Chapter 5

Treatments

Chapter 5
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Chapter 5

Treatments

This chapter describes activities planned or anticipated to occur in LSRs in the foreseeable future. Most of these activities are intended to accelerate the development of late-successional habitat. Others, such as grazing, trail management and quarry development are included to disclose the conditions under which they would be consistent with LSR objectives. Activities are described in detail. Criteria describing conditions or areas where the activities might occur are described. Many of these criteria can be traced back to the maps and acre summary tables in Chapter 4. Most activities contain a projection of the scale of activity in LSRs across the Forest.

Habitat manipulating activities not addressed in this chapter are subject to REO review prior to their implementation. The reader should also review the REO exemption letter included at the end of Chapter 1 for further information regarding REO review requirements.

5-1 Young Stand Thinnings

This treatment involves thinning very young (10-20 year-old) stands of trees, most of which were planted after regeneration harvests. Trees were planted at a density which assured full stocking of desired tree species within five years after harvest. Most of these plantations were planted to densities between 400 and 600 seedlings per acre. In some of these plantations, mortality reduced the planted seedlings to a minimally acceptable level which would not need thinning. In most cases, though, natural seeding has increased the stocking far beyond the original planting density, some as high as 1,500 stems per acre or more, by the time the plantation is ready for thinning.

These stands are usually thinned when the trees are tall enough to have expressed individual relative dominance, but not so large that the resulting slash would persist as a fuel hazard.

The target spacing or stocking level in these thinnings is usually designed with the subsequent treatment in mind. If a thinning is expected later in the life of the stand, a predetermined number of trees per acre should be left so that the stand does not stagnate prior to the next thinning. If no subsequent treatments are planned, a wider spacing or lower stocking level is typically prescribed to avoid stagnation.

Need for Change

The desired condition for most of these young plantations, as described in Chapter 3, is to have large diameter trees, multiple layered canopies, standing snags, large woody material on the forest floor, and canopy gaps. Nature has provided these characteristics in existing old-growth stands after many hundreds of years. Attainment of old-growth characteristics is very slow, because these stands tended to grow at maximum density. Diameter growth is very slow, and there is little understory development until canopy gaps formed late in the life of the stands.

With no thinning, the tree canopy in these stands quickly shades out any existing vegetation and limits establishment of new vegetation to only the most shade-tolerant species. The live crown of the trees begins to decline at this time, as the lower branches are shaded out. As the live crown of the trees diminishes over time, individual tree growth and total stand development slows, and remains slow if not thinned. With no intervention, these stands will remain at maximum density for many decades until natural mortality opens the canopy up enough to allow expansion of crowns and understory response from increased light. Development of all of the desired late-successional characteristics will proceed very slowly under these conditions.

The response in diameter growth of trees which have been thinned is well documented (Curtis, 1992; Tappeiner, 1982; Reukema, 1977; Wiley, 1974). In addition to increasing diameter growth, thinnings can also improve resistance to insects and diseases, reduce fire ignition hazard, increase windfirmness, and control species composition.

Treatment Criteria

The following conditions will identify a young plantation for young stand thinning in the LSRs:

1. The average height of the trees in the plantation should be at least 10-15 feet.
2. The density of the trees is high enough to interfere with rapid development of the stand. In general, this level is typically 400 trees per acre or more for westside plantations.

Treatments Description

Uniform Thinning vs. Mixed Treatments:

A wide range of treatments are available in each individual plantation. There are also situations which make it desirable to combine a mixture of treatments - thin, no thin, and gap creation. In deciding which treatment or combination of treatments to use in each plantation, the following guidelines should be considered:

1. The existing diversity of the landscape surrounding the plantation. Will the area benefit from a mixed treatment, or would a uniform thinning contribute more to diversity in an area which already has diverse structure in the surrounding stands?
2. Consider the size of the plantation and the cost of implementing a mixed treatment. It may be more cost effective to implement mixed treatments only in the largest plantations (e.g., greater than 20 acres).
3. Utilize existing microsites of diversity within each unit, such as hardwood patches, understocked areas or openings caused by root rot, or other factors, in deciding whether mixed treatments are needed.
4. When prescribing a mixed treatment, consider the logistics of implementing a subsequent commercial thinning when locating unthinned patches or other treatments which are not intended to be thinned again.

Specifications for Thinning

In the portions of young plantations which will be thinned, the following guidelines should be considered.

1. The prescribed spacing should be determined by the timing of the next thinning and by the expected average stand diameter at the time of the next treatment. Opportunities for extending the availability of forage in deer and elk winter range is another consideration in deciding the spacing.

   Past thinnings have implemented target spacing ranging from as close as 11 feet by 11 feet (about 360 trees per acre) to as wide as 20 feet by 20 feet (about 110 trees per acre).

2. Existing species diversity within the thinned acres of a plantation should be maintained or increased. Certain tree species which are minor in composition and which contribute to species and structural diversity should be favored as leave trees. For example, western redcedar usually exists as a small percentage of the composition in westside Cascade plantations. Since it does not compete with Douglas-fir in height growth, and it is considered valuable in the long-term for habitat structure, it should be left uncut in many plantation thinnings.

3. Mixed treatments in intermediate (commercial) stands have been recommended by the Regional Ecosystem Office to promote development of late-successional conditions and to exempt the projects from REO review. In plantations where this is considered appropriate, the following guidelines should be considered:

   a. Ten to fifteen percent of the area should be left in unthinned patches. The sizes and locations of these should consider future management needs.

   b. Three to ten percent of the area should be in openings roughly ¼ to ½ acre in size.

   c. Three to ten percent of the area should be left in heavily thinned patches (e.g. less than 50 trees per acre).

   d. The remaining 65-70 percent of the area should be thinned to a spacing considered appropriate for future management objectives.

Schedule of Activities

Based on Table 4-34 Age Classes by LSR, there are almost 32,000 acres of stands in the 10-20 year age class inside the LSRs of the Gifford Pinchot National Forest (see Maps 4-8b, 4-9b, … 4-16b). Some of these stands have been thinned, and some are stocked at levels that would not need thinning. However, the majority of these stands remain as potential thinning opportunities. At least 75 percent of the stands (24,000 acres in this age class) presently meet the criteria for young stand thinning.

In addition to the stands described above which presently meet the criteria for thinning, potentially one half of the stands in the less than 10 year age class will grow to meet the criteria for thinning in the next five years. This adds another 13,000 acres.

In summary, the combined totals for the two youngest age classes that would meet the criteria for young stand thinning is 37,000 acres in the next five year period. If scheduled evenly over the next five years, this would average about 7,400 acres per year within the LSRs.

Priorities for Treatment

There has been no young stand thinning in the LSRs for six years. Highest priority stands for immediate treatment would be the oldest stands in this age class at the lower elevations. These stands have grown the fastest, and are reaching the upper limits of diameters suitable for young stand thinning. They are also on the most productive sites and should show the greatest response to this treatment. Other considerations in allocating limited funds for this activity include choosing plantations in areas where there is greatest fragmentation, and big game winter range areas which would benefit from extended forage production.

Table 5-1 shows the number of acres considered available for young stand thinning by LSR. As described above, it assumes that about 75 percent of the total acres in the 10-20 year age class and 50 percent of the 0-10 year age class would be available in the next five year period. The total acres for both of these categories are allocated evenly over the five year projection. Additional acres of thinning will continue to come on line at the rate of about 2600 acres each year after 2001, until 2006.

Table 5-1 Five-Year Young Stand Thinning Opportunities

LSR	Acres
Gotchen	555
Lewis	10,750
Mineral	5,900
Nisqually	4,670
Packwood	3,210
Peterson	1,315
Quartz	295
Wind	8,410
Woods	1,840
Totals	36,390

Monitoring

Implementation monitoring of young stand thinning activities should be done at the time of inspection of the project contracts. Typically, no other formal stand exams are performed in these young stands until they approach the age for a commercial thinning (35-45 years old). At the time of the contract inspection, an estimate of the residual trees per acre and species composition can be assessed and compared to the projected stocking level in the prescription. This should be done on a sample basis, one in every five stands.

In mixed treatment stands, it will be important to get the same information, but stratified by the different treatments within the stand. This information will be valuable in future effectiveness monitoring.

Literature Cited

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Tappeiner, J. C., J. F. Bell, J. D. Brodie. 1982. Response of Young Douglas-fir to 16 Years of Intensive Thinning. Oregon State University, School of Forestry. Research Bulletin 38.

Wiley, Kenneth N., Marshall D. Murray. 1974. Ten-Year Growth and Yield of Douglas-fir Following Stocking Control. Forestry Research Center, Weyerhaeuser Company, Centralia, WA. Forestry Paper No. 14.

5-2 Commercial Thinning

Need for Change

The intent of this treatment is to thin densely stocked stands to enhance structural diversity and accelerate development of late-successional characteristics. Many younger stands developed following timber harvest, stand-replacement wildfires, and other disturbances. Many of the older stands originated from wildfire and are structurally very similar to younger stands. The cost of this treatment would limit its application if it were not subsidized by commercial extraction of a portion of the trees cut.

Large portions of these stands are fully stocked with young trees, primarily Douglas-fir. Because of high existing stand density, a long time may be required to grow very large trees, an important component of old-growth forests. Franklin and others note:

> Many existing old-growth stands may have regenerated slowly, growth patterns of individual trees suggest growing conditions essentially free from competition for a century or more. If initial densities of stands are moderate - at current recommended levels for managed stands - precommercial and commercial thinnings will be necessary during the first 100 years of a long-rotation forest management cycle. (Franklin, et al. 1981)

High densities of younger stands may limit or delay the attainment of large, old-growth trees, a key characteristic of the desired future condition.

Thinnings can provide faster attainment of large-diameter individual trees than would otherwise be possible in young, fully stocked forest stands. In addition, structural and species heterogeneity can be enhanced by thinning in areas that are relatively uniform in stocking, species composition, and tree size, by not applying the thinning treatment uniformly.

Stand Development With Thinning

Following a commercial thinning, several individual tree characteristics develop that would not with no thinning.

1. The process of self-pruning, in which the lower limbs of the tree die from too much shading, slows or stops. This allows the tree to develop deep live crowns and a higher percentage of live crown for a given tree height. When the live crown of the trees is maintained or increased, the tree responds with increased growth in diameter and root strength. The bark gets thicker faster.
2. When the branches of the trees are kept alive for a long time, they grow thicker and become stronger which can be beneficial for snow interception or perches for bird habitat.
3. The root system of the trees left standing after a thinning are allowed to occupy the space made available by those which were removed. A stand of trees which has been thinned is likely to be more resistant to windthrow than one which is unthinned.

From a stand level perspective, thinnings present the opportunity to increase species diversity and structural diversity.

1. Species diversity can be increased by selecting certain species which are under-represented to be left uncut. For example, western redcedar typically is present in small numbers in many Douglas-fir stands. Since it does not compete in height growth with Douglas-fir, yet it is valued for its

wildlife habitat contribution, it can be left uncut to develop in the understory. Its relative numbers and its growth rate would be increased.

2. Structural diversity can be increased with thinnings because the increased light to the forest floor allows the shade-tolerant trees to grow more rapidly in height and diameter. When unthinned patches are left in the stand, there will be more diversity in average diameters, live crown heights, and understory development.
3. Thinning provides the opportunity to create snags and down wood where they are deficient.

Consequences of No Action. If no thinning is carried out within LSRs, attainment of some aspects of the desired condition will be delayed. Young forest stands will develop at higher stocking levels, and will develop large trees later in life.

Franklin and others (1981), discuss impacts of not thinning on the potential for developing large, old-growth trees. They note:

> Growth rates of individual trees will be too low at high densities, or at moderate densities on less productive sites to produce desired sizes of stems even after 200 years.

Stand Development With No Thinning

Stands that are never thinned reach maximum density very early - about age 20-25. At maximum density, the lower branches get shaded and quickly die, reducing the live crown percent of each tree. When live crowns are reduced, all of the benefits mentioned above from thinnings are lost or delayed for a long time.

1. Unthinned stands develop very slowly because of the competition for limited resources on the site. The individual crowns are maintained at a minimum size, sometimes as little as 10 percent of the height of the trees. The branches are never allowed to grow large until neighboring trees die out.
2. Diameter growth is always slow because live crowns are kept small. The achievement of large diameters which are beneficial for snags and down wood takes a very long time.
3. Root system growth is small when the site is fully occupied.
4. Understory development of shade-tolerant tree species and related shrubs is very slow or nonexistent until enough overstory trees die and drop out of the overstory. The number of different species is kept to a minimum until very late in the life of the stand.

Treatment Criteria

NWFP direction proposes timber harvest only in stands less than 80 years old; therefore, candidates are those stands within LSRs that are less than 80 years old, that are composed mostly of poles and/or small trees (GPVEG size classes 5-8). Approximately 90,000 acres within the LSRs are between the ages of 20 and 80 (see Maps 4-9, 4-14, 4-19, 4-24, 4-29, 4-34, 4-39, 4-44, and 4-49).

The Forest contains large contiguous acreage in stands from 75 to 100 years old which originated from stand replacement fires near the turn of the century. The Yacolt, Cispus, Siouxon, and Lewis River fires burned in this time period. These stands, are very similar in structure to younger forests. They are quite even in age and size, and consist primarily of Douglas-fir.

Criteria. Candidate stands are those so dense that individual trees are growing slowly. As these stands stagnate, they may

be naturally thinned by mortality caused by insects and disease. Various stocking guides can be used to assess stocking levels. For example, relative density can be used to estimate stand density for Douglas-fir (Curtis 1982). Thinning is most appropriate when relative density equals or exceeds 50-55; this describes a stand with about 175 15-inch trees per acre, or one with about 105 21-inch trees per acre.

Since early seral tree species have the greatest potential for longevity and attaining large size, stands with components of Douglas-fir, noble fir, western white pine, ponderosa pine, and western larch would have highest priority. Young, even-size, even-age, single-species stands are also high priority; thinning may help to develop a more varied stand structure and species composition in these stands.

Very young plantations (i.e., 35-45 years old) will often be highest priority for treatment. These stands will generally benefit most from treatments; they grow very fast at these ages. In addition, many stands in that age class may be relatively uniform, and could benefit from increased stand diversity. Other criteria for identifying high priority stands are crown ratio of greater than 40 percent, good access (to minimize road construction), and high density of tree stocking.

On a landscape scale, consideration should be given to stands that are important in providing connectivity (such as the Dog Mountain area and the large blocks of young stands in Woods, Wind and Lewis LSRs), or in areas where reduction of fire risk is important. Conversely, some areas, such as occupied spotted owl activity centers, will be low priority or avoided.

Many stands should not require treatment. Stands that currently have a diversity of tree sizes and species, areas of wide tree spacing, and that are developing late-successional or old-growth forest characteristics are low priority candidates for thinning. Stands with ongoing mortality due to pathogens (i.e., laminated root rot disease in Douglas-fir stands) may thin themselves, and develop added structural diversity as the disease progresses in the stand. On a landscape scale, we may want to leave stands untreated for added diversity.

Scale of Activities. Approximately 500 acres per year of thinning (primarily existing plantations) would enable us to evaluate practices. This would amount to about 1/2 of 1 percent of the gross acreage in these age classes within LSRs on the Forest.

Treatments Description

The objective of the thinning treatment is to help develop conditions meeting the desired conditions described in Chapter 3. Treatments should result in the long-term development of large individual trees, diversity of stand structure and species composition, snags, and down logs. Treatments should also develop structure and functions that may benefit late-successional related species. Some considerations suggested by the Regional Ecosystem Office, in their July 9, and September 30, 1996 letters exempting certain commercial thinning activities from REO review include:

> Ten percent or more of the resultant stand would be in unthinned patches.
>
> Three to 10 percent of the resultant stand would be in heavily thinned patches (i.e. less than 50 trees per acre) or in openings up to ¼ acre in size, to maximize individual tree development, encourage some understory vegetation development and to encourage the initiation of structural diversity.

The remainder of the stand should be thinned to a spacing appropriate for future management objectives. For example, a relative density of 35 (Curtis, 1982) will maximize growth on residual trees following thinning, yet will allow for future suppression mortality as stands grow and competition increases. This amounts to about 40 30-inch diameter trees per acre, or 67 21-inch trees per acre. Other guides or growth simulators may be used to estimate stand development following thinning.

The scale of activities should be considered in project planning. A small plantation might be treated uniformly when it adds diversity to the large-scale landscape. For example, a small plantation may be heavily thinned within a landscape that already contains unthinned patches and open areas.

Criteria for leave trees should be site-specific, but should provide for development of large crowns and limbs in some trees, maintaining minor species and structural diversity in stands, and maintenance of some trees with damage or disease, consistent with LSR objectives. While development of future large, old-growth individuals requires retention of large, healthy trees in the stand, a diversity of leave tree conditions is desirable.

Thinning should favor trees in dominant and co-dominant crown classes, although trees in all crown classes should be maintained to provide structural diversity. Thinning should not reduce tree species diversity.

In young stand commercial thinning (30-60 years) the key benefit is in maintaining fast individual tree growth. Trees can get big very quickly at this age. Also, it is a good time to get a second cohort started for future layering. Down logs and snags are not as important, given that they would be small in diameter and not last long. In thinning older stands (60-80 years) more emphasis should be placed in providing structure, snags, and down logs. Potential down logs and snags in older stands would be larger and more valuable as habitat. There is also likely to be intermediate trees and saplings to maintain and promote for canopy layering.

Snags and existing down wood will be retained, especially large snags or down logs, that may be remnants from previous stands of large trees. These late-successional forest features add structural diversity to the forest. They may be included within non-thinned or lightly thinned portions of stands.

Additional down wood will usually be required from existing live trees in thinning operations (see 5-6 Down Wood Management, page 5-26). Larger trees should generally be favored (see Size of Down Wood, page 5-27), it may be desirable to reduce leave-tree stocking in some portions of stands, particularly areas thinned to be small openings or heavily thinned patches, to utilize some larger trees as large down logs. An option may be to leave these trees standing, and monitor down wood added by windthrow in the first few years after thinning.

Related Activities

Other activities may be appropriate to conduct in conjunction with thinning to develop late-successional or old-growth forest characteristics. Thinning operations should include development of snags within thinned stands, from existing green trees, where current levels are deficient, or safety considerations require felling of snags during thinning operations. Some trees may be left to provide for down wood. See 5-5 Snag Management, page 5-23 and 5-6 Down Wood Management, page 5-26 for details.

Underplanting may be used to accelerate development of secondary tree canopies and to increase species diversity. Generally, underplanting should be accomplished with shade-tolerant tree species, such as western hemlock or Pacific silver fir.

Development of secondary tree canopies can also be accomplished on sites with existing small understory trees by protecting regeneration during thinning operations. Trees that survive the thinning will benefit from increased light and moisture, and develop more quickly.

A large percentage of big game winter range on the Gifford Pinchot National Forest lies within LSRs. Practices that enhance forage production, yet do not detract from LSR objectives, should be considered. For example, temporary roads in commercial thinnings might be seeded with native forage species to allow for some increased forage production while the thinned stand is more open.

Monitoring

Implementation monitoring should be conducted following treatment activities (including follow-up work such as snag and down wood creation). Formal or informal stand examination should be conducted to estimate stand density, and snag and down wood levels in thinned areas. Small openings and unthinned areas should be estimated by walk-through examination and review of maps or photos. If projects cover large areas, subsampling (i.e., 20 percent) may be adequate.

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Curtis, Robert O., 1982. A Simple Index of Stand Density for Douglas-fir. Forest Science, Vol. 28, no. 1, pp. 92-94.

Franklin, Jerry F.; Cromak, Kermit; Denison, William; McKee, Arthur; Maser, Chris; Sedell, James; Swanson, Fred; and Juday, Glen. 1981. Ecological Characteristics of Old-Growth Douglas-Fir Forests. USDA Forest Service, Pacific Northwest Forest and Range Experiment Station General Technical Report PNW-118.

USDA Forest Service, Pacific Northwest Region, Regional Ecosystem Office, 1996. Criteria Exempting Certain Commercial Thinning Activities from REO Review July 1996 Letter to Regional Interagency Executive Committee

5-3 Structural Enhancement in Older Stands

Need for Change

Many stands over age 80 contain little, if any, structural diversity (see Map 5-1, page 5-13 and Table 5-2). Many of these stands originated following wildfire around the turn of the century and have closed canopies of a single species. Stands of this type will develop late-successional/old-growth attributes very slowly. Minor, non-extractive treatments to these stands will promote or accelerate the development of structural diversity.

Treatment Criteria

Stands most likely to receive treatment range in age from 80 to 150 years, are relatively even-aged, consist of a single or few overstory species and lack vertical diversity. Candidate stands also lack structural components such as large snags, large down logs, multiple canopy layers and understory patches. Treatments will be applied to stands where natural pathogens are not present nor predicted to play a significant role in the near future.

An estimate of the extent of candidate stands was made by querying the existing vegetation database for the structural stage of stands older than 80 years. Table 5-2 illustrates the results. The location of these possible treatment opportunities is shown on Map 5-1.

There are many opportunities to promote structural diversity, especially in the closed small tree structural stage. These stands probably contain the least diversity since canopy closure is high and species diversity is likely low. These stands were probably initiated following wildfire around the turn of the century. Promoting structural diversity in these stands may also help to accelerate the development of larger overstory trees.

