-florocarbon based pesticides	- habitat quality changed little. It is determined by cliffs and rock outcrops with suitable nesting ledges.	- weathering of cliffs and rock outcrops.
Survey & Manage Species			
Red Tree Vole – change unknown probably decrease in population levels.	- fragmentation and loss of habitat due to timber harvest practices.	- quality of habitat is similar.	
Other Species (Big Game)			
Big Game – change uncertain.	- increased human presence due to road construction. - distribution of harvest units or fire events across the landscape.	- little change in quality. - possible change in availability of forage.	- fire suppression - tree planting