Table 5-2 Candidate Stands for Structural Enhancement

Structural Stage	Age >80 Acres
Closed sapling, pole (<9" dbh)	1,870
Open sapling, pole (<9" dbh)	716
Open small tree (9"-21" dbh)	18,978
Closed small tree (9"-21" dbh)	91,431
Lite forest (usually >21" dbh)	1,345
Large tree, single-story (>21" dbh)	15,420
Total	129,840

Treatments Description

Proposed treatments include the creation of snags, falling green trees or snags, underplanting shade-tolerant tree species and creating small openings in the overstory canopy. Treatments that include killing green trees should be applied only to stands that have sufficient live trees to meet required levels of large overstory trees as described in Chapter 3. Amounts of snags and down logs will be determined based on site-specific analysis and levels recommended in the Snags and Down Wood Treatments in this chapter (page 5-23).

Snags may be created by introducing heart rot organisms or blasting tops off of live trees with explosives. Both methods have certain advantages in promoting habitat for snag-dependent species, so both will be considered based upon site-specific analysis. Girdling may be employed if other treatment alternatives are not feasible. Down logs may be added to the forest floor by falling live trees or, where abundant, snags. Falling by blasting with explosives near the ground is desired to provide a ragged edge to the log which will accelerate colonization by decomposing organisms. Falling may be used if blasting is not feasible. Where applicable, snags and down logs may be created simultaneously by blasting at intermediate heights.

Multiple canopy layers may be developed by planting shade-tolerant trees, appropriate for the site, in open understory areas. It is desirable to integrate this underplanting with the creation of snags and down logs, where small openings would be created to facilitate the underplanting.

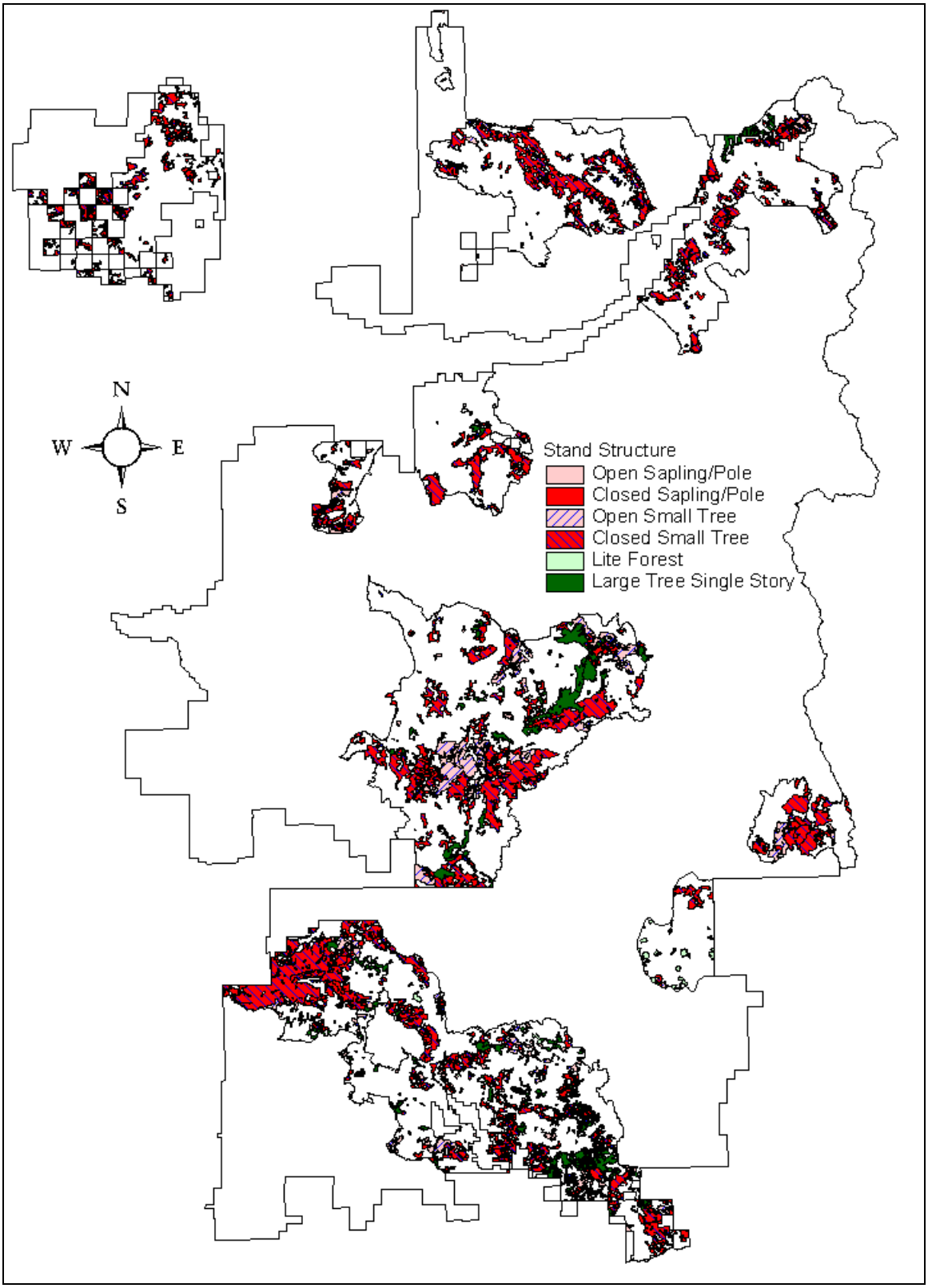
Created canopy gaps should mimic natural gaps in size and extent - average width of about 30 feet, maximum width of about 60 feet; no more than 15 percent of the stand area. In the grand fir zone, some stands that are dominated by grand fir may be enhanced by providing openings that range in size from ¼ to 5 acres to allow regeneration of ponderosa pine and Douglas-fir. Creation of small gaps in the forest canopy may be necessary for some late-successional and old-growth associated plant species, including tall bugbane (*Cimicifuga elata*) which requires small openings in the canopy to maintain viable, reproducing populations.

Understory shrubs, forbs and other organisms may be introduced in created openings, especially those that are limited in number or distribution.

Most of the above-described treatments may also be accomplished by allowing natural or prescribed fire to burn in these stands. The extent of such burning will be confined to opening sizes described above, for prescribed burns, and to ten acres if naturally occurring.

Scale of Activities. In spite of the large pool of candidate stands (see Table 5-2), funding may limit this treatment to less than 50 acres per year for the forseeable future. Some activities may be funded from K-V generated by projects in nearby Matrix areas.

Map 5-1 Older Stand Enhancement Opportunities



5-4 Treatments to Reduce Fire Risk and Maintain Late-Successional Forest in Gotchen LSR

Need for Change

Desired Condition. Twentieth century management in the Gotchen area has allowed multiple-canopy forests to develop and be maintained through fire exclusion. Old-growth that once dominated the landscape have been removed through partial timber harvest. Stands today are generally more dense and differ in species composition. These stands, primarily grand fir, are generally less fire tolerant and have a greater susceptibility to insects and other pathogens than the historic stands. One of the consequences of the change in stand composition is the continuing spruce budworm infestation.

The west portion of the LSR has been historically dominated by grand fir at lower elevation and subalpine fir at the higher elevations. However, prior to fire exclusion, the dry grand fir zone in the east portion of the LSR was comprised of open park-like stands of ponderosa pine and Douglas-fir. In the past few years stands in the Gotchen LSR have been infested with spruce budworm, with the most defoliation, mortality and resulting fuels accumulation occurring in the south and east areas of the LSR.

The desired condition within the moist grand fir zone in the west portion of the Gotchen LSR is to maintain the current large acreage of late-successional forest. (See Gotchen LSR Desired Condition, p. 3-15.)

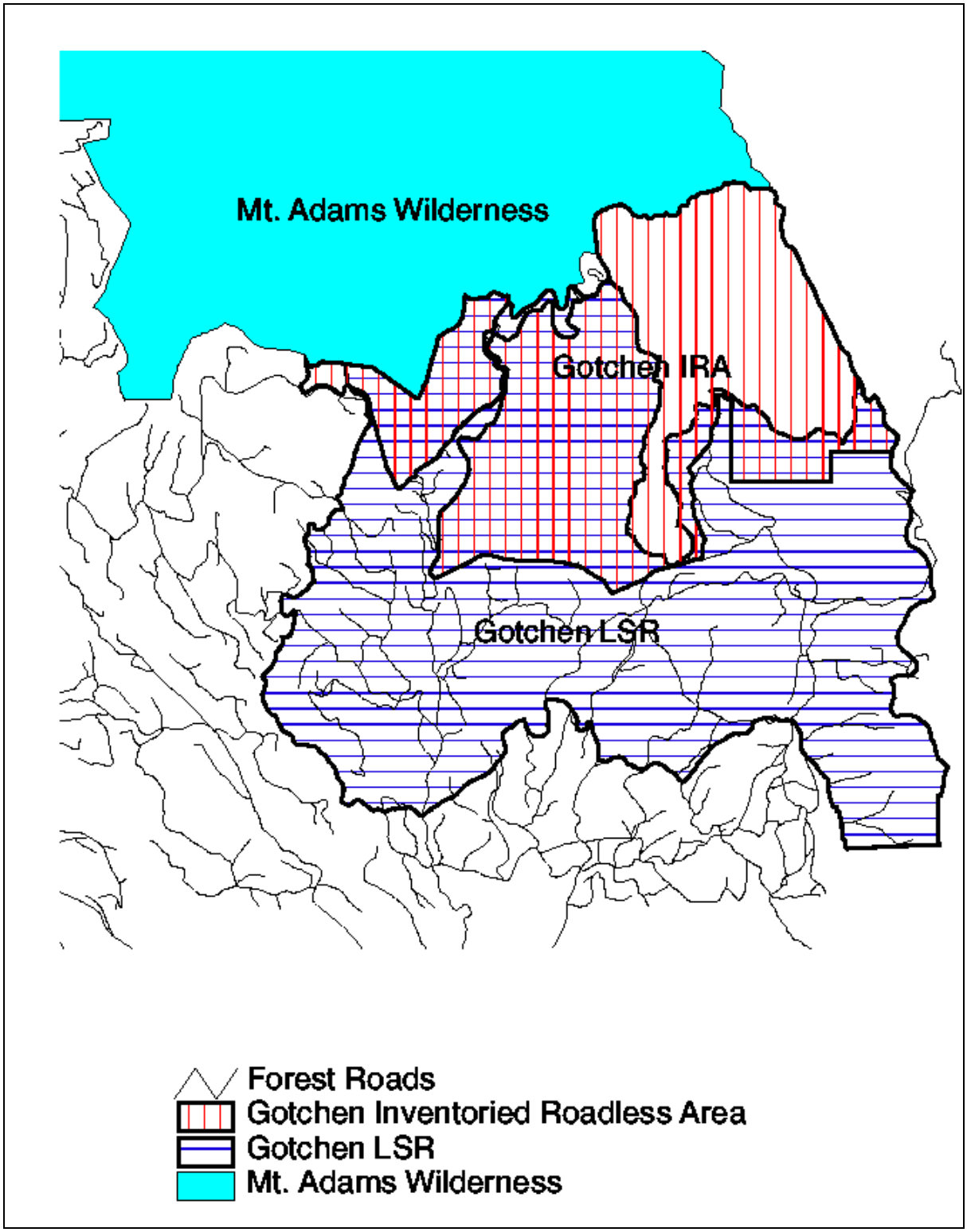
In the easterly portion where the grand fir stands are more at risk of loss from insects and disease, and thereby subjecting the entire LSR to loss from fire, the desired condition is a mosaic of stands containing fire tolerant, and more insect and disease resistant species intermingled with the healthy grand fir stands. This could be accomplished in the eastern portion of the LSR by increasing the amount of single-story, large-tree forests comprised of early-seral tree species (ponderosa pine, western larch, Douglas-fir) that are maintained by underburning or similar fuel treatments. These early-seral species typically comprise eastern Cascade old-growth forest.

Probability of catastrophic loss to fire will be reduced throughout the LSR by developing a central fuel break. An east boundary fuel break will be developed if conditions warrant.

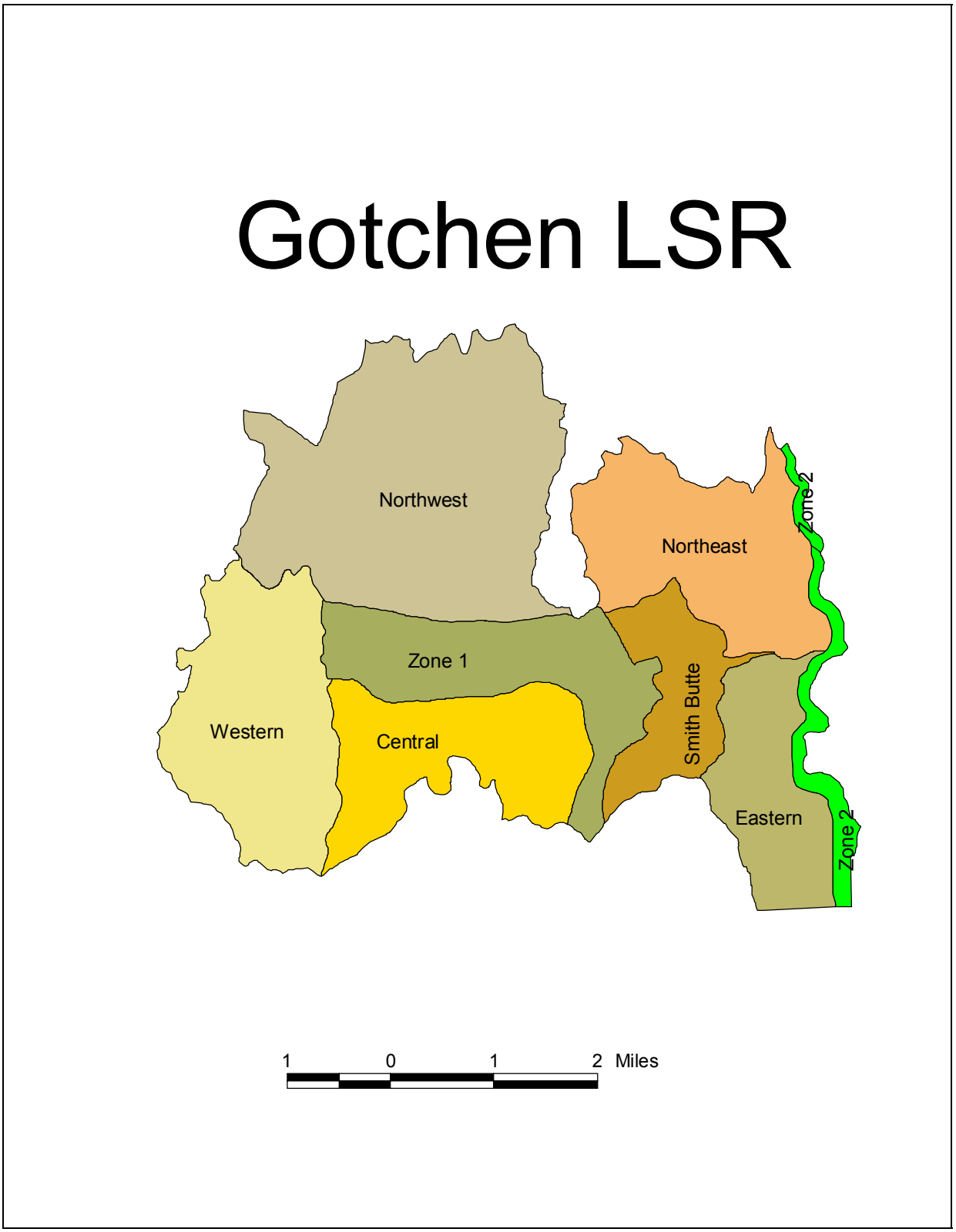
Existing Condition. The northern portion of the LSR overlaps the Gotchen Creek Inventoried Roadless Area. The southern portion of the LSR is heavily roaded (See Map 5-2, page 5-15.

Many of the current stands in the Gotchen LSR have developed following fire exclusion and selective removal of ponderosa pine and Douglas-fir during the 20th century. Large portions of these stands are now stocked with 80-100 year old stands of grand fir and Douglas-fir, with some residual overstory of old-growth ponderosa pine, Douglas-fir, and western larch. These stands are late-successional, but they may not be sustainable in the long-run. In the past 10 years, increasing amounts of insect and disease activity has caused a decline in tree health. Because of current insect and disease activity, forest stands have become increasingly susceptible to large-scale stand replacement fire. Even without fire, we are losing old-growth ponderosa pine and Douglas-fir. These older trees are under increasing stress, brought on by competition in today's more dense conifer stands.

Map 5-2 Gotchen LSR and Inventoried Roadless Areas



Map 5-2A Gotchen LSR Assessment Areas



In general, stands in the dry grand fir zone function as dispersal habitat for spotted owls. The more moist grand fir stands in the west function as nesting, roosting and foraging habitat.

In 1997, when the LSRA was initially prepared, spruce budworm were present in the LSR but not viewed as an imminent threat of a stand replacing disturbance. Insects and disease had caused widespread pockets of defoliation. Aerial and field reconnaissance in 1998 determined the budworm population was expanding in severity and extent, resulting in defoliation, top kill and fuel accumulation. The risk of stand replacing fire had become moderate to high in all but the westerly portions of the LSR as Fuel Model 10 (heavy fuel concentration) became more prevalent across the landscape.

The LSR is partitioned into two fuel break treatment zones and six forest health assessment areas, see Map 5-2A, page 5-16. The two treatment zones were areas included in the 1997 LSRA to reduce the risk of a large-scale, stand-replacing fire by providing fuel breaks along the easterly boundary and through the middle of the LSR. The six assessment areas were added to address fuels and declining stand conditions associated with the spruce budworm infestation. See REO exemption letter, page 5-21.23.

Existing conditions and management options specific to each of the treatment zones and assessment areas are summarized by area beginning on page 5-19 and in Table 5-3B, page 5-21.17 and

Table 5-3C, page 5-21.18.

FIRE HAZARD AND PROBABILITY

Chapter 6 assesses fire risk for the LSRs Forestwide. Table 6-1 indicates a fire frequency of one fire per 16 years per thousand acres or about one fire in the Gotchen LSR each year.

The potential sources of fire occurrence within the Gotchen LSR include the following:

Dispersed campsites. Due to topography and vegetation, there are many dispersed sites throughout the LSR. These sites are not inventoried, and are difficult to regulate. Many of these sites, which are often located along user-made roads, are used during the summer and autumn months. Unattended campfires, and fire starts from automobile exhaust systems coming in contact with cured grass on high clearance, primitive wheel tracks are potential causes for fire.

Other recreational use. The area attracts many day-use recreationists including hunters, hikers, berry pickers, bikers, and sight seers. Smoking may be the primary fire risk from these recreationists.

Travel corridors. Many forest visitors drive on the LSR's numerous primitive roads during the summer and early fall. Cured grass, which is highly flammable, is often encroaching on the road or growing between the wheel tracks.

Lightning. Thunderstorms are a common summer occurrence. These storms are accompanied by lightning, erratic winds, and, most often, precipitation. Although rain can limit the actual number of ignitions, the main factor that determines whether a fire starts is the fuel loading in the area that the lightning strikes. When lightning strikes areas of high fuel loading, fires are likely, regardless of precipitation.

Each assessment area was given an adjective rating of high, moderate or low based on fuels accumulation and historic occurrence of

lightning (See the Existing Condition for each assessment area beginning on page 5-21.17).

Fire Behavior. While the probability of occurrence may not have changed significantly, fuels loading and thus the consequences of a fire start has increased in much of the southern portion of the LSR from a Fuel Model 8 to Fuel Model 10. Maps 6-6 and 6-8 on pages 6-14 and 6-16 depict expected fire rate of spread and fire flame length for potential fire occurrence during the warmest, driest period of late summer - early fall, based on an analysis conducted in 1997. As depicted on these maps, many of the areas in Gotchen where a high rate of spread and long flame lengths are expected lie outside of the two fuel break treatment zones. Map 5-2B Fuel Model 10 Locations, page 5-21.1, portrays distribution of Fuel Model 10. When compared to Map 6-6, page 6-14 and Map 6-8, page 6-16, Map 5-2B gives an indication of how the risk of high-intensity fire increased throughout the LSR between 1997 and 1999.

Fire will occur in the LSR. The probability of fire occurrence by lightning or human causes is estimated for each assessment area in Table 5-3B, page 5-21.17.

With the help of the *BEHAVE* fire behavior model, fire behavior and resistance to control can be predicted. This program uses fuel models, topography, and weather models to predict and rate fire behavior in terms of *low*, *moderate*, or *high*. These ratings are good indicators of fire line intensity and resistance to control, and/or rate of spread as follows:

- **Low** - Fires can be attacked and controlled directly with ground crews building fire line and will be limited to burning in understory vegetation.
- **Moderate** - Hand built firelines alone would not be sufficient in controlling fires. Heavy equipment and retardant drops would be more effective.
- **High** - The most hazardous conditions in which serious control problems would occur i.e., torching, crowning, and spotting. Control lines would have to be established well in advance of flaming fronts, and heavy equipment and backfiring might be necessary to widen control lines.

Management Strategy. Twelve distinct stand conditions have been identified in the LSR (nine stand types, two fuel models, and one habitat type). Management treatment is recommended for each stand condition. These treatments would be applied in keeping with a five part strategy to maintain the LSR on a path toward the desired future condition.

First, the development of early seral tree species will be promoted throughout the LSR by managing stocking within existing plantations and future plantations that result from salvage (see Treatment Description, Groups 1-3). This stocking control should lower the risk of stand disturbance now and in the future. Also, the occurrence of stands managed in this way on the landscape should reduce the overall risk of the LSR to large stand replacement fires.

Second, mature stand treatments (see Treatments Description, Groups 4-7, page 5-21.2) are proposed to reduce fuel hazard by salvaging dead and dying trees, treating ground fuels, and, particularly in the eastern areas, promoting the development of fire and insect resistant tree species. The intention is to maintain the late-successional attributes where they exist, so that stands remain suitable habitat for late-successional species

Third, high fuel levels (Fuel Models 8 and 10) would be treated by mechanical methods and underburning. See Map 5-2B, page 5-21.1.

Fourth, two fuel break zones have been identified to reduce the likelihood of a large-scale fire in the LSR. Zone 1 was delineated to break up the concentration of fuels across the LSR by taking advantage of natural fire barriers, roads and thinned plantations. Zone 2 is a fuel break up to ¼ mile wide adjacent to the Forest boundary on the east side of the LSR. Within these zones, the combination of the proposed treatments will create a mosaic of stands with reduced fuel loads and stand densities in which crown fire is unlikely. Consequently, these

zones would slow advancing fire and provide opportunities to control a fire.

Fifth, budworm infected owl nest sites may be sprayed with the pesticide Bt to preempt loss of critical owl nesting habitat.

In summary, this approach seeks to accomplish the following:

- Maintain current late-successional forests.
- Foster future stability by managing the species composition of younger stands so that they develop into more ecologically stable late-successional forest.
- Apply treatments that promote more ecological stability in late-successional forests that have a structure prone to disturbance.
- Reduce the threat of stand replacing fire in the LSR as a whole.

This approach recognizes that the current risk of stand replacement disturbance rose from low to moderate between 1997 and 1999 and has the potential to increase rapidly.

Treatment Criteria and Stand Conditions

Candidate stands and conditions for treatments to minimize the risk of large-scale disturbance and loss of late-successional habitat are comprised of nine Stand Groups, two Fuel Models and owl nest sites.

Group 1 - Young Plantations. A mosaic of plantations occurs throughout the southern portion of the Gotchen LSR. They are generally healthy stands, are currently not late-successional habitat, and have low amounts of fuels. They present good opportunities as areas to maintain in a low-risk category as they grow and develop. They also serve as potential "anchors" for adjacent treatments to minimize disturbance risks.

Group 2 – Maturing Plantations. These are primarily densely stocked, Douglas-fir dominated stands less than 80 years old. Like the Young Plantation in the southern portion of the LSR, they would also be maintained in a low risk category and would serve as potential "anchors" for adjacent treatments to minimize disturbance risks.

Group 3 - Lightly Stocked Stands. These are very open, lightly stocked stands (less than 40 percent canopy closure), primarily grand fir. Often, root diseases or insects have caused mortality and resulted in the open condition. Since they are already open, these stands no longer function as late-successional habitat, and are excellent candidates to be reforested with early seral ponderosa pine and Douglas-fir. These stands are typically Fuel Model 10.

Group 4 - Dead and Dying Stands. These are partially stocked stands (less than 40 percent canopy closure) with mortality from insects and diseases (root disease, spruce budworm, fir engraver beetle and others). These are stands that have continuing mortality from insects and diseases, and may soon resemble the open stands mentioned in Group 3, above. Typically, a combination of root diseases, high stem density and insects are causing a decrease in tree vigor and eventual mortality, especially in grand fir. As with Group 3, these stands no longer function as late-successional habitat. These stands are often Fuel Model 10.

Group 5 - Declining Stands. These are partially stocked stands (greater than 40 percent canopy closure) with mortality from pathogens (root disease, spruce budworm, fir engraver beetle and others). These are stands that have continuing mortality from pathogens, similar to Groups 3 and 4. Typically, a combination of root diseases and insects are causing a decrease in tree vigor and eventual

mortality, especially in grand fir. These stands still function as late-successional habitat, but will lose that function in the future 5-10 years. These stands are often Fuel Model 10.

Group 6 - Remnant Old Growth. These stands contain at least a partial stocking of large, old-growth ponderosa pine and Douglas-fir, with secondary canopies composed primarily of grand fir. These ecologically valuable legacy features are at risk from competition from dense understory grand fir. These stands are typically Fuel Model 8.

Group 7 - Mature Grand Fir. These are stands fully stocked with grand fir, containing few overstory old-growth trees. These stands may be candidates for creation of small openings (group selection), to initiate development of early seral species without sacrificing their current status as late-successional, suitable owl habitat. These stands are typically Fuel Model 8.

Group 8 - Boundary Grand Fir. These are grand fir stands along the Forest boundary in the LSR. Stands subject to treatment within this group are those within one-quarter mile of the LSR boundary. This area may be important in providing connectivity to late-successional habitat on Yakama Nation lands to the east. These stands are typically Fuel Model 8.

Group 9 - Dense Lodgepole Pine located north and east of Smith Butte. Mature lodgepole pine stands are susceptible to mountain pine beetle, although little is present today. Significant mountain pine beetle mortality would increase fire hazard, threatening adjacent late-successional stands. Younger, harvested lodgepole pine stands have areas of heavy slash. Lodgepole pine stands provide important habitat for northern 3-toed and black-backed woodpeckers. The black-backed woodpecker is a rare/locally endemic species. Dense, unthinned stands provide habitat for snowshoe hares which are the prey base for lynx. These stands may be Fuel Model 8 or 10.

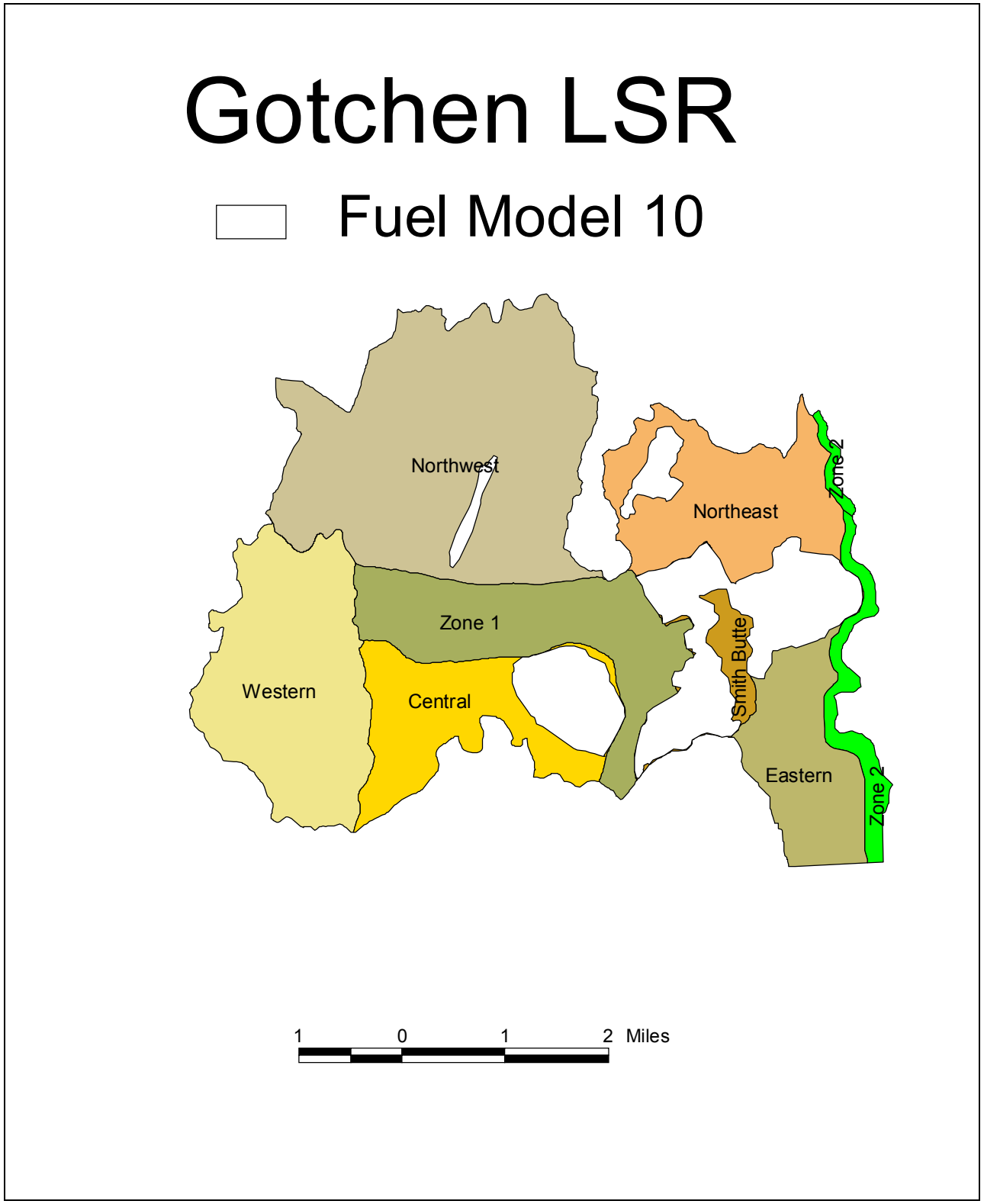
Fuel Models 8 and 10. The majority of the LSR falls into either Fuel Model 8 or Fuel Model 10 as described in *General Technical Report INT-122 Aids to Determining Fuel Models for Estimating Fire Behavior, April 1982.* In the northern most portion of the LSR, moss is the primary conveyor of fire. Moss has not been described in a fuel model.

Fuel Model 8 generally produces slow-burning ground fuels with low flame lengths. An occasional jackpot may be encountered. Usually, these fuels only pose fire hazards under severe weather conditions involving high temperatures, low relative humilities, and high wind speeds. Fuel Model 8 is most often associated with Stand Groups 6 through 9.

Fuel Model 10 generally has fires that burn in the surface fuels and ground fuels with greater intensity than the other timber litter models such as Models 8 and 9. Crowning, spotting, and torching of individual trees are much more frequent in this model. Controlling fires in this fuel model is difficult. Fuel Model 10 is most often associated with Stand Groups 3 through 5 and portions of Stand Group 9.

Spotted Owl Nest Sites are located throughout the LSR. Of the six known sites, five are presently occupied. The best 100 acres surrounding the nest site is a high priority for protection from budworm and fire.

Map 5-2B Fuel Model 10 Locations5-1



Treatments Description

Table 5-3, page 5-21.4, summarizes the treatment prescriptions, resulting fire hazard, suitability as late-successional habitat, particularly for the northern spotted owl and whether each is exempt from REO review.

Stand Group 1 - Young plantations. This treatment is described in detail in section *5-1 Young Stand Thinnings*, page 5-1. Thinning these stands should not only promote growth, but should help to maintain the sites in a low fire-risk situation. Young stand thinning may be applied in young stands throughout the Gotchen LSR. This treatment is exempt from REO review.

Stand Group 2 - Maturing Plantations. This treatment is described in detail in section *5-2 Commercial Thinning*, page 5-6. Commercial Thinning may be applied to candidate stands less than 80 years old wherever they occur in the LSR. This treatment is exempt from REO review.

Stand Group 3 - Lightly Stocked Stands. These stands should be reforested with primarily ponderosa pine and Douglas-fir to provide an early seral component for future stands. Pathologists should be consulted to determine presence of root diseases, and for advice on reforestation tree species to use. Since the objective is to provide long-term growing space for these trees, wide spacings of planted trees should be used. Exact spacing guidelines should be based on individual site characteristics. This treatment would be applied throughout the LSR. This treatment is exempt from REO review.

Stand Group 4 - Dead and Dying Stands. These stands will be harvested, consistent with NWFP Salvage Guidelines, to remove dead and dying trees not needed to meet LSR objectives and to reduce the risk of large-scale, stand-replacing fire. Harvested areas will be reforested with early seral tree species, as discussed under Stand Group 3. Early seral tree species should be maintained.

These stands do not function as late-successional habitat; reforestation should help to regrow a late-successional stand that is more resistant to large-scale disturbance. This treatment could be applied throughout the LSR, although the initial focus should be in and adjacent to Treatment Zone 1. Treatments in Stand Group 4 are subject to REO review.

Stand Group 5 - Declining Stands. These stands should be treated to remove dead and dying trees to reduce fire risk, and reforested as described for Stand Group 3.

Group 5 stands still function as late-successional habitat, but may not in the near future, because continued tree mortality may reduce the stands below minimum stocking levels. Treatment should only be in stands where an interdisciplinary team, including biologists, determines that the stand will not function as late-successional habitat within the next 5 years. At present, most candidate stands for this treatment are in Treatment Zone 1 and the southern portions of the LSR. Stand Group 5 Treatments are subject to REO review.

Stand Group 6 - Remnant Old Growth. In these stands, it would be beneficial to thin in the immediate vicinity of individual old-growth trees, removing understory and mid-canopy grand fir and western hemlock. This would lessen competitive stress on the older trees, and reduce risk of mortality from crown fires by removing ladder fuels. This treatment should remove approximately ½ of the shade-tolerant trees that are in the immediate vicinity (within 2 crown widths), and should not be applied to more than ½ of the old-growth trees in an area. This treatment should be applied throughout the LSR. This treatment is exempt from REO review.

Stand Group 7 - Mature Grand Fir. Two treatments may be applied in these stands,

and both may be applied in a given stand where appropriate.

First, to add structure and provide an early seral species component, small openings (approximately 1 tree length by ½ tree length in size) may be created and reforested with ponderosa pine, Douglas-fir, and western larch seedlings. No more than 20 percent of the acreage on a landscape should contain these small openings.

Second, stands may receive a light thinning to enhance stand resilience after insect attack. Thinning should concentrate on removing mid-canopy trees, and should harvest no more than 25 percent of stand basal area. At least 40 percent canopy closure of conifers should remain to allow stands to continue to function as spotted owl dispersal habitat. Any large early-seral trees will be retained. This treatment is exempt from REO review.

Stand Group 8. Boundary Grand Fir. Treatment in these stands consists of thinning to approximately 40 percent canopy closure, to provide a partial fuel break, yet maintain connectivity with the Yakama Nation lands to the east. This treatment is exempt from REO review.

Stand Group 9. Dense Lodgepole Pine Stands. Slash in young managed stands with heavy fuels concentrations should be hand piled, as necessary, to reduce fire risk.

Mature stands should be monitored for mountain pine beetle. A 3-step monitoring procedure is recommended by specialists at the Westside Insect and Disease Technical Center:

1. Apply risk-rating to lodgepole pine stands. This risk-rating gives an estimate of potential for mountain pine beetle outbreaks.
2. Track occurrence of nearby mountain pine beetle activity, annually, by monitoring annual insect and disease detection flights.
3. If risk-rating indicates high potential for outbreak of mountain pine beetle, and if monitoring shows mountain pine beetle in the vicinity or in stands in the LSR, contact entomologists at the Westside Insect and Disease Technical Center for a field review. If, in their opinion, there is a high likelihood that a mountain pine beetle outbreak is imminent or beginning, consider timber harvest and/or fuels treatments to manage fuel levels at an acceptable risk to the LSR.

Stand Group 9 Treatments are subject to REO review.

Fuel Models 8 and 10. Fuel models overlay the stand conditions described by the stand groups. Areas with Fuel Models 8 and 10 may be treated based on either the stand conditions, as described above, or the fuels conditions. Areas of Fuel Model 8 would be treated primarily by handpiling and machine piling along roads in the northern two assessment areas within Stand Group 7. Areas of Fuel Model 10 larger than 10 acres in size would be treated by removing dead and dying fuels, handpiling, machine piling or chipping. Roadside areas would be highest priority for treatment to expand the effectiveness of a road's function as a fuel breaks and reduce the risk hazard from human caused fire starts along roads.

Fuel Model 10 Treatments, other than those along key roads as described in the Three-Year Action Plan, are subject to REO review. Roads identified in the Three-Year Action Plan are:

80, 8040, 8040020, 8020, 8020021,
82, 8200060, 8200181, 8225, 8225101

Table 5-3 Treatment Summary

Stand Group, Fuel Model, or Treatment Area Component	Prescription	Late-Successional Forest Function		Potential Location of Treatment	Fire Hazard Post Treatment	Fire Tolerant Late Successional Forest in the Future	Exempt from REO Review
		PRE TREATMENT	POST TREATMENT				
Young plantations (SG 1)	Young stand thinning	No	No	Within plantations throughout LSR	Low	Yes	Yes
Maturing Plantations (SG 2)	Commercial thinning	No	No	Throughout LSR w/in dense stands of Douglas-fir	Low	Yes	Yes
Lightly Stocked Stands (SG 3)	Retain existing early seral spp., reforest with ponderosa pine and Douglas fir	No	No	Throughout LSR except Boundary	Low	Yes	Yes
Dead and dying Stands (SG 4)	Salvage and Reforest	No	No	Throughout LSR except Boundary	Low	Yes	**No**
Declining Stands (SG 5)	Salvage/reforest when mortality will result in loss of late successional habitat within 5 years.	Yes/No	No	Throughout LSR except Boundary	Low	Yes	**No**
Remnant Old Growth (SG 6)	Thin shade-tolerant spp. from immediate vicinity of individual remnant old growth	Yes	Yes	Throughout LSR	Moderate to Low	Yes	Yes
Mature Grand Fir (SG 7)	Create small openings, regen with early seral spp. Thin to enhance tree resilience	Yes	Yes	Treatment Zone 1, Smith Butte, Central and Northeast	Moderate to High	Difficult to determine; depends on future stand health	Yes
Grand fir along the Forest Boundary (SG-8)	Create partial fuel break with thinning to 40% canopy closure	Yes	Yes	Treatment Zone 2	Moderate Low to	Yes	Yes
Lodgepole Pine (SG 9)	Remove suppressed, dying fuels. Pile existing slash concentrations Consider treatments if mt. pine beetle outbreak is likely.	No	No	Lodgepole pine stands east and north of Smith Butte	Moderate to Low	No	No
Fuel Model 8	Chip, handpile, machine pile underburn	Yes	Yes	Throughout LSR	Moderate to Low	Yes	Yes
Fuel Model 10	Remove suppressed, dying fuels, chip, handpile, machine pile	Yes	Yes	Throughout LSR	Moderate to Low	Yes	Yes along key roads identified in the 3-year Action Plan. No for rest of LSR.
Known Spotted Owl Nests	Spray best 100 acres of habitat with Bt	Yes	Yes	Throughout LSR	Moderate to Low	Yes	Yes

Assessment Area Objectives

The ID Team assessed ecological functions at the landscape scale and attributed functions to each assessment area. The purpose of this assessment was to ensure that risk reduction activities would not jeopardize ecological functions. Management objectives were formulated to address the functions provided by each assessment area.

Table 5-3A Management Objectives by Assessment Area, describes the objectives of each assessment area. The objectives define the limits of silvicultural and risk reduction activity that could occur within the given assessment area. For example, one of the objectives of the Eastern Assessment Area is to maintain connectivity for spotted owl dispersal. Treatment activity would be permitted only to the extent that the connectivity function would not be diminished.

Objectives for Treatment Zones l and 2 are not included in Table 5-3A. The objective for Treatment Zone 1 is to provide a central fuel break, which would serve as an anchor from which to suppress wildfires. The objective of Treatment Zone 2 is to serve as a shaded fuel break that provides dispersal quality habitat for spotted owls and other late-successional species.

Table 5-3A Management Objectives by Assessment Area

Eastern	Smith Butte	Central	Western	Northwest	Northeast
Maintain connectivity for spotted owl dispersal (primary function)	**Maintain** connectivity for spotted owl dispersal (primary function)	**Maintain** connectivity for spotted owl dispersal (primary function)	**Maintain** NRF function (primary function) for existing pair	**Maintain** NRF function (primary function) for existing pair	**Maintain** connectivity for spotted owl dispersal (primary function)
Maintain NRF function for *King Mt.* pair home range.	**Maintain** NRF function for *Smith Butte* pair home range.	**Maintain** NRF function for existing owl pair home range.	**Maintain** connectivity for spotted owl dispersal	**Maintain** connectivity for spotted owl dispersal	**Maintain** NRF function for existing owl pair home range.
Maintain lodgepole community in 10% of the treatment area at 33% in each successional stage.	**Maintain** lodgepole community in 10% of the treatment area at 33% in each successional stage.				**Maintain** lodgepole/sub alpine community at 33% in each successional stage.
Reduce volatility and spread potential to prevent fire spreading to adjacent areas.	**Reduce** volatility and spread potential to prevent fire spreading to adjacent areas.	**Maintain** low volatility and spread potential	**Maintain** low volatility and spread potential	**Maintain** low volatility and spread potential	**Reduce** volatility and spread potential to prevent fire spreading to adjacent areas.
Decrease likelihood of human caused fire starts	**Decrease** likelihood of human caused fire starts				**Maintain** upland meadows from conifer encroachment
			Protect potential bull trout habitat	**Protect** potential bull trout habitat	

Application of Treatments on the Landscape

The composition of each area in the LSR was considered with respect to the management objectives, stand groups and treatment criteria to identify management options in each of the eight areas in the LSR. This section discusses the unique features of each area and the management options they provide.

Existing conditions for each Assessment Area are summarized in Table 5-3B, page 5-21.17. Management Options are summarized in Table 5-3C, page 5-21.18.

TREATMENT ZONE 1 (1,800 ACRES)

EXISTING CONDITION

Stand Group	Percent
SG-1 Young Plantations	25%
SG-2 Maturing Plantations	
SG-3 Lightly Stocked	
SG-4 Dead and Dying	15%
SG-5 Declining	20%
SG-6 Legacy Old Growth	10%
SG-7 Mature Grand Fir	30%
SG -9 Dense Lodgepole	

This fuel break area, located in the center of the LSR, has large acreage of existing open forest (mostly plantations), and ties in with other areas of low risk, such as existing roads and the Aiken Lava Bed. Treatments within this area should increase the percentage of area in early seral/open forest condition, while maintaining connectivity of late-successional forest across the LSR.

The fuel loading along roads in the area is high. Treatment Zone 1 was located to take advantage of the network of existing roads and plantations. Since the intent is to utilize these roads and plantations as anchors for controlling fire, any future road closure would be by gate and legal closure order rather than obliteration or a more permanent barrier.

This is a historically fire prone area which is subject to lightning. The likelihood of a lightning caused fire is considered moderate. The likelihood of a human caused fire, especially during hunting season, is considered to be moderate because the area is popular with hunters in the fall.

The potential for fires within this area to spread to other portions of the LSR is considered to be moderate.

Although nesting, roosting and foraging habitat (NRF) are present, the primary habitat function for the spotted owl is as connectivity and dispersal habitat

MANAGEMENT OPTIONS

The area lends itself to underburning. It is relatively flat, contains large trees, several plantations, and is roaded. Reintroducing fire into the ecosystem would not only treat fuels to reduce the risk of catastrophic fire, but would also retard succession to grand fir dominated stands. There is a need for silvicultural treatment prior to re-introduction of fire into Stand Groups 4 and 5. Removal of dead and dying trees within Groups 4 and 5 would reduce fuels enough to allow underburning followed by under-planting with budworm resistant species such as ponderosa pine and western larch. Typically after treatment, the Group 4 and 5 stands would retain about 20 percent to 25 percent canopy closure.

Approximately 15 percent of the assessment area (about 270 acres) contains Group 4 stands, and an additional 20 percent contains Group 5

stands. These collapsing stands contain heavy fuel loads, which pose a high threat to the entire assessment area as well as adjacent areas of the LSR. These stands would be treated by removing the dead and dying trees, and reforesting with more sustainable early-successional species such as larch, Douglas-fir, and ponderosa pine. Reducing the fire risk by removing dead and dying trees, treating existing fuels, and establishing more stable early successional species would move these acres towards a more sustainable condition.

In the western portion of Treatment Zone 1 there are opportunities to thin around legacy trees (SG-6) to relieve them of stress from competing grand fir.

TREATMENT ZONE 2 (400 ACRES)

EXISTING CONDITIONS

Stand Group	Percent
SG-1 Young Plantations	10
SG-2 Maturing Plantations	10
SG-3 Lightly Stocked	0
SG-4 Dead and Dying	0
SG-5 Declining	0
SG-6 Legacy Old Growth	0
SG-8 Mature Grand Fir	70
SG-9 Dense Lodgepole	10

These are lands within ¼ mile of the Forest boundary running the full north - south length of the LSR. All the mature grand fir stands within this area would be managed as Group 8 stands.

The northern half of the treatment zone is adjacent to Yakama Nation lands, the southern half is adjacent to state and private lands.

There are several user-made roads in the southern portion of the treatment zone. These roads provide access to the Forest from the private lands to the east.

The Yakama Nation, whose lands lie to the immediate east of the Forest boundary, have taken an aggressive policy towards treating the spruce budworm infested stands and the resultant fuels on their side of the line. The Yakama are harvesting grand fir stands, treating activity fuels, and regenerating to budworm resistant species.

The Group 8 stands are stocked with budworm susceptible species. At present, they are relatively healthy, and the adjacent landowners - especially the Yakama Nation and Campbell Group - are aggressively treating their budworm infested stands and resultant fuels.

The treatment zone is primarily stocked with grand fir. Prior to fire exclusion, the area was stocked with ponderosa pine and Douglas-fir. Grand fir stands within areas where grand fir was not historically present appear to be more susceptible to budworm infestation.

Approximately 25 percent of the grand fir stands have been thinned, and are relatively healthy.

Except for pockets of Fuel Model 10, fuel loading is at acceptable levels (Fuel Model 8).

The likelihood of ignition of fire from natural causes is unknown. This is the eastern-most portion of the Forest, and is subject to lightning. The likelihood of a lightning-caused fire start on either side of the Forest boundary is considered moderate.

The potential for fire to affect adjacent areas of the LSR is moderate.

MANAGEMENT OPTIONS

The creation of a shaded fuel break along the Forest boundary would give the LSR protection from off-Forest disturbance. We would not implement the fuel break unless the current conditions change. The triggering events would be:

- Fuels accumulation to Fuel Model 10 on lands adjacent to the Forest
- The Group 8 stands start to show evidence of decline and fuel build-up.

Managing this area as Treatment Zone 2 gives us the flexibility to create a fuel break along the entire length of the Forest boundary should the triggering events occur sometime in the future.

EASTERN ASSESSMENT AREA (1,300 ACRES)

EXISTING CONDITIONS

Stand Group	Percent
SG-1 Young Plantations	15
SG-2 Maturing Plantations	10
SG-3 Lightly Stocked	0
SG-4 Dead and Dying	10
SG-5 Declining	5
SG-6 Legacy Old Growth	0
SG-7 Mature Grand Fir	50
SG-9 Dense Lodgepole	10

The assessment area is primarily stocked with grand fir. Grand fir stands are less resistant to fire than the ponderosa pine stands which dominated the area prior to fire exclusion. It is believed that grand fir stands within areas that were historically stocked with ponderosa pine are more susceptible to budworm infestation than those that have been continuously dominated by grand fir.

Fuel loading is high (Fuel Model 10) within about 30 percent of the area. The fuel loading along Forest Road 82, the main travel route through this area, is high (Stand Group 9 with Fuel Model 10).

The assessment area contains a network of existing roads and plantations. Since the intent is to utilize these roads and plantations as anchors for controlling fire, any future road closure would be by gate and legal closure order rather than obliteration or a more permanent barrier.

The probability of a lightning caused fire is moderate; this was historically a fire-dominated ecosystem. The fire cycle in this area is from 5 to 45 years. Because the area is popular with hunters, the likelihood of ignition from people, especially during hunting season, is considered to be moderate.

The potential of fires within this area to spread to other portions of the LSR is considered moderate, particularly in the fall when prevailing winds are from the east.

Although nesting, roosting and foraging habitats (NRF) are present, the primary habitat function for the spotted owl is as connectivity and dispersal habitat.

MANAGEMENT OPTIONS

The area lends itself to underburning. It is relatively flat, contains large trees, several plantations, and is roaded. Reintroducing fire into the ecosystem not only treats fuels to reduce the risk of catastrophic fire, but also retards succession to grand fir dominated stands. There is a need for silvicultural treatment prior to re-introduction of fire into Stand Groups 4 and 5. Removal of dead and dying trees within Groups 4 and 5 would reduce fuels enough to allow underburning followed by under-planting with budworm resistant species such as Douglas-fir, ponderosa pine and

western larch. Typically, after treatment, the Group 4 and 5 stands would retain about 20 percent to 25 percent canopy closure.

The Group 7 stands, which are comprised of budworm host species (80 percent grand fir, 20 percent Douglas-fir and other), are candidates for budworm infestation. However, many of these stands have recently been thinned, have low fuel loading, are relatively healthy, and are currently functioning as late-successional habitat. These stands would not be subject to silvicultural treatment unless they decline to Stand Group 4 and 5.

SMITH BUTTE ASSESSMENT AREA (1,000 ACRES)

EXISTING CONDITION

Stand Group	Percent
SG-1 Young Plantations	0
SG-2 Maturing Plantations	25
SG-3 Lightly Stocked	0
SG-4 Dead and Dying	15
SG-5 Declining	15
SG-6 Legacy Old Growth	0
SG-7 Mature Grand Fir	35
SG -9 Dense Lodgepole	10

The assessment area is primarily stocked with grand fir and lodgepole pine. Prior to fire exclusion, the area was stocked with ponderosa pine and Douglas-fir. Grand fir stands within areas historically stocked with ponderosa pine are quite susceptible to budworm infestation.

Fuel loading is extremely high (Fuel Model 10) within about 70 percent of the area. Stands in this area have suffered the heaviest level of damage and mortality from insects and disease. Due to mortality and dead tops on defoliated trees, the fuel buildup will continue even if the budworm infestation subsides. Fire volatility would be very high due to heavy/flashy fuels.

Due to the assessment area's fuel loading, stand conditions, topography, and location, the risk of a fire start in this area consuming a large portion of the LSR is high.

This assessment area also has several hundred acres of lodgepole pine stands with heavy fuel concentrations.

The area contains a network of existing roads and plantations. As in the Eastern Assessment Area, the intent is to use these roads and plantations as anchors for controlling fire.

The assessment area is a historically fire prone area. There are numerous snags present, a prominent topographic feature (Smith Butte), and the area is subject to lightning. For these reasons, the probability of a lightning caused fire is considered high.

Although there is a known owl nest within the assessment area, the primary habitat function for spotted owls is as connectivity and dispersal habitat.

Approximately 200 acres of the assessment area are being considered for possible establishment of a Research Natural Area. The two hundred contiguous acres of unmanaged grand fir is considered to be unique.

MANAGEMENT OPTIONS

Approximately 15 percent of the assessment area (about 150 acres) contains Group 4 stands, and an additional 15 percent contains Group 5 stands. These collapsing stands contain heavy fuel loads, which pose a high threat to entire assessment area as well as adjacent areas of the LSR. These stands would be treated by removing the dead and dying trees, and

reforesting with more sustainable early-successional species such as larch and ponderosa pine. Reducing the fire risk by removing dead and dying trees, treating existing fuels, and establishing more stable early successional species would move these acres towards a more sustainable condition.

The Smith Butte Assessment Area contains about 350 acres of Stand Group 7. These stands would not be treated unless they begin to decline to Stand Group 5.

Portions of the Smith Butte Assessment Area are suitable for underburning. These are the flat, roaded areas containing stands of large trees as well as plantations. Reintroducing fire into the ecosystem will serve to treat fuels and suppress succession to grand fir dominated stands.

CENTRAL ASSESSMENT AREA (1,800 ACRES)

EXISTING CONDITIONS

Stand Group	Percent
SG-1 Young Plantations	5
SG-2 Maturing Plantations	0
SG-3 Lightly Stocked	0
SG-4 Dead and Dying	15
SG-5 Declining	15
SG-6 Legacy Old Growth	20
SG-7 Mature Grand Fir	45
SG-9 Dense Lodgepole	0

The northeastern third of the assessment area is primarily stocked with grand fir. Prior to fire exclusion, the area was stocked with ponderosa pine and Douglas-fir. The western two thirds of the assessment area contains about 350 acres of grand fir stands with a relatively large component of old-growth ponderosa pine.

The assessment area is a dry, historically fire-prone area. Fuel loading is high (Fuel Model 10) within about 30 percent of the area.

The northeastern portion of the assessment area has suffered insect and disease damage and mortality. Heavy fuel loads (Fuel Model 10) are present within about 30 percent of the Central Assessment Area (about 560 acres). Due to mortality and dead tops on defoliated trees, the fuel buildup will continue even if the budworm infestation subsides. Due to the assessment area's fuel loading, stand conditions, and location, the risk of a fire start in the northeastern portion consuming a large portion of the LSR is high.

The probability of a lightning caused fire is moderate; this was historically a fire-dominated ecosystem. The fire cycle in this area is from 5 to 45 years. The risk of human caused fires is believed to be moderate based on its popularity as a recreation destination.

The potential for fires within this area to spread to adjacent areas of the LSR is high if the fire occurs within the northeastern third of the assessment area because of heavy fuels. It is relatively low for the remaining two thirds.

The assessment area contains a network of existing roads and plantations. As in the Eastern and Smith Butte Assessment Areas, the intent is to use these roads and plantations as anchors for controlling fire. Road closures should provide for easy access for fuels management and fire suppression.

The area provides spotted owl NRF, connectivity and dispersal habitat.

MANAGEMENT OPTIONS

The Stand Groups 4 and 5 in the northeastern third of the Assessment Area contain heavy fuel loads, which pose a high threat to entire assessment area as well as adjacent areas of the LSR. The Group 4 and 5 stands in this assessment area are intermixed and, for practical purposes, would be treated as one stand type comprising almost a third of the treatment area. There are opportunities to enhance the stability of these stands by removing the dead and dying trees, and reforesting with more sustainable early-successional species such as larch and ponderosa pine.

The Central Assessment Area contains over 850 acres of Stand Group 7. Although relatively healthy at present, the Group 7 stands in the western portion of the assessment area are stocked primarily with budworm host species. If pathogen or insect activity increases within these stands, they should be assessed for treatment to increase stand resilience, reduce fuel loads, stand densities, and the risk of catastrophic disturbance.

With approximately 340 acres of Stand Group 6, and relatively good access, the Central Assessment Area provides the opportunity to thin around legacy trees to relieve them of stress from competing grand fir. The Central Assessment Area lends itself to underburning. It is relatively flat, contains large trees, and is roaded. In some areas there will be a need for silvicultural treatment to reduce ladder fuels prior to re-introduction of fire into the landscape. Reintroducing fire not only treats fuels and reduces the risk of catastrophic fire, but also suppresses succession to stands dominated by grand fir.

WESTERN ASSESSMENT AREA (2,400 ACRES)

EXISTING CONDITIONS

Stand Group	Percent
SG-1 Young Plantations	15
SG-2 Maturing Plantations	5
SG-3 Lightly Stocked	0
SG-4 Dead and Dying	0
SG-5 Declining	0
SG-6 Legacy Old Growth	30
SG-7 Mature Grand Fir	50
SG-9 Dense Lodgepole	0

The stands in the Western Assessment Area are primarily stocked with grand fir having Douglas-fir and ponderosa pine components. Although the Western Assessment Area is a transition zone to cooler moister conditions, and therefore not as dry as the more easterly assessment areas, it is still within the relatively dry grand fir zone. Prior to fire exclusion, the area was stocked with ponderosa pine, Douglas-fir, and grand fir. Grand fir stands that were historically stocked with a grand fir component are somewhat less susceptible to budworm infestation than those historically stocked with ponderosa pine.

With the exception of pockets of Fuel Model 10, most of the assessment area is Fuel Model 8.

The Western Assessment Area contains a network of existing roads and plantations. Since the intent is to utilize these roads and plantations as anchors for controlling fire, road closures should provide for easy access for fuels management and fire suppression.

Because it is somewhat more moist than the easterly assessment areas, the probability of a lightning caused fire is low. This was historically a fire-

dominated ecosystem. The fire cycle in this area is from 70 to 250 years. The popularity of the area with recreationists earns it a moderate risk of human caused fire.

The potential of fires within this area to spread to other portions of the LSR is considered to be low.

The Western Assessment Area provides the spotted owl with nesting roosting and foraging habitat.

MANAGEMENT OPTIONS

The assessment area contains over 1,400 acres of mature grand fir stands. The Group 7 stands are stocked with budworm host species (60 percent grand fir, 20 percent Douglas-fir), and are susceptible to budworm infestation. However, many of these stands have recently been thinned, have low fuel loading, are relatively healthy, and are currently functioning as late-successional habitat. If these stands remain healthy, they would not be considered for silvicultural treatment.

If the trigging events do occur, small-scale thinning to enhance stand vigor would be considered as a test of its efficacy in maintaining stand health.

With approximately 960 acres of Stand Group 6, and a relatively good access, the Western Assessment Area provides the opportunity to thin around legacy trees to relieve them of stress from competing grand fir.

There is a need for silvicultural treatment prior to re-introduction of fire into the landscape. The area lends itself to underburning. It is relatively flat, contains large trees, several plantations, and is roaded.

NORTHWESTERN ASSESSMENT AREA (4,300 ACRES)

EXISTING CONDITION

Stand Group	Percent
SG-1 Young Plantations	0
SG-2 Maturing Plantations	0
SG-3 Lightly Stocked	0
SG-4 Dead and Dying	0
SG-5 Declining	0
SG-6 Legacy Old Growth	40
SG-7 Mature Grand Fir	60
SG-9 Dense Lodgepole	0

The Northwestern Assessment Area's stands are stocked with grand fir, Douglas-fir and ponderosa pine components. Like the Western Assessment Area, this area is a transition zone to cooler moister conditions, and therefore not as dry as the more easterly assessment areas. The southern three-quarters of the assessment area is within the grand fir zone. The northern quarter of the assessment area is within the mountain hemlock zone. Prior to fire exclusion, the area was stocked with ponderosa pine, Douglas-fir, and grand fir. Stands historically stocked with a grand fir component are somewhat less susceptible to budworm infestation than those historically stocked primarily with ponderosa pine.

The stands within the mountain hemlock zone are stocked with lodgepole pine and subalpine fir. These stands are 80 to 90 years old, are approaching the end of their life cycle, and are starting to decline.

Except for pockets of Fuel Model 10, the majority of fuels within the grand fir zone portion of the assessment area is at Fuel Model 8. In the mountain hemlock zone, moss in addition to foliage, is a significant contributor to crown fire.

As stands start declining in the mountain hemlock zone, fuels (in addition to moss) will start to build up and transition into Fuel Model 10.

The western third of the assessment area contains a small network of roads and plantations. These roads and plantations will be utilized as anchors for controlling fire. Any future road closure would be by gate and legal closure order rather than a more permanent barrier. The majority of the Northwestern Assessment Area is unroaded.

Because it is somewhat more moist than the easterly assessment areas, the probability of a lightning caused fire is low. This was historically a fire dominated ecosystem. The fire cycle in this area is from 70 to 250 years. Because of its limited access, the risk of a human caused fire is considered low.

The potential of fires within this area to spread to other portions of the LSR is considered to be low. However, suppression would be difficult since most of the Northwestern Assessment Area is unroaded.

From a landscape perspective, maintaining the stand health and reducing fire risk in the Northwestern Assessment Area would help protect late-successional habitat within the adjacent Mt. Adams Wilderness where management options are restricted.

The Northwestern Assessment Area provides the spotted owl with nesting roosting and foraging and dispersal habitat.

MANAGEMENT OPTIONS

The Northwestern Assessment Area contains over 2,200 acres of Stand Group 7. About 75 percent of the stocking consists of budworm host species (grand fir, and Douglas-fir), and are susceptible to budworm infestation. However, most of these stands have low fuel loading, are relatively healthy, and are currently functioning as late successional habitat.

Commercial thinning is not considered appropriate for the following reasons:

1. Although comprised of budworm host species (mostly grand fir), the stands are considered to be somewhat less susceptible to budworm infestation relative to the dry site grand fir stands within the LSR. The Northwest Assessment Area is within the moist grand fir zone.
2. The analysis area functions as NRF habitat for the spotted owl. The mature grand fir stands are functioning as late-successional habitat. A minor amount of budworm-induced mortality could improve the structural complexity of the stands.

Risk reduction salvage would not be considered in these stands unless the following triggering events occur to change the current situation:

- Fuel buildup increases to where Fuel Model 10 occurs on a minimum of 10 contiguous acres.
- Budworm activity increases to level *BS 2* for 2 years, or *BS 3* for 1 year.
- Stands show a marked evidence of stand decline.

While the Northwestern Assessment Area contains approximately 1,500

acres of Stand Group 6, opportunities to thin around legacy trees will be limited by access.

NORTHEASTERN ASSESSMENT AREA (2,100 ACRES)

EXISTING CONDITION

Stand Group	Percent
SG-1 Young Plantations	0
SG-2 Maturing Plantations	0
SG-3 Lightly Stocked	0
SG-4 Dead and Dying	0
SG-5 Declining	5
SG-6 Legacy Old Growth	35
SG-7 Mature Grand Fir	50
SG-9 Dense Lodgepole	10

Approximately 85 percent of the stands within the assessment area are stocked with budworm host species. These stands are less resistant to fire than the ponderosa pine stands which characterized the area prior to fire exclusion. The Northeastern Assessment Area is primarily stocked with grand fir. Other species present include Douglas-fir, lodgepole pine, subalpine fir, and remnant ponderosa pine. Prior to fire exclusion, the area was stocked with ponderosa pine, Douglas-fir, and lodgepole pine. Grand fir stands within areas historically stocked with ponderosa pine are more susceptible to budworm infestation.

The southern three-quarters of the assessment area is within the grand fir zone. The northern one-quarter of this assessment area is within the mountain hemlock zone. The stands within the mountain hemlock zone are stocked with lodgepole pine and subalpine fir. These stands are around 90 years old, are approaching the end of their life cycle, and are starting to decline. Between 15 percent and 30 percent of the trees in these stands have dead tops, which ultimately contribute to fuel buildup.

Fuel loading is high (Fuel Model 10) within about 20 percent of the Northeastern Assessment Area. The lodgepole stands within the grand fir zone are overstocked and contain a large amount of ladder fuels. Within the mountain hemlock zone, moss is the primary carrier of fire. There is no fuel model to describe moss carried fire.

The Northeastern Assessment Area is mostly unroaded; the existing network of roads and partial cut units is quite limited. There are no plantations within the assessment area. The intent is to utilize the few roads and partial cuts as anchors for controlling fire. Road closures would be by gate and legal closure order rather than a more permanent barrier. Due to the more uneven topography, location, and existing use patterns, gates would be a more effective tool for road closure than within the other five assessment areas.

The probability of a lightning caused fire is moderate; this was historically a fire-dominated ecosystem. The fire cycle in this area is from 5 to 45 years. Because of limited accessibility, the risk of a human caused fire is considered low.

The potential of fires within this area to spread to other portions of the LSR, particularly in the fall when the prevailing winds are from the east, is considered to be moderate.

There is a known spotted owl activity center on the south side of Snipes Mountain. The stands in this area contain small (one acre) patches of large (≥ 30”dbh) Douglas-fir, grand fir, and subalpine fir. The understory is

relatively clear and open. Fuels are relatively light. The owls, which are banded, have moved out of the site, and are known to nest on Yakama lands to the east. The site, which is probably the highest elevation nest site on the Forest (4,400'), is presently unoccupied. There has been no modification of the habitat, and the reasons for the nest abandonment are unknown.

The Northeastern Assessment Area may contain lynx habitat.

From a landscape perspective, maintaining the stand health and reducing fire risk in the Northeastern Assessment Area would help protect late-successional habitat within the adjacent Mt. Adams Wilderness where management options are restricted

MANAGEMENT OPTIONS

About one-half of the assessment area contains Group 7 stands. These stands are relatively healthy, and are currently functioning as late-successional habitat. However, their age (80-90 years), species composition (grand fir, subalpine fir, and lodgepole pine) place them at risk of declining into Group 5 stands. These stands would not be treated unless the following triggering events occur to change the current condition:

- Fuel buildup increases to where Fuel Model 10 occurs on a minimum of 10 contiguous acres.
- Budworm activity increases to level *BS 2* for 2 years, or *BS 3* for 1 year.
- Stands show a marked evidence of stand decline.

If the trigging events do occur, small scale thinning to enhance stand resilience may be considered, as well as risk reduction salvage and fuel treatment.

Table 5-3B Existing Condition by Assessment Area

Assessment Area Attribute	Eastern 1,300 acres	Smith Butte 1,000 acres	Central 1,800 acres	Western 2,400 acres	Northwest 4,300 acres	Northeast 2,100 acres)
Potential for fire to affect other areas	Moderate due to patchy fuels	High	High in SE portion, low in rest of the treatment area	Low	Mod. potential to spread into Wilderness due to moss component	Moderate
Risk of fire from other area	Low to Mod. from off Forest via east winds	Moderate	High from Smith Butte via east wind	Low	Low	Low to Mod from off Forest via east winds
Fuel Model 8 (% treatment area)	70%	25%	70% but at risk to go to FM 10 due to BS 3	95%	95%	85%
Fuel Model 10 (acres)	30%	75%	30% but at risk to increase	5%	5%	15%
Fire Volatility	High due to flashy fuels	Very High due to heavy/ flashy fuels	Low	Low	Moderate	Moderate
Rate of Spread	Moderate	High	Low, but at risk to go to high due to BS 3	Low	Moderate	Moderate
Probability of ignition a) **Lightning** b) **Human**	 a) Mod b) Mod	 a) High b) Mod	 a) Mod b) Mod	 a) Mod b) Mod	 a) Mod b) Mod	 a) Mod b) Mod
% SG 4 (Loss of LS Function)	10%	15%	15%	0	0	0%
% SG 5, (Loss of LS function)	5%	15%	15%	0	0	5%
% SG 6 (Fully Stocked w/Old Growth	0	0	20%	30%	40%	35%
% SG 7 a) **suscept. to budworm** b) **benefit from resilience thin**	50% a) High b) Low, already thinned	35% a) High b) Mod, some areas need thinning	45% a) High b) Low, already thinned	50% a) High b) Low, already thinned	60% a) Mod due to spp. b) Mod. due to age	50% a) High b) Mod. due to age
% SG 9 (Mature lodgepole pine)	10%	10%	0	0	0	10%
Spotted Owl function	Primarily connectivity, some NRF	Primarily connectivity, some NRF	Primarily NRF, also provides connectivity	Primarily NRF	Primarily NRF	Primarily connectivity, some NRF
Presence of legacy groves	Low	Low	Low	Moderate	High	Moderate
Lynx Function a) **denning** b) **forage**	a) Low b) Moderate	a) Mod. b) Mod.	a) Mod. b) Mod.	a) Mod. b) Mod.	a) High b) High	a) High b) High
Potential Bull Trout Habitat	No	No	No	Yes	Yes	No
Special Features	Lodgepole	Meadow, Bats, Lodgepole	Sub alpine fir, wet meadows	Oak groves		Lodgepole

Table 5-3C Management Options by Assessment Area

Assessment Area Attribute	Treatment Zone 1	Eastern	Smith Butte	Central	Western	Northwest	Northeast
Underburning	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Risk Reduction Salvage Groups 4 and 5 and underplant.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Thin Group 7 Stands to enhance resilience.	Yes	No	Yes	Yes	No	No	Yes
Legacy Tree Culturing	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Roadside Fuel Reduction	Yes	Yes	Yes	Yes	No	Yes	Yes
Lodgepole Pine Mgt	No	Yes	Yes	No	No	No	Yes

Triggers

In the context of this Assessment, triggers are the criteria that lead to further analysis under NEPA, which in turn, may result in a decision to implement a management activity.

Table 5-3D, page 5-21.19, summarizes, by assessment area, the criteria that may lead to a proposal for silvicultural activity within the LSR. Management activities exempted from further REO review are summarized in Table 5-3 (page 5-21.4).

Three-Year Action Plan

Table 5-3E, page 5-21.19, is a three-year action plan of risk reduction activities. Some of these activities require REO review prior to implementation (see Table 5-3). This action plan is a projection of activities the Forest may implement in and adjacent to the Gotchen LSR over the next three years. Silvicultural treatments in the adjacent Matrix land allocation are not subject to REO review.

Matrix activities shown are those believed to contribute to the sustainability of the LSR by reducing risk in surrounding lands. For some activities funded through timber sales, it may be necessary to bundle LSR activities with adjacent Matrix activities to assemble commercially viable sales. If budworm or other pathogen activity intensifies and risk increases beyond that which is anticipated, this tentative schedule would be adjusted to respond to the situation within the framework established by this assessment. Decisions to implement any of these activities will be made with public involvement through the NEPA process.

The action plan was developed in pursuit of the objectives described in Table 5-3A. In developing the plan, the Forest placed the highest priority on those actions which reduce the risk of large scale stand replacing fire. The lowest priority for action are those activities which do little to reduce the risk of fire

throughout the LSR, and/or those activities for which the required triggering event has yet to occur.

Table 5-3D Triggers

Assessment Area Component	Treatment	Eastern, Smith Butte, Central, and Western Assessment Areas, Treatment Zone 1	Northeast and Northwest Assessment Areas	Treatment Zone 2 (Forest Boundary)
SG-4 Dead and dying stands	Risk Reduction Salvage Reforest w/ non-host species	Where SG-4 occurs	Where SG-4 occurs	N/A
SG-5 Declining stands	Risk Reduction Salvage Reforest w/ non-host species	Where SG 5 occurs in TZ 1, ≥ 20% of Assessment Areas	≥ 20% of treatment area	N/A
SG-6 Remnant Old Growth	Old Growth Culturing	Where SG-6 occurs	Where SG-6 occurs	N/A
SG-7 Mature grand fir stands	Thin from below to increase stand resilience and/or small group selection. Maintain 40% canopy cover.	Fuel Model 10 ≥ 10 acres, or stand can benefit from resilience thin East, Smith Butte, Central only	Northeast only: Fuel model 10 ≥ 10 acres. Budworm @ BS 2 in 2 years, or BS 3 for 1 year. Fuel models exceed FM 8. Evidence of stand decline. Resilience thin or group select adjacent to roads as test	N/A
SG-8 Boundary grand fir stands	Thin from below, maintaining at least 40% canopy cover	N/A	N/A	Fuel buildup on adjacent non-National Forest lands
SG-9 Dense Lodgepole pine stands	See SG-9, page 5-3	Applicable to Eastern and Smith Butte. Where it occurs.	N/A	N/A
FM 8	Treat fuels, underburn	No need to act except Treatment Zone 1	SG 7 showing signs of decline and fuels starting to build	Where it exists.
FM 10	Treat fuels, remove dying and suppressed trees	≥ 10 acres	≥ 10 acres	Where it exists
Aerial Spray	Aerial Spray Bt.	Within best 100 acres adjacent to owl nest	Within best 100 acres adjacent to owl nest	N/A

Table 5-3E Three-Year Action Plan

Project Description	Year 1 Acres	Year 2 Acres	Year 3 Acres
Roadside Commercial thinning as a fuel treatment within the LSR	450	400	0
Young stand management (Thinning and fuels treatment	200	200	200
Fuels treatment along key roads and small wood removal (hand piling and chipping)	100	100	0
Salvage and reforestation (Group 4 and 5 stands).	400	0	0
Bt spraying of selected sites inside LSR (100 acre owl cores) Forest boundary area (Matrix)	600 (Nests) 800 (Matrix)	0	600 (Nests) 800 (Matrix)
Underburning	400	400	400
Regeneration harvest in Matrix	150	0	0
Legacy tree culturing throughout LSR (Clearing around selected trees)	100	0	0
Commercial thinning timber sale (LSR & Matrix).	550	0	0
Commercial thinning within Boundary Treatment Area (TZ 2)	0	0	0

CRITERIA

The following describes the stand and landscape level criteria used to prioritize activities for the three year action plan portrayed in Table 5-3E. All activities discussed in the Management Options section are not necessarily priorities for the near future. For more detail on the treatments see Treatments Description, page 5-21.2.

Roadside stand and fuel treatments These treatments include roadside commercial and precommercial thinning, and roadside fuel treatments such as cutting and piling fuels for chipping. Highest priority for fuels reduction and silvicultural treatments are areas which are described by the following four attributes.

- Presence of Fuel Model 10 or SG 9
- High fire volatility
- Moderate to high risk of ignition
- Moderate to high potential for the fire to affect other areas
- Along key roads

Treatment of these fuels reduces risk of human caused fires from roadside ignitions while increasing the effectiveness of roads as fuelbreaks.

Young Stand Management would include pre-commercial thinning, pruning and fuel reduction throughout the LSR to promote the development of late-successional habitat. Management of lodgepole pine plantations would be considered separately from other plantations to optimize habitat for snowshoe hare, the prey base for lynx.

Risk Reduction Salvage of collapsing Group 4 and 5 stands, and reforestation with non-budworm host species will occur primarily in Treatment Zone 1, the extreme southwest portion of the Smith Butte Assessment Area, and the southeastern portion of the Central Assessment Area. The stands identified for risk reduction salvage in the Smith Butte and Central Assessment Areas are, for the most part, adjacent to Treatment Zone 1. The salvage of these collapsing stands would, in effect, increase the size and effectiveness of the original central fuel break (Treatment Zone 1).

Targeted spraying the best 100 acres of habitat adjacent to the known spotted owl nests with Bt would protect nesting/roosting habitat from possible budworm defoliation. Targeted spraying such as this has been shown to be an effective short-term (1-2 year) treatment. Population sampling of spruce budworm will be used to determine the necessity of spraying. Only those owl nests with high budworm populations would be sprayed. Spraying along the Matrix south of the LSR will also be assessed.

Underburning would occur within the Eastern Assessment Area and within the western portion of the Central Assessment Area. These underburns would occur in areas with low potential for catastrophic fire, and where there is a low to moderate risk of fire spreading in from other areas. The primary purpose of the underburns would be to reintroduce fire on the landscape to maintain low fuels levels and suppress succession to grand fir.

Regeneration harvest within the adjacent Matrix is a part of the overall landscape level strategy for reducing the risk of catastrophic fire within and around the LSR. Matrix stands exhibiting budworm damage would be proposed for harvest and conversion to non-host species such as ponderosa pine.

Legacy tree culturing will occur primarily in the Central, Western, and Northwestern Assessment Areas. These treatments would likely be packaged with harvest in the Matrix as well as roadside commercial thinning to make an economically viable sale. As described in the treatment for Stand Group 6, the understory within the immediate vicinity of individual legacy trees would be thinned to lessen the competitive stress to these trees, and, to reduce the chance of mortality from crown fires by removing ladder fuels.

Commercial thinning timber sale within the LSR, but away from key roads is considered a low priority for action. However, commercial thinning within the adjacent Matrix, would, in all likelihood, be coupled with legacy tree culturing, roadside commercial thinning, and Matrix regeneration in order to make a viable timber sale.

Many of the mature grand fir stands within the LSR have already been commercially thinned. The majority of the non-thinned mature grand fir are located within the Northwest and Northeast Treatment Areas. Within the Northwest Assessment area, commercial thinning would not be prescribed for the following reasons:

1. Although comprised of budworm host species (mostly grand fir), the stands are considered to be somewhat less susceptible to budworm infestation relative to the dry site grand fir stands within the LSR. The Northwest Assessment Area is within the moist grand fir zone stocked with pine.
2. The analysis area functions as NRF habitat for the spotted owl; the mature grand fir stands are functioning as late successional habitat. Some budworm-induced mortality would improve the structural complexity of the stands.

Within the Northeast Assessment area, commercial thinning is considered to be low priority for the following reasons:

1. At present, the mature grand fir stands are relatively healthy; there is evidence of only minor amounts of budworm activity.
2. The mature grand fir stands are functioning as spotted owl dispersal habitat. Some budworm induced mortality would only improve the structural and complexity of the stands.

Commercial Thinning within Treatment Zone 2 to create a forested fuel break is at present not a high priority for action. The Yakama Nation has been aggressively treating budworm infested stands and the resultant fuels on the tribal lands adjacent to the Forest boundary. This has greatly reduced the potential for catastrophic damage to the LSR from fire originating on the tribal lands. If fuels start building on the tribal lands in the near future, we would schedule a commercial thin to create a fuel break as the need arises.

Other Activities Conducted In Conjunction With Treatments

Treatments should consider development of snags and down wood. See *5-5 Snag Management* and *5-6 Down Wood Management*, which follow, for details. It may be possible to partially cover snag and down wood requirements by existing mortality, or anticipated future mortality from live trees with poor vigor. Designing treatments to include untreated patches of forest, in which snag retention may be more feasible, may help in maintaining adequate existing snags.

Where possible, utilize K-V funds from projects for precommercial thinning of adjacent plantations.

Treatments should provide for management of fuel conditions through use of prescribed fire or mechanical/hand treatment methods as described in Chapter 6.

Monitoring Plan

Declining Stands (Stand Group 5) The health of Stand Group 5 should be monitored to validate our ability to predict their decline to nonsuitable habitat within 5 years.

Underburning within the LSR or in similar stands in the matrix should be monitored to assess its effectiveness in reducing fuels, suppressing grand fir regeneration, and effects on residual stand mortality.

Spotted Owl Nest Sites should be monitored to determine occupancy and fecundity. Nest sites should also be monitored to assess the effects of Bt spraying on owl behavior.

Implementation monitoring should follow treatment activities (including follow-up work such as snag creation). Formal or informal stand examination should be conducted to estimate stand density, snag, and down wood levels in treated areas. Area of small openings and untreated areas should be estimated by walk-through examination and review of maps or photos. If projects cover large areas, sampling of a portion of the area or a portion of stands (i.e. 20 percent) may be sufficient.

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MEMORANDUM

DATE: September 1, 1999

TO: Nancy Graybeal, Acting Regional Forester, Forest Service, Regions 6

FROM: Donald R. Knowles, Executive Director

SUBJECT: Regional Ecosystem Office Review of the Amendment to the Gifford Pinchot 1997 Forestwide Late-Successional Reserve Assessment for Risk-Reduction Treatments in the Gotchen Late-Successional Reserve

Summary

The Regional Ecosystem Office REO) and the interagency Late-Successional Reserve Work Croup have reviewed the amendment to the Gifford Pinchot 1997 Forestwide Late-Successional Reserve Assessment (LSR) for risk-reduction treatments in the Gotchen Late-Successional Reserve (LSR). The REO finds that the LSRA, as amended, provides a sufficient framework and context for future risk-reduction projects within the LSR. In addition, future risk-reduction activities described in the amended LSRA that meet its criteria and objectives, and which are consistent with the Standards and Guidelines (S&Gs) of the Northwest Forest Plan (NFP) are exempt from future REO review, except for those projects noted below, which would remain subject to REO review. In addition, based on new information and changed conditions within and surrounding the LSR (see below), REO has also withdrawn our previous exemption for reviewing treatments in SG-4 stands.

Basis for the review

Under the S&Gs for the NFP, a management assessment should be prepared for each large LSR (or group of smaller LSRs) before habitat manipulation activities are designed and implemented. As stated in the S&Gs, these assessments are subject to the REO review. The REO review focuses on the following:

1. This review considers whether the assessment contains sufficient information and analysis to provide a framework and context for making future decisions on projects and activities. The eight specific subject areas that an assessment should generally include are found in the NFP S&Gs (page C-11). The REO may find that the assessment contains sufficient information or it may identify topics or areas for which additional information, detail, or clarity is needed. The findings of the REO review are provided to the agency or agencies submitting the assessment.

2. The review also considers treatment criteria and potential treatment areas for silvicultural, risk-reduction, and salvage activities if addressed in the LSRA. When treatment criteria are clearly described and their relationship to achieving desired late-successional conditions are also clear, subsequent projects and activities within the LSR(s) may be exempted from the further REO review, provided they are consistent with the LSR criteria and NFP S&Gs. The REO authority for developing criteria to exempt these actions is found in the S&Gs (pages C12, C-13, and C-18). If such activities are not described in the LSRA and exempted from future review in this memorandum, they remain subject to future REO review.

Scope of the Assessment and Description of the Assessment Area

The Gifford Pinchot National Forest submitted a document titled "Gotchen LSR Proposal for Amendment of the Forest Wide Late-Successional Reserve Assessment." Additional supporting information included: (1) a 'white paper', titled "Thinning and the western spruce budworm," which described effects of certain silvicultural manipulations on the spruce budworm and helped support some of their treatment rationale, (2) a document prepared by the fire/fuels planner dated July 26, 1999, titled "Addendum of fire/fuels inputs for the Gotchen LSR Amendment"; and (3) a topographic map of the LSR showing the key roads where fuel reduction activities would occur in the LSR. In addition, members of the LSR work group made two field trips (October 23, 1998 and July 27, 1999) to look at conditions described in the assessment and discuss some of the proposed treatment areas.

The Gotchen LSR is a 15,000 acre LSR and the driest LSR on the Forest, with much (86%) of it being in the grand fir vegetation zone. The LSR is described in a Forest-wide LSRA that has already been reviewed by REO (November 18, 1997 REO memo) and certain activities described in that assessment have been exempted from future REO review. Since that review, a spruce budworm outbreak that was originally described as light has increased in extent and severity within and outside of the LSR. The Forest is amending their original LSRA to address these changed conditions. This amendment modifies the original LSRA in the following ways: (1) additional treatments would occur in stands typed as fuel models 8 & 10; (2) Bacillus thuringiensis (Bt) would be sprayed in the immediate vicinity (the best 100 acres of habitat) of known spotted owl nests to reduce canopy loss to spruce budworm; (3) treatments originally limited to certain zones would occur in other portions of the LSR; and (4) fuels reduction, including commercial thinning, would occur in dense, mature lodgepole pine stands as part of roadside fuel reduction projects. Except for this treatment in dense lodgepole pine stands, the stand groups, stand prescriptions, and anticipated effects described in the original LSRA remain unchanged.

Review of the Assessment

The REO reviewed the amended LSRA in light of the eight subject areas identified in the S&Gs (page C-1 l) and finds that the amended LSRA provides a sufficient framework and context for designing future actions. The following treatments described in this amendment (as summarized

in Table 1 of the amendment) are exempt from future REO review: (1) treatments in fuel model 8 along roads within the northern two assessment areas in SG-7 stands; (2) treatments in fuel model 10 that are along key roads as identified in the supplemental map provided to REO (3) treatments of mature grand fir (SG-7) in the Smith Butte, Central, and Northeast portions of the LSR; (4) spraying of Bt in the immediate vicinity of known spotted owl nests (5) the expansion of Treatment Zone 2 to create a fuel break in grand fir stands along the eastern LSR boundary (SG-8); and (6) the treatment of dense, mature lodgepole pine stands along key roads, as identified in the supplemental map provided to REO, to reduce fuels.

Projects not exempted from REO review

Treatments in mature lodgepole pine stands, SG-9, not described above, remain subject to REO review as per the 1997 LSRA. In addition, the following treatments are subject to future REO review. Criteria describing these projects sufficiently to exempt them from further review may be developed and submitted to REO at a later date. Examples of factors that could be considered in developing these criteria include topography, aspect slope, distance from a high-risk area, location on the landscape as part of a landscape wide fuel break, potential to protect valuable late-successional habitat, ability to meet assessment area objectives, etc.

Dead and Dying Stands (SG-4): This treatment would remove dead and dying trees from those stands that are partially stocked and declining and have less than 40% canopy closure. The original LSRA stated, “this treatment could be applied throughout the LSR, although the initial focus should be in the proposed treatment zone." However, the condition of the LSR has changed greatly since the original review. The 1997 LSRA described the spruce budworm condition of the Gotchen LSR on page 4-42 as, "The severity of the current outbreak is light, defoliation and some top kill. Being on the western edge of the outbreak area, a slightly higher moisture regime may temper the ultimate impact of this outbreak on the Gotchen LSR. However, there are many stands that are very susceptible...To the extent standing dead and down fuels increase, the hazard potential for catastrophic fire also increases." The 1999 amendment states that the budworm outbreak in and around the LSR has increased in extent and severity, markedly increasing defoliation and fuels buildup with a corresponding increase in the probability of a large-scale stand-replacing fire. Because the extent and amount of this stand type has significantly changed since the original review, REO would like to review this treatment or see more specific criteria before exempting this activity from future review. While reducing fuel loads may be warranted in portions of the LSR to help reduce the risk of large-scale disturbances, small areas of disturbance are valuable components of late-successional systems and retention of some of these pockets is valuable to late-successional species.

Declining Stands (SG-5): This treatment would occur in partially stocked and declining stands with greater than 40% canopy closure where it is determined that these stands will cease to function as late-successional habitat within the next 5 years. The purpose of this treatment is to reduce the potential fuel buildup and subsequent risk of a large-scale, stand-replacement event. The amendment proposes to consider treating these stands throughout the LSR. While the reduction of existing and potential fuel buildup may be warranted in places throughout the LSR, these stands also provide interim value to late-successional species that would be lost if treated.

Fuel Model 10 treatments: This treatment would treat suppressed, dying fuels throughout the **L**SR via removal, chipping, handpiling, or machine piling. This treatment would be primarily applied along roadsides. Treatments in stands meeting the condition of fuel model 10 that are not along key

roads as identified on the supplemental map provided to REO and part of an integrated roadside fuels reduction treatment remain subject to REO review.

Conclusions

This amendment to the 1997 Gifford Pinchot Forestwide LSRA is specific to risk-reduction treatments in the Gotchen LSR Based on the review of the documentation and discussions with Forest staff, the REO finds that the LSRA, as amended, provides a sufficient framework and context for decision makers to proceed with project development and analysis. In addition, activities described in this amended LSRA are exempt from future REO review with the following exceptions: treatments in fuel model 10 stands that are not part of fuel treatments along key roads as identified on the supplemental map provided to the REO, treatment of SG-4 stands, and treatment of SG-5 stands. Additionally, treatments in mature lodgepole pine stands, SG-9, not described above, remain subject to REO review as per the 1997 LSRA.

cc:

REO RIEC, LSR Work Group

Mt. Adams and Wind River Acting District Ranger, Mary Gibson

Forest Supervisor, GIP

Lisa Freedman, FS

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5-5 Snag Management

Need for Change

Snags are an important component of late-successional forest ecosystems. They provide important habitat for many late-successional related plants and animals, and function as down wood after they fall. The NWFP (p. B-5, B-7) notes the importance of snags as a key element in late-successional forests. Table J2-8a-k indicates that many late-successional species benefit from snags (Mitigation 12, Appendix J-2 NWFP FEIS).

Data on existing snag levels from inventory plots on the Gifford Pinchot are summarized in the Table 5-4. Data are from plots that had at least 1 tree greater than 200 years old.

Table 5-4 Existing Snags per Acre (from old-growth inventories)

Plant Zone	Snags Per Acre	
	15-25"dbh	> 25"dbh
Western Hemlock	7	5
Silver Fir	9	6
Grand Fir	4	3
Mountain Hemlock	11	5

Standards and guidelines for salvage and silvicultural activities in LSRs require that adequate levels of snags be maintained after the activities. The NWFP (ROD p. B-5) states that moderate-to-high accumulations of large logs and snags are desired characteristics of late-successional and old-growth habitats. In a letter dated 7/9/96 the REO noted that for projects, one objective is to attain 100 percent of potential populations for snag-dependent species.

Neitro et al. (1985) describe requirements for snag-dependent wildlife species, and procedures for calculating numbers of snags required to maintain different population levels for westside forests. The Snag Recruitment Simulator Model (SRS) (Marcot 1992) is based on the model in Neitro et al. (1985). The model indicates that 4.34 snags per acre greater than 15 inches dbh are required to maintain 100 percent population levels of primary cavity excavators for the westside of the Cascades. For the east side of the Cascades, 5.26 snags per acre are required. The difference between east and west of the Cascades is based on differences in species of primary cavity excavators found in each area.

Results of validation monitoring that has occurred since publication of Neitro et al. (1985) indicate that some of the assumptions of the model are not valid. Work by McComb et al. (1992) and Schreiber (1987) indicates that secondary cavity nesters may be more sensitive to snag density than primary cavity excavators. The model calculates snag densities by determining the number of snags needed for nesting and roosting. However, Lindquist and Mariani (1991) and Bull (pers. comm.) have concluded that managing for nest and roost snags may not provide adequate numbers of snags for foraging habitat in western Washington and eastern Oregon. In addition, the model does not account for different types of snags used by species such as bats and Vaux's swift. This indicates that the above numbers may be inadequate for maintaining populations of all snag dependent wildlife species.

Information on snag densities from studies on snag dependent wildlife may be more appropriate to use in managing snags in LSRs. In the Oregon Coast Range, Mellen (1992) found snag densities at Pileated woodpecker nest sites to average 6.5 snags per acre greater than 16 inches dbh. In grand-fir stands of northeast Oregon, Bull (1980) found densities of snags greater

than 16 inches dbh at nest sites of flickers to average 6 per acre and at nest sites of hairy and black-backed woodpeckers to average 3.2 per acre. Bull (1993) found snag densities (greater than 20 inches dbh) in stands used by Vaux's swifts to be 16 per acre in northeast Oregon.

Treatments Description

Since information suggests that some current guidelines may be conservative, the goal is to manage for number of snags present in old-growth stands. Existing levels, appear to moderately exceed both models' outputs and research results.

Trees considered to be snags are dead, or dying, decayed trees which have dead or broken tops (see Neitro et al. 1985, pg. 154).

Snag numbers. The density and size of snags remaining after treatment should resemble natural stands of the same stand diameter and age. When stand diameter is greater than 15 inches dbh, manage for desired (inventoried from stands older than 200 years) levels of snags within LSRs by vegetation zone, per Table 5-4.

When treating smaller diameter stands the numbers and sizes of snags shown in Table 5-4 may not be practicable. These younger stands do not naturally contain the density and sizes of snags that are found in 200-year old stands. Killing a number of the largest trees in the stand to create snags would be counter to the objective of accelerating the growth of large trees for future habitat. The minimum snag numbers for smaller diameter stands is shown in. These figures were derived from forest inventory plots.

Table 5-5 Snags in Small Diameter Stands

Plant Zone	Number of Snags 11-17 in dbh
Western Hemlock Pacific Silver Fir Grand Fir	3
Mountain Hemlock	5.5

Distribution. Snags should be left in clumps during harvest operations. This should address safety concerns, and mimics the irregular distribution of snags on landscapes. Partial compensation of snag loss by leaving green trees for conversion is acceptable.

Treatments in young stands (11-21 inch dbh) should seek to preserve all existing snags greater than 15 inches dbh, as well as remnant green trees and snags from the previous stand by locating unthinned clumps where existing shags are present.

Timing. Implement snag creation within 5 years following salvage and thinning operations to utilize K-V funding. Assess natural mortality before creating snag from green trees. Tree mortality may partially satisfy needs.

Snag size. - (Neitro et al. 1985):

dbh - 1/2 of snags should be the largest available. All should be greater than 15 inches dbh, if available.

height - the taller the better but at least 1/2 over 40 feet tall and the rest over 10 ft. tall.

Species composition. Within the Grand Fir Zone, give preference to ponderosa pine and western larch.

Within the Pacific silver fir and western hemlock zones, give preference to Douglas-fir.

Otherwise, generally reflect the existing stand composition.

When converting green trees, make sure to maintain minor species as stand components. For example, if ponderosa pine is a minor component of a stand, it should not be converted.

Decay stage distribution. Maintain about 50 percent hard snags (stages I and II, Neitro et al 1985) and about 50 percent soft snags (stages III, IV, and V). This approximates the decay class distribution of mature/old-growth stands as indicated in Spies et al. (1988) and summarized in Table 5-6.

Table 5-6 Decay Class Distribution

Stage	Percent of Biomass		
	Young Stands	Mature Stands	Old-Growth Stands
I	5	8	20
II	19	38	41
III	26	33	25
IV	31	17	11
V	19	4	3
TOTAL	100	100	100

Consider down wood availability. Where down wood is deficient, leave additional snags to provide future high-quality down wood (see Treatment 5-6, page 5-26).

Distribution over time. Use Snag Recruitment Simulator model (Marcot 1992) to determine needs for future snag recruitment, where necessary.

Snag creation. Snags may need to be created over time or in stands currently lacking sufficient numbers of snags dead and dying trees. Snag creation techniques include:

- Blasting Out The Tops - this method leaves a jagged top that is readily invaded by decay causing organisms - the tops can be left on site to count towards down log requirements.

  Cutting Out The Tops - similar to blasting but less inviting to decay causing organisms.

- Girdling - girdling should be done at the point where breakage is desired. Trees girdled at the ground tend to break at the ground fairly quickly, limiting the life of the snag.

- Inoculation With Decay Organisms - this method is experimental but looks like it may be promising - any trees inoculated should be monitored closely to see if the desired results are accomplished.

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5-6 Down Wood Management

Need for Change

Down logs are an important component of late-successional ecosystems. They are an important pool of energy, carbon, and nutrients in ecosystems and thus can have effects on site productivity (Harmon et al. 1986). Down logs and their associated microenvironments and structure provide habitat and/or food critical for maintaining populations of fungi, arthropods, bryophytes, some vascular plants and many vertebrates (ROD p. C-40, Harmon et al. 1986). The CWD (coarse woody debris) field in Table 4-6 indicates those wildlife species that rely on down logs. In addition, NWFP FEIS Tables J2-8a-k indicate many late-successional associated species that benefit from down logs (Mitigation 11). For this reason the NWFP (ROD p. B-5) states that moderate-to-high accumulations of large logs is a desired late-successional characteristic in LSRs.

Data on existing down wood levels from inventory plots on the Gifford Pinchot are summarized in Table 5-7. These data are from plots that had at least 1 tree greater than 200 years old.

Standards and guidelines for salvage and silvicultural activities in LSRs require that adequate levels of down wood be maintained after the activities. In a letter dated 7/26/96, the REO recommends using research results on the biological needs of species using down logs as a basis for determining appropriate levels to retain. Existing levels of down wood could be misleading due to past harvest activities, salvage, firewood collection, or fire.

Table 5-7 Down Wood Ground Cover

Zone	Avg. % Cover	Maximum % Cover
Western Hemlock	6	25
Silver Fir	6	24
Grand Fir	3	5
Mountain Hemlock	1	14

There is a limited amount of biological information available on down logs as wildlife habitat. Available data is expressed in terms of percent cover of down wood. On the Olympic Peninsula, empirical data suggest that 15-20 percent cover of coarse woody debris on the forest floor, well distributed across the site, would be adequate for most small mammals (Carey and Johnson 1995). This is a level of down wood which is higher than would be expected to normally occur in most late-successional stands in the Western Cascades (Carey, pers. comm.). However, inventory data from the Gifford Pinchot indicates that some older stands can reach levels as high as 25 percent cover of down logs (Table 5-7).

Data from the Coast Range of Oregon indicate that occupied flying squirrel habitat has an average of 10 percent cover of down logs; unoccupied sites averaged about 5 percent cover of down logs (Andrew Carey, pers. comm.). This data is probably more reflective of typical down wood levels in the Western Cascades than the Olympic data (Andrew Carey, pers. comm.).

In southwest Oregon, down logs covered 7 percent (range 5-12 percent) of the home ranges of California red-backed voles (Tallmon and Mills 1994). The drier sites of southwest Oregon probably more closely reflect conditions on the east side of the Gifford Pinchot than from the Coast Range or Olympics.

The amount of CWD needed to maintain mycorrhizal fungi and site productivity is lower than that indicated for small mammal habitat as described above (Graham, et al. 1994). Graham, et al. (1994) report CWD in terms of biomass. Calculations from this data indicate a percent cover of 2 to 6 percent for the Grand fir Zone is adequate to maintain mycorrhizal fungi and site productivity.

Percent Cover. Because information on down wood as small mammal habitat is expressed in percent cover, guidelines below for each vegetation zone and activity are also expressed in percent cover.

The percent cover recommended will vary by vegetation zone and treatment. The cover goals should be met within 5 years after the stand manipulation treatment. This will allow for trees or snags that will normally fall soon after a treatment occurs to contribute to percent cover goals. This 5-year window will allow K-V funds to be used to create logs if necessary.

Treatment standards on the following pages vary for different activities. Salvage treatments in older stands have higher requirements for retaining down wood than do commercial thinning activities. For salvage activities in older stands, standards should allow for leaving an optimum level of down wood. For commercial thinnings, standards prescribe leaving lessor amounts, that are still in the range suggested by research. This should increase the likelihood of implementing thinning projects, and providing future large trees on those acres.

A simple method to calculate the percent cover of down wood is to use a linear transect. The length of transect intercepted by down wood is recorded and compared to the total transect length. For example, if a 100 foot transect intercepts three logs, and the total length of the transect that crosses the down wood is 10 feet, the transect samples 10 percent ground cover (10 feet transect crossing down wood divided by 100 feet total transect length). Logs less than 6 inches in diameter and 5 feet in length should not be counted.

Spatial Distribution. The percent cover guidelines do not need to be met on every acre but the average over a treatment area or stand should meet the guidelines. Avoid excessive jackstrawing of logs. Also avoid creating large areas with no down logs.

Size of Down Wood. In general, the larger the log, the better, in terms of longevity, fuel load concerns, and habitat (microsites). Most logs should be at least 20 feet long. Logs less than 5 feet long do not count toward the percent over goal. Size distribution of logs will depend on availability but smaller logs should make up a small proportion of the total and should primarily consist of decayed logs (Classes III, IV, V).

In general, down logs should be counted only if they are greater than 6 inches in large-end diameter, and material less than 6 inches in diameter (10 inches east of Cascades) should be avoided due to fire concerns and relatively low value of smaller logs. The percent cover of down wood reported in the above studies includes logs down to 10 cm (4 inches) in diameter. Less than 10 percent of the total down wood cover is generally between 3 to 6 inches in diameter (based on inventory data) and thus counting only logs greater than 6 inches in diameter has a small impact on total percent cover. In some cases, such as commercial

thinning, a 6 inch minimum may be hard to meet. If trees need to be felled to create down wood, the whole tree to the tip may be counted if it is at least 6 inches dbh. Project planners should work closely with a fuels specialist to minimize problems with fuel loading that may be caused by leaving smaller diameter wood on the ground.

Species Composition. Species composition of down logs should reflect the species composition of the stand.

Decay Class Distribution. Table 5-8 shows the distribution of logs by decay classes in terms of percentage of total down wood biomass occurring in each decay class in forests of the Washington Cascades (Spies et al. 1988).

Based on this data, amounts of down wood cover in sound (Classes I and II) and decayed (Classes III, IV, V) logs are given below for each vegetation zone.

Table 5-8 Percents of Down Wood by Decay Class

Stand Age Decay Class	Mature	Old Growth
I	3	2
II	16	14
III	32	43
IV	26	29
V	23	14
Total	100	100

Managing Down Logs Through Time. The goals for maintaining down logs as outlined below will require managing for some replacement logs as existing logs decay through time. A coarse woody debris decay and recruitment model is currently under development by the Area 7 Ecology Program. Completion of the model is expected in summer of 1997. This model should be used on a site-specific basis to determine the number of standing trees and/or snags needed to replace logs as they decay, before the stand is producing coarse woody debris.

Treatments Description

Mature Stand Treatments and Salvage

High Down Wood Levels

Western Hemlock and Pacific Silver Fir Zones

The goal is to maintain at least 20 percent cover in down logs greater than 6 inches in diameter. This percent cover is based on research by Carey and Johnson (1995) which indicates that 15-20 percent cover of coarse woody debris is adequate for most small mammals. The minimum diameter is to mitigate concerns for fuel loading.

Salvage areas are to be managed for the high end of down wood levels because in natural systems these are the areas that would provide high density pockets of coarse woody debris.

Distribution by decay class should be at least as follows to mimic natural conditions in old-growth stands (Spies et al. 1988):

- 4 percent cover sound logs (decay classes I and II)
- 16 percent cover decayed logs (decay classes III, IV, and V)

If decayed logs are deficient (i.e. after fire consumes down wood) compensate by leaving additional sound logs up to 10 percent cover. If total cover of down logs is still below 20 percent, compensate further by leaving enough standing dead and dying trees to equal the amount deficient. Decayed logs cannot compensate for sound logs.

Grand Fir Zone

The goal is to maintain at least 10 percent cover in down logs greater than 10 inches in diameter. This percent cover is based on the fact that current down wood levels in the Grand Fir Zone are about 1/2 the levels in western hemlock and silver fir zones and the NWFP Standards and Guidelines for down wood in Matrix lands east of the Cascades require leaving 1/2 the down logs required for the west side. Managing for high levels may increase risk of fire. In addition, research on flying squirrels (Carey, pers. comm.) and California red-backed voles (Tallmon and Mills (1994) was utilized. The larger minimum diameter is to mitigate higher concerns for fuel loading on the east side of the Cascades.

Distribution by decay class should be at least as follows to mimic natural conditions in old-growth stands (Spies et al. 1988):

- 2 percent cover sound logs (decay classes I and II)
- 8 percent cover decayed logs (decay classes III, IV, and V)

If decayed logs are deficient (i.e., after fire consumes down wood) compensate by leaving additional sounds logs up to 7 percent cover. If total cover of down logs is still below 10 percent, compensate further by leaving enough standing dead and dying trees to equal the amount deficient. Decayed logs cannot compensate for sound logs.

Mountain Hemlock Zone

The goal is to maintain at least 10 percent cover in down logs greater than 6 inches in diameter. This percent cover is based on the fact that current maximum down wood levels in the Mountain Hemlock Zone are about 1/2 the levels in Western Hemlock and Silver Fir Zones. In addition research on flying squirrels (Carey, pers. comm.) and California red-backed voles (Tallmon and Mills (1994) was utilized. The minimum diameter is to mitigate concerns for fuel loading.

Distribution by decay class should be at least as follows to mimic natural conditions in old-growth stands (Spies et al. 1988):

- 2 percent cover sound logs (decay classes I and II)
- 8 percent cover decayed logs (decay classes III, IV, and V)

If decayed logs are deficient (i.e. after fire consumes down wood) compensate by leaving additional sounds logs up to 7 percent cover. If total cover of down logs is still below 10 percent compensate further by leaving enough standing dead and dying trees to equal the amount deficient. Decayed logs cannot compensate for sound logs.

Intermediate Stands Treatments - Commercial Thinning

Moderate Down Wood Levels

While providing optimum levels of down wood in young stands can substantially improve the utility of these stands for late-successional forest-related species, it is one of several objectives which will lead to the creation of late-successional forest conditions. Other objectives include opening the stand to encourage the development of a diverse understory and releasing suppressed trees to grow more quickly into large trees typical of late-successional forests.

In some cases leaving the suggested levels of down logs may not be practicable. Felling a large number of trees to be left on-site may result in a sale that is not economically feasible. If the sale is not sold, none of the benefits to the development of late-successional conditions will be realized. The amount of down wood in the

undisturbed stands surrounding the treatment area is a key consideration in determining the minimum level of down wood needed in the harvested area.

The following guidelines should be met where possible. See the "Implementation Considerations" for suggestions on balancing conflicting objectives on economically marginal sales.

Western Hemlock and Pacific Silver Fir Zones

The goal is to maintain at least 10 percent cover in down logs greater than 6 inches in diameter. This percent cover is based on research on amount of down logs in flying squirrel habitat (Carey, pers. comm.) The minimum diameter is to mitigate concerns for fuel loading. See the discussion on Size of Down Wood, page 5-27.

Distribution by decay class should be at least as follows to mimic natural conditions in old-growth stands (Spies et al. 1988):

- 2 percent cover sound logs (decay classes I and II)
- 8 percent cover decayed logs (decay classes III, IV, and V)

If decayed logs are deficient (i.e. due to past fire or harvest) compensate by leaving additional sounds logs up to 5 percent cover. Decayed logs cannot compensate for sound logs.

Grand Fir Zone

Maintain at least 7 percent cover in down logs greater than 10 inches in diameter. This percent cover is based on research on amount of down logs in red-backed vole habitat in SW Oregon (Tallmon and Mills, 1994). The minimum diameter is to mitigate higher concerns for fuel loading on the east side of the Cascades. See the discussion on Size of Down Wood**,** page 5-27.

Distribution by decay class should be at least as follows to mimic natural conditions in old-growth stands (Spies et al. 1988):

- 1 percent cover sound logs (decay classes I and II)
- 6 percent cover decayed logs (decay classes III, IV, and V)

If decayed logs are deficient (i.e. due to past fire or harvest) compensate by leaving additional sounds logs up to 3 percent cover. Decayed logs cannot compensate for sound logs.

Implementation Considerations for Commercial Thinning. The intent is to meet the down wood goals within the 5-year K-V funding window and not necessarily at the time of harvest. Extending the time frame for implementation of the down wood goal acknowledges that down wood is often provided by windfall following harvest operations. The project area should be monitored for down wood accumulation in the third year after harvest and remaining down wood needs provided by non-extractive treatment funded by K-V.

In some stands, meeting the above down wood guidelines for commercial thinning at the time of harvest or within the 5-year window of K-V funding opportunity could jeopardize the economic feasibility the sale. In these cases the interdisciplinary planning team should balance the reduction of down wood benefits with the objectives of accelerating the development of other late-successional characteristics.

When down wood goals can not be met, the NEPA document should disclose the rationale for balancing downed wood, other late-successional, and economic objectives of the project. The silvicultural

prescription should include a description of how and when down wood goals will be achieved in future treatments. The following guidelines should be helpful in balancing late-successional objectives with sale economics.

Stands Over 15 Inches in Diameter

In stands where the average diameter is greater than 15 inches, meeting the "moderate" down wood guidelines should be a high priority. These sales should be more economically viable because of the larger tree size. The objective is to meet the above commercial thinning down wood guidelines by the time of the last treatment and this is likely to be the last management entry and opportunity to create down logs. Down logs of this size are of higher value to wildlife and will last longer. See Figure 5-1 Down Wood Decision Tree, page 5-33.

Stands Less Than 15 Inches in Diameter

In smaller diameter stands, the "moderate" down wood level should be met where feasible. In stands where average stand diameter is less than 15 inches, the benefits of opening up the stand to increase diversity and tree growth may outweigh the benefits of providing relatively small diameter down wood levels described in the "moderate" level goals beginning on page 5-29. If the project is not feasible at "moderate" levels of down wood, a lower level of down wood may be acceptable under conditions described below. Data from Spies et al. (1988) indicates that young stands typically have fewer down logs in the sound decay classes than older stands

Low Down Wood Levels

If half of the treatment unit area is within 230 feet of untreated stands having at least the "moderate" level of down wood or two-thirds of the treatment unit perimeter is adjacent to untreated stands having the "moderate" level of down wood, a "low" level of down wood is acceptable. See Figure 5-1, page 5-33.

Leave additional sound logs to provide a total of 3 percent cover (compared to the "moderate" level of 5 percent), or 2% in the Grand-fir zone (compared to the "moderate" level of 3%). Provide these percent covers of down wood on at least half of the harvest unit**.** Manage for the down wood goal (from crop or harvest trees) on at least 50 percent of the acres in the harvest unit, and distributed across the unit. This means 50 percent of the acres meet the reduced down wood goal (not 50 percent of the goal averaged over all acres). This distribution should provide suboptimal but useable down wood habitat. (The concept of providing useable habitat on 50 percent of a landscape was the basis for the 50-11-40 rule for spotted owl dispersal habitat.)

If the project is not feasible at the "low" down wood level and is beneficial to LSR objectives, it is subject to REO review prior to implementation.

Other Considerations. When selecting trees for down wood, consider selecting some from the larger (crop) trees as well as the smaller trees which would normally be harvested in a thinning. The larger trees will create better habitat and longer lasting down logs. Felling crop trees as down wood would also result in wider crop tree spacing which would promote larger crowns.

Commercial thinnings will involve relatively small logs. To maximize the habitat value of these small logs on the forest floor, down wood should be left in groups, rather than evenly distributed.

Ideally, decayed logs should make up about 80% of the down wood component.

Since we cannot create decayed logs, except to leave sound logs to decay, care should be taken to leave as many decayed logs on site and as undisturbed as possible. See Carey and Johnson (1995) for suggestions on minimizing disturbance of existing logs during harvest operations.

Literature Cited

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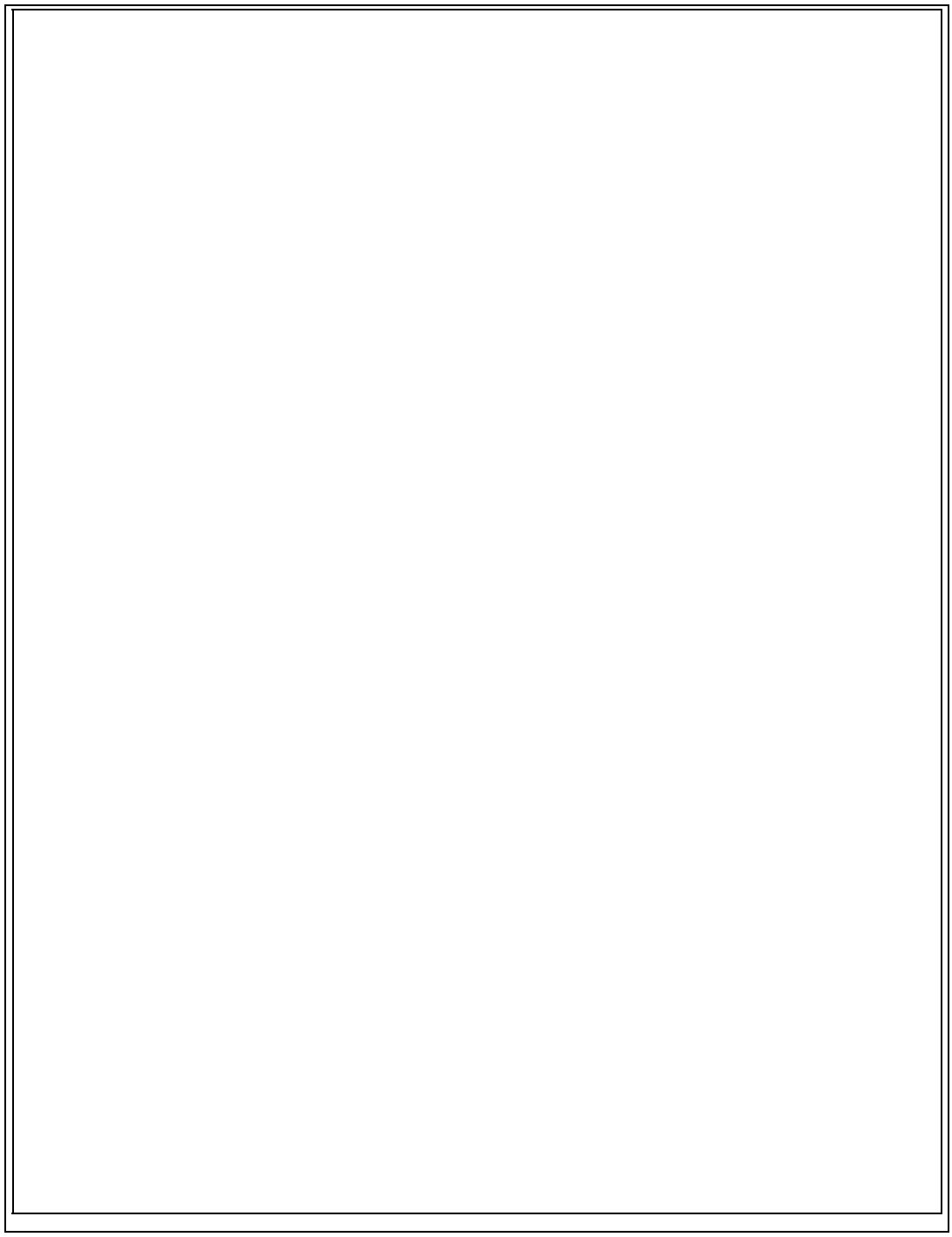
Tallmon, David, and L. Scott Mills. 1994. Use of logs within home ranges of California red-backed voles on a remnant of forest. J. Mamm. 75:97-101.

Figure 5-1 Down Wood Decision Tree



5-7 White Pine Blister Rust Treatments in LSRs

Need For Change

Western white pine is an indigenous species that suffers from white pine blister rust (*Cronartium ribicola*), a non-native fungal disease. The disease is widespread, and young western white pine (less that 30 feet tall) are most susceptible to infection and mortality. Genetically resistant white pine planting stock has only recently become widely available. Thus, there are many established plantations (10-30 years old) with western white pine that are highly vulnerable to the disease. Eventual mortality depends on the rust hazard of the site; the suitability of a particular site for the development of the rust fungus. The ultimate impact could be a delay in the development of some plantations to the late-successional condition, and a reduction in species diversity.

Treatment Criteria

Candidate stands would be in the 10-20 year age class with either planted or naturally seeded western white pine that are 5-20 feet tall. Candidate stands should also meet one of the following conditions:

1) Plantations where western white pine is a major component and rust hazard is moderate to very high. Gains in white pine survival will assist in meeting overall stocking objectives.
2) Plantations where western white pine is a minor component and rust hazard is moderate or lower. Treatment is likely to retain the western white pine component of this stand.

A method of determining blister rust hazard has been described by Petrick (1996), and considers rust index (Rice 1991), ribes level (the rust's alternative host), and environmental conditions.

There are approximately 100 to 200 acres of candidate stands that could be treated each year over the next decade. The majority of these stands are located in the Peterson LSR.

Limits to Application

Candidate stands describe a fairly narrow range of conditions for LSRs within the Gifford Pinchot. These treatments are not needed in candidate stands where the predicted rate of western white pine mortality would result in adequate stocking and species diversity, and even negate the need for precommercial thinning. It also would not be warranted in stands with very low levels of western white pine and high rust hazard because we are likely to loose these white pines regardless of treatment. The need for treatment is expected to decline substantially after ten years, as existing plantations pass through the window of opportunity for treatment and any new plantations should include rust resistant western white pine equal to the rust hazard present on the site.

Blister rust treatment will be dependent on availability of timber stand improvement funding and demand for stewardship contracts.

Treatments Description

Pruning and Excising.

Young trees are susceptible to rust because of the high percentage of young foliage in a high humidity environment close to the ground. Rust infections and cankers that develop on the bole or on branches within two feet of the bole have the potential to eventually girdle the tree. Thus, pruning the lower branches reduces potential infection sites, and the spread from already infected branches.

If the bole of the tree already has a canker and the tree is large enough, the canker may be excised. Canker excision consists of scribing a circle in the bark around the canker, thus creating a gap in the sapwood between diseased and healthy tissue (Hagle 1989).

Practice in Detail. Within candidate stands, pruning may be accomplished in two entries: the first when trees are about 5-8 feet in height, and the second when trees are 15-20 feet in height. The secondary treatment may target only infected branches and include excising bole cankers within 6 feet of the ground. Typically, all branches on the lower half of the tree are removed. Pruning only occurs on the western white pine. Pruned boughs may be removed as a commercial product (floral greenery), thus lowering the cost of treatment.

Pruning and excising would follow precommercial thinning if it is anticipated. Precommercial thinning has been shown to increase blister rust infections in pure stand of western white pine. This increase in infections can be negated by pruning (Hungerford 1982).

Literature Cited

Hagle, Susan K., Geral I. McDonald, and Eugene A. Norby. 1989. White pine blister rust in northern Idaho and western Montana: alternatives for integrated management. Gen. Tech. Rep. INT-261. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 35 p.

Hungerford, Roger D., Ralph E. Williams, and Michael A. Marsden. 1982. Thinning and pruning western white pine: a potential for reducing mortality due to blister rust. Res. Note INT-322. Odgen, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 7 p.

Petrick, John A. 1996. White pine blister rust hazard rating. Unpublished report. Cottage Grove, OR. U.S. Department of Agricultury, Dorena Tree Improvement Center. Cottage Grove, OR.

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5-8 Road Management

Need for Change

A goal for LSRs is to provide large blocks of unfragmented late-successional habitat. Roads fragment habitat. Public access provided by open roads is believed to disrupt the behavior of certain wildlife species. The current road system in the LSRs is an artifact of pre-NWFP management which required high road densities to provide access for timber management. Many roads are either no longer needed or their future use does not warrant year-around access or past maintenance standards. Some decommissioned roads may be maintained as trails.

New permanent road construction will be rare within the LSRs. Where road access is needed for silviculture or salvage, they will usually be temporary roads which are obliterated at the completion of the project. See 5-14 Noxious Weed Treatment, page 5-48 for a discussion of road management strategies to reduce the spread of noxious weeds.

Consequences of No Action. Failure to close and decommission unneeded roads could result in continued wildlife harassment and fragmentation of habitat. Forgoing road construction when needed for stand manipulation activities would result in the loss of opportunities to enhance late-successional habitats.

Treatment Criteria

The *Forest Access and Travel Management Plan* (ATM) describes desired future conditions for roads throughout the Forest. The ATM was assembled prior to the Northwest Forest Plan and most desired conditions were developed based on the 1990 Forest Plan. However the ATM was intended to be an iterative process, updated frequently by watershed analysis and through the project planning process. There is a need to review the DFCs in light of changes in management direction brought by the NWFP, especially within the LSRs.

Under the ATM most arterial and collector roads will remain open and be maintained to provide safe access to the public, and protect soil and water resources. Most road closures are in response to Forest Plan management objectives such as providing recreation opportunities and wildlife habitat. Map 4-53, page 4-115, displays the existing road system in each LSR. Table 4-39, page 4-120, summarizes road mileage in each LSR.

Treatments Description

Roads needed for future management activities or fire suppression access may be closed by barriers or gates. The roads to be barricaded would be closed to vehicular traffic, thereby reducing the vulnerability of wildlife to harassment during breeding, feeding and resting periods.

Watershed analyses have recommended road maintenance and storm proofing to reduce drainage problems before fill failure or gullying occurs. Since these activities will be confined to the road prism or clearing limits, their effects on late-successional habitat should be negligible.

Within right-of-way clearing limits, encroaching vegetation may be cut to maintain visibility. Hazard trees will be felled along roadways and developed campgrounds. Felled trees may be removed if coarse woody debris in the area is adequate. Snag creation away from the road or campground should be considered if hazard tree falling results in a snag deficit. Desired levels of snags and down wood are discussed by plant association in Treatments 5-5 Snag Management and 5-6 Down Wood Management.

Roads to be decommissioned are permanently closed and removed from the transportation system. Some decommissioned roads may be maintained as trails. Decommissioning involves removing culverts, ripping the road surface, and installing waterbars and dip drains. All disturbed sites that will not naturally reseed within one growing season should be revegetated. Grass, forbs, shrubs and trees material may be used as the site dictates. Erosion matting may be used on unstable slopes. The decommissioned road prism will be returned to a vegetated condition and, in some cases, resemble the natural contours of the landscape. Over time, the plant community would consist of many local, native species, developing structure and biodiversity benefiting late-successional associated species; however, many initial seed sources for the plant material will not be local. As per Regional Forester's memo (April 14, 1994, file code 2600), regarding Use of Native and Nonnative Plants, nonnative, short-lived annuals and perennials should be seeded; expectations are that the native species would become established within 1 to 2 years.

Presently there are few road construction projects within the LSRs. Some road realignment is underway to repair damage from the 1996 storms. Road construction should be planned to avoid or minimize impacts on late-successional habitat. Road construction should generally only be planned where potential benefits exceed the costs of habitat impairment (ROD p. C-16). Salvage and stand manipulation projects should minimize the amount of new road required. Alternate access methods, such as helicopter logging should be considered as an alternative to road construction. Any new roads built for stand management activities should be closed or decommissioned upon completion of the project.

5-9 Watershed Restoration

Need For Change

The purpose of the watershed restoration activities is to restore and enhance ecosystem function, and watershed conditions in particular. These projects will have negligible effects on late-successional habitat. Watershed restoration is one of the four cornerstones of the NWFP Aquatic Conservation strategy. The goals may include reduction of sediment yields to streams, reduction of maximum water temperatures, restoration of riparian vegetation, and establishment of bank and channel stability. Other projects are designed to repair roads damaged by heavy rain and high run-off during winter, and to prevent future erosion. Some roads will be decommissioned and closed to vehicular use. Most of the restoration work related to roads is confined to the road prism, will have negligible effect on late-successional habitat and will not be addressed in this Assessment. See *Programmatic Biological Assessment for Forest Management* (Armstrong et al. 1996) for details of these projects.

Implementation of watershed restoration projects should result in an accelerated, although gradual, improvement of aquatic habitats through stabilization of chronic sediment sources and increased biodiversity of riparian ecosystems.

Consequences of No Action. Watershed damage would heal at a slower rate. The duration of adverse effects such as sedimentation and elevated water temperatures would be extended.

Treatment Criteria

Candidates for treatment are limited to areas damaged by past management actions or natural events.

Map 5-3 Watershed Restoration Opportunities and Appendix 1 display identified watershed restoration opportunities within LSRs.

Treatments Description

Slope Stabilization and Rehabilitation

The objective of these projects is to enhance upslope stability by revegetating these sites using a grass/forb or shrub mix interplanted with conifers, native hardwoods or shrubs. On sensitive slopes erosion control blankets may be installed.

This work involves treating landslides and unstable slopes where vegetation is generally lacking. It includes hand planting of deep rooted species, including shrubs and trees; in some cases this is followed by hand- or aerial-seeding and fertilization, using a forb/grass/shrub mix.

When access is available to areas treated, planting and seeding is done by hand. In areas without road access, helicopters may be used to complete the seeding. Helicopter seeding generally occurs in the early fall season, and less often in the spring. On any particular road segment, use of helicopters will be limited. There will be few passes of a helicopter within 200 feet of the ground to deliver seed (and in some cases, fertilizer) to the disturbed site.

Up to 200 acres may be seeded each year and will vary with the extent of storm related damage. Within the deer and elk biological winter range forage species should be considered in seed selection.

Riparian Restoration

A riparian restoration project would interplant coniferous trees among homogeneous stands of deciduous trees. On some sites existing coniferous tree seedlings would be released from hardwood competition. The long-term objective of the project is to provide shade for the streamcourses, provide bank stability, biodiversity, and develop a potential source for high-quality, large woody debris in stream and riparian reserve areas. The need for riparian restoration must be balanced against the contribution that pure hardwood stands make to biological diversity at the landscape scale. The only site preparation necessary is the scarification of a planting site for the individual tree seedlings. There are 1,288 acres of hardwoods in stream associated riparian reserves within LSRs. Forestwide, up to 50 acres of riparian hardwood stands might be interplanted or released each year.

Seed Collection

Collection of seed and plant materials native to the Forest should allow the Forest to reduce use of non-native species. The Late-Successional Standards and Guidelines (ROD p. C-19) recommend that non-natives (plant and animal) should not be introduced into LSRs.

A short-term impact would be a small reduction of seed source for natural regermination of collected species at selected sites. The amount of seed collected will be so small as to have negligible effect on local populations.

Instream Stabilization and Fish Habitat Restoration

These projects are planned to help restore or enhance in-stream channel conditions. Projects would utilize large boulders and logs to stabilize banks and the channel. Streambank stabilization should decrease the width-to-depth ratio of streams, provide greater channel stability and improve habitat for native fish stocks. The boulders and logs could be transported to the site and placed by wheeled and/or tracked vehicle or by helicopter. Where down wood is surplus, it may be relocated for use in stream channels within the LSR. Soil bioengineering techniques would be used along streams to increase lower-bank vegetation. Riparian hardwood stands would be underplanted with conifers which will have the long-term benefits of:

a) reducing maximum water temperatures to acceptable levels for salmonids;

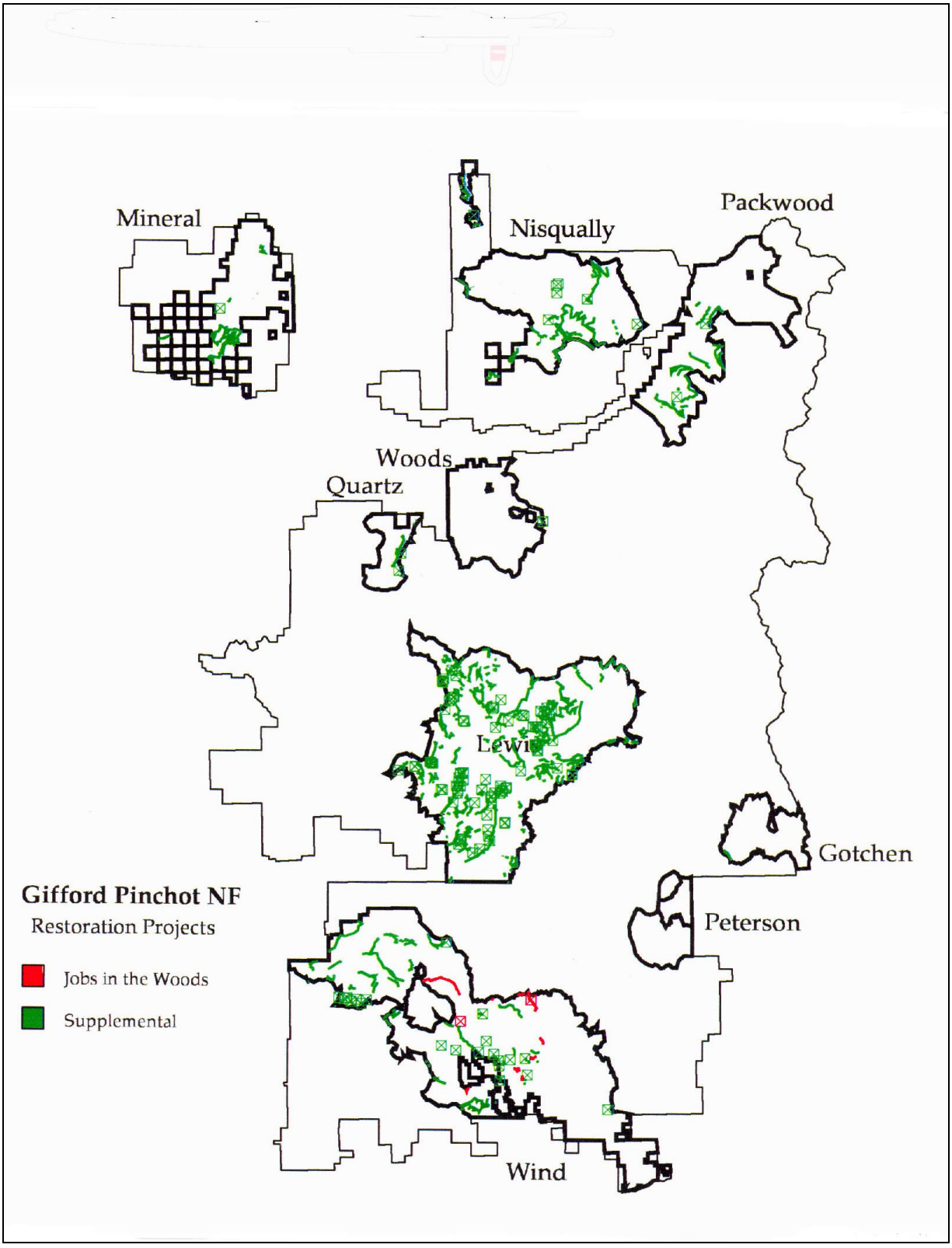
b) increasing stream shade; and

c) increasing in-stream large woody debris. Work involves the use of hand tools, including rock drills, in addition to heavy machinery, depending on access. In inaccessible areas, materials will be delivered to the site by helicopter. This activity should occur during the low-flow period, typically June 15 through September. These projects can occur throughout the Forest, usually in third- or fourth-order streams. Some second-order streams may also be treated.

Literature Cited

Armstrong, K., C.Cash, and R.Scharpf. 1996 Programmatic Biological Assessment for Forest Management. August 1996 revised.

Map 5-3 Watershed Restoration Opportunities



5-10 Trail Management

Need for Change

Demand for hiking, horseback riding, and ORV recreation opportunities is expanding. Use of many existing trails exceeds Recreation Opportunity Spectrum standards. Overuse diminishes the recreation experience and leads to resource damage. There are opportunities to accommodate the growth in demand by expanding the trail system within the LSRs, as well as other areas of the Forest. The Forest Plan projected 340 miles of trail construction and reconstruction and 1,250 miles of trail maintenance in the first decade. Because of funding shortfalls, accomplish-ments are far short of this projection.

Within the LSRs are designated cross-country ski trails which are part of a trail system accessed from Sno-Parks. The best snow conditions for these trails occurs when there is an opening in the tree canopy about the width of the trail corridor (20 to 30 feet). An adequate opening results in less interception of snow by tree crowns, and provides deeper, fresher snow on the ski trail surface. While many ski trails already have these semi-open crown conditions (most are located on existing single lane single lane roads) some trails would benefit from removal of individual trees along the trail to improve snow conditions on the ski trail. It is also desirable to remove roadside reproduction (alder and small conifers), which under the weight of snow, bend over and crowd the trail. Some of this brushy vegetation is routinely removed by roadside brushing.

Consequences of No Action. The primary effect of not implementing these projects would be the loss of recreation opportunities and continued congestion of the existing trail system.

Treatment Criteria

The trail construction and reconstruction projects in Table 5-9 have been proposed within LSRs over the next 5 years. The trail program has been under funded in recent years. Limited funds for trail maintenance has resulted in an emphasis on trail reconstruction in preference to new construction.

Cross-Country Ski Trail Maintenance. High priority candidates include about three miles of existing trails located on Forest Roads 8225 (from spurs 181 to 101) and 8225081 (from 8225 intersection to 110) in the Gotchen LSR. Also in the Gotchen LSR, approximately seven miles of trail have been suggested for potential future development through various scoping and planning processes, much of which is described in the King Integrated Resource Analysis (1991).

Another high priority is about three miles of trail along Road 7605 and 7605-086 that provide winter access to Burley Mountain Lookout in the Woods LSR.

Table 5-9 Planned Trail Construction and Reconstruction

Project Name	Project Length	Year	LSR Affected	Type of Use
Valley Trail Connection to Kraus Ridge Tr.	7 mi.	1998	Woods	Motorcycle, Mt. bike, horse, hiker
Burley Mt. Tr. Connection	3.5 mi.	1999	Woods	Hiker
Allen Mt. *RTT	3 mi.	1998	Nisqually	Motorcycle, Mt. Bike, horse, hiker
Lake Christine Trail Recon-struction	1.8 mi.	1997	Nisqually	
Puyallup Trail Reconstruction	2.5 mi.	1998	Nisqually	Hiker, horse
Carlton Creek Trail Recon-struction	4.0 mi.	1997	Packwood	Hiker, horse
Tatoosh Trail Reconstruction	9.0 mi.	1998	Nisqually	Hiker, horse
Bypass Trail Relocation/ Reconstruction	1.0 mi.	1997	Packwood	Hiker, horse

*RTT - Roads to Trails

Treatments Description

Trail construction and reconstruction projects can require the use of chainsaws, small power tools, hand tools, and trail machines such as small excavators, tractors, and compactors. Some understory clearing, including the removal of small trees less than 2 inches in diameter, may occur. Even though trails are designed to minimize the removal of larger trees because of their aesthetic value, a few larger trees or snags may need to be removed. Trail construction or reconstruction may involve the use of blasting.

Activities should be scheduled to minimize impacts to wildlife.

Construction and use on trails will be managed to be consistent with LSR objectives.

Cross-Country Ski Trail Maintenance. In areas where total canopy cover results in poor snow conditions, overstory trees will be removed to allow more snowfall on the trail. Removal of single trees, opening a maximum of a 25 to 30 foot corridor (about the width of a road right-of-way) is desirable.

5-11 Salvage and Risk Reduction

Although the objectives of traditional salvage practices often include an element of risk reduction, the NWFP makes an important distinction between salvage and risk reduction. Salvage guidelines are described in the NWFP on pages C-13 to C-16, and guidelines for Risk Reduction are described on pages C-12 to C-13. Salvage guidelines may be relaxed when salvage is used as a tool to reduce the risk of large-scale disturbances.

Refinements to NWFP Salvage Guidelines

The following is intended to clarify the application of three of the eleven salvage guidelines in their application to the Gifford Pinchot LSRs; the 10 acre minimum disturbance size and 40 percent crown closure threshold are not modified.

Timber salvage may be proposed to remove dead and dying trees from an area following a stand-replacing event due to wind, fire, insects, and/or diseases. At present, salvage operations are only being considered for hazard trees and windthrow within road prisms and within the Gotchen LSR.

Disturbances can be considered to occur in three size categories; small, those under 10 acres; moderate, those of 10 to several hundred acres; and larger disturbances. Salvage activities will not be conducted in small disturbances, unless needed to reduce risk of large scale disturbances. Salvage in disturbances larger than several hundred acres are not addressed in this assessment and will be subject to REO review. The following is intended to apply to disturbances in the "moderate" size range. This would typically include wind driven fire events spanning one or two burning periods.

Larger scale disturbances covering thousands of acres, which could occur from fires or volcanic eruptions, would require consideration of landscape issues specific to each disturbance and would be subject to REO review.

Guideline 2 (NWFP S&G p. C-14)

When managing standing live trees within salvage areas, consider potential interactions with insects and disease. In most cases insects and disease will aid in the development of desirable structures (snags and down wood). However, the threat of insects and pathogens to cause additional loss of adjacent late-successional forest or retard the development of younger stands may warrant the immediate conversion of green trees to snags or even the removal of some infected live trees.

The following three situations may be encountered:

1) Douglas-fir bark beetle populations may increase following fire or windthrow. We can expect some level of attack on adjacent green trees, given the desired level of down wood to be left on site. The total impact to green trees can be reduced by minimizing brood habitat. Brood trees (visible signs of boring dust) or potential brood trees (less than 20 percent of live green crown ratio remaining due to fire scorch and greater than 50 percent bark circumference or 50 percent of roots killed on greater than 14" dbh tree) are likely to succumb to attack. These trees may be credited toward the snag total. They may be removed if snag levels are in excess of the desired level for both snags and downed logs (Guideline 7, ROD p. C-15). They should not be removed if either snags or downed logs are deficient.

2) Stands warranting salvage in the Gotchen LSR (see Gotchen treatments Group 4) may have been affected by not only western spruce budworm, but probably fir engraver beetle and/or laminated, Armillaria, and annosus root rots. Management of the future stand to favor early seral species (e.g. ponderosa pine, western larch, and Douglas-fir) in most cases provides a long-term solution to minimize landscape impacts from insects and disease. In the short-term within salvage units, remaining live grand fir are likely to succumb to the insects and diseases mentioned, providing a flow of snags and downed logs, perhaps well above desired levels. Thus, deliberations on leaving live trees and snags (mainly grand fir) within salvage units should also consider the resultant fire hazard and the ability to establish and maintain early seral species.

3) Laminated root rot and dwarf mistletoe will rarely exceed the ten acre disturbance size threshold. Large laminated root rot and dwarf mistletoe infections can spread to adjacent stands and deteriorate a developing conifer understory. In most cases infection centers can be restricted to discrete areas by favoring disease tolerant and non-host species within and around infection centers during understory treatments (reforestation, sapling thinning). Where planting disease intolerant and host species is needed to meet LSR objectives, consider converting live trees to snags if they are infested with dwarf mistletoe or occur on the perimeter of laminated root rot pockets.

Guidelines 3 and 4

Coarse woody debris and snags will be left on site so that in the future it will contain amounts similar to naturally regenerated stands. These levels vary by plant zone and the stage of stand development prior to the disturbance. Snag and down wood guidelines for salvage are provided in 5-5 Snag Management and 5-6 Down Wood Management.

5-12 Grazing

Effects of Grazing on Ecosystem Function

On the Gifford Pinchot grazing impacts have been a part of the ecosystem for about 100 years; and early grazing was much more intense than present. All three range allotments are open range allotments, in that there are no fenced pastures. (See Chapter 4 - Grazing) There are, however, some features that are fenced to exclude livestock (Cave Creek wetland, Glacier Springs, Pinetree Springs, Peterson Campground).

LSRs primarily provide transitory range. Animals graze on grass, forbs and shrubs in cutover or otherwise disturbed forests. Roadsides which are maintained in an early seral condition and meadows provide persistent forage, and typically more forage per acre than disturbed forests.

As early seral vegetation matures, forage production for domestic animals drops. Within the Lewis and Peterson LSRs, transitory range provided by young plantations may be reduced by 25 percent by the end of the decade (see Table 4-11). In the Gotchen LSR transitory range may remain near current levels through this decade, as trees within plantations are managed at wider spacings and further stand disturbance is expected from western spruce budworm.

Grazing in early-successional forest appears to have little direct impact on tree development. Direct negative impacts include trampling of seedlings or their being browsed. These impacts are minimal, widely dispersed, and are largely avoided by managing the movement of sheep herds and the placement of cattle salt licks.

Domestic livestock use of late-successional/ old-growth forest rarely occurs. The exception would be forests within the grand fir series in Gotchen LSR. Past partial cutting has created numerous skid roads and landings, many of which were seeded with grass. These conditions, along with a gentle terrain, permit cattle to graze throughout many late-successional stands.

Cow Camp serves as a handling facility for the Mt. Adams Allotment. It is located within a late-successional forest stand adjacent to Gotchen Creek. Cow Camp is allocated as an administrative site and is eligible for inclusion in the National Register of Historic Places. Cow Camp was used by the permittee to corral and hold large numbers of livestock, it is currently used as a staging area for the permittee's trucks, trailers, and horses. Cattle are either driven directly into trailers or driven directly off national forest land toward the permittee's land. The decision document for the Mt. Adams Grazing Allotment Plan found that given its current use, Cow Camp does not prevent attainment of late-successional reserve objectives.

Indirect effects, both positive and negative, occur from changes in the forb and shrub community and soil biota. Sheep grazing has been used to reduce tree competition from shrubs. In general, forage preferences may alter species composition. Soil compaction and feces accumulation where animals congregate has many known and unknown impacts on plant and animal biota.

Of the mollusks and one vascular plant listed for protection from grazing (ROD p. C-6), none have been documented and most are not suspected to occur on the Gifford Pinchot National Forest. The Lewis LSR is within the historic range of several Survey and Manage mollusks, one of which is suspected to occur (see Table 4.7). Effects to riparian ecosystems are discussed in each watershed analyses.

The continuation of grazing activity at the established levels of use should not have an affect on the four components of stand structure and composition of late-successional and old-growth forests (e.g., the number of living old-growth trees per acre, the number of standing snags per acre, the amount of down woody debris present on both forest floor or in streams, or multi-layered canopy characteristics).

Likewise, the five ecological processes described in the NWFP, p. B-2 should not be affected with the continuation of grazing at present levels to a degree that would preclude achievement of the objectives for the LSR. This conclusion is supported in part by the field review in July, 1994, by Fred Hall, Regional Plant Ecologist.

At the levels that are currently permitted, the degree of disturbance to the ecosystem from grazing activity is extremely low and is not a risk factor in maintaining a healthy ecosystem to achieve the objectives of the LSR.

Conclusions

On a coarse scale, the degree of use by domestic livestock within the LSR is low and likely to decrease over time as early-successional forests mature. The overall impact is neutral to LSR objectives.

Fine scale concerns remain for specific Survey and Manage species and sensitive plants. Areas of concern are where high animal use sites overlap likely habitat (i.e., riparian zones and meadows). Current allotment management plan monitoring efforts focus on these sites (Cave Creek Wildlife Special Area and Upper Gotchen Meadows). These are also the sites where limited fencing to exclude livestock has occurred. Consequently, adjustments have been made in grazing practices, and monitoring is occurring to determine if further adjustments are warranted.

Existing handling facilities do not interfere with LSR objectives. The only potential conflict is with Cow Camp, and the NEPA document extending the grazing permit makes the finding that it is consistent with LSR objectives.

5-13 Meadow Treatment

Need for Change

The National Forest Management Act and federal Endangered Species Act directs the Forest Service to maintain biological diversity. Many plant and animal species inhabit meadow habitats, including some which are candidates for federal listing and on the Regional Forester's sensitive species list. Because of fire suppression, some of our meadow-inhabiting species may have declined in abundance and may be rare, in part, due to loss of habitat. In cases where meadow habitat within LSRs is critical to the viability of these species, treatments to maintain or restore meadow should be proposed. This treatment includes but is not limited to pale blue-eyed grass habitat maintenance in the Peterson LSR.

In the *Trout Lake Creek Watershed Analysis* (which includes the Peterson LSR), it was recommended that small upland meadows within forest matrix (0.5 acres) be maintained and conifer succession rates in meadows be controlled to maintain landscape diversity and habitat (p. 93).

Consequences of No Action. If sufficient meadow habitat is not maintained, a decline in population viability is likely. For species which are limited geographically, loss of important populations could ultimately lead to federal listing.

Treatment Criteria

Candidates for treatment include areas with federal candidate, listed, or sensitive species which are intolerant of shade. Examples include:

- Grassy Knoll
- Peterson Prairie
- Gotchen Meadows

Treatments Description

Treatment to restore or maintain meadow habitat could be accomplished using fire or mechanical removal of trees through girdling or cutting.

5-14 Noxious Weed Treatment

Need for Change

Noxious weed populations within the LSRs include, but are not limited to, tansy ragwort, spotted knapweed, black knapweed, yellow hawkweed, and scotch broom. They compete with native species for limited resources and spread into adjacent areas.

Consequences of No Action. Noxious weeds alter the species composition, structure, and diversity of a site. They are generally most invasive in disturbed areas with high light levels. As the forest canopy closes, noxious weed populations of upland species often decline. In younger stands, noxious weeds compete with native

vegetation reducing biological diversity of plants and animals that depend on them. Noxious weeds may also compete with conifer plantings for light, nutrients, and water. Growth rates may be reduced where noxious weed density is high. Purple loose strife may eliminate nesting sites and nesting material for wetland-inhabiting birds.

Treatment Criteria

Map 5-4 displays known areas of noxious weed infestations within LSRs.

Treatments Description

The objective of the noxious weed treatment is to reduce competition and limit spread into adjacent areas.

Treatments for noxious weeds vary by species. Methods include mechanical, chemical, and biological. Chemical controls are discouraged under the Mediated Agreement. Handpulling, mowing, and the use of biological control insects are tools that can reduce populations of certain noxious weeds and are aligned with LSR objectives. Biological control methods have a high level of host specificity. Biological control insects are available for controlling of tansy ragwort, Canada thistle (*Cirsium arvense*), diffuse knapweed (*Centaurea diffusa*), spotted knapweed (*Centaurea maculosa*), and St. Johnswort (*Hypericum perforatum*). Biological control releases will be performed based on accepted protocols, with respect to density of insects, timing, and species selection.

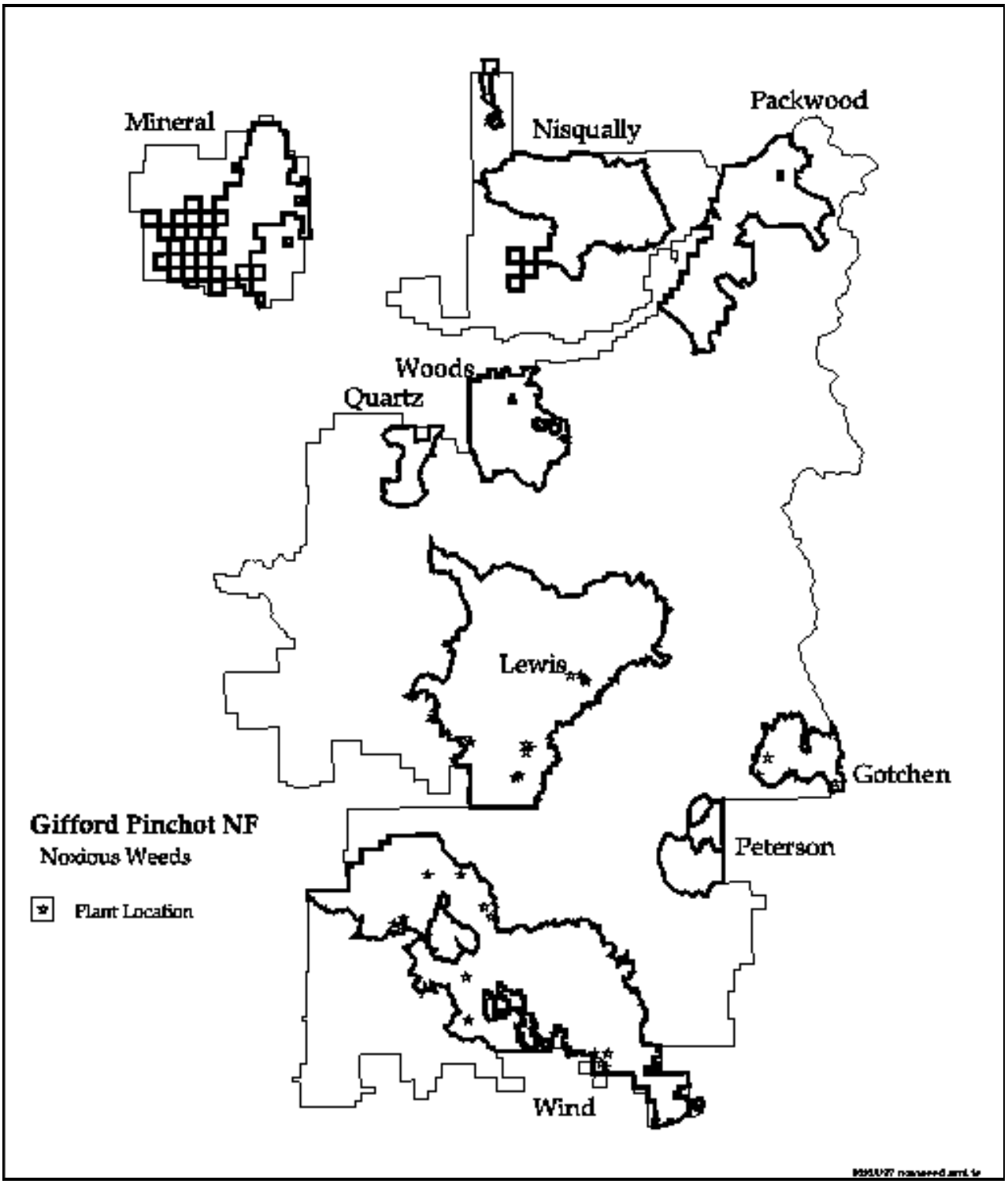
The treatment plan will rank noxious weed projects using the following criteria:

a) Class of noxious weed
b) Density of population (degree of competition)
c) Proximity to suitable habitat for further spread (level of risk)
d) Availability of cooperative funding and assistance.

Table 5-10 Biological Control Opportunities

Noxious Weed	Biological Control Insect
Tansy ragwort	Root boring flea beetle (*Longitarsus jacobaeae*) Cinnabar moths (*Tyria jacobaeae*)
Canada thistle	Stem mining weevil (*Ceutohynchus litura*)
Knapweed	Seed head gall flies (*Urophora affinis, U. quadrifasciata*)
St. Johnswort	Klamath weed beetle (*Chrysolina quadrigemina*)

Map 5-4 Nxious Weed Treatment Opportunities



5-15 Quarry Operation

Rock quarries typically impact from 1 to 5 acres per site with 1 to 2 acres being most common. Development of the quarry results in removing vegetation and soil overburden. Most rock requirements for road maintenance and flood damage repair will be met by existing and previously utilized quarries. However, new sites will be needed to limit transportation costs and provide economical sources of rock.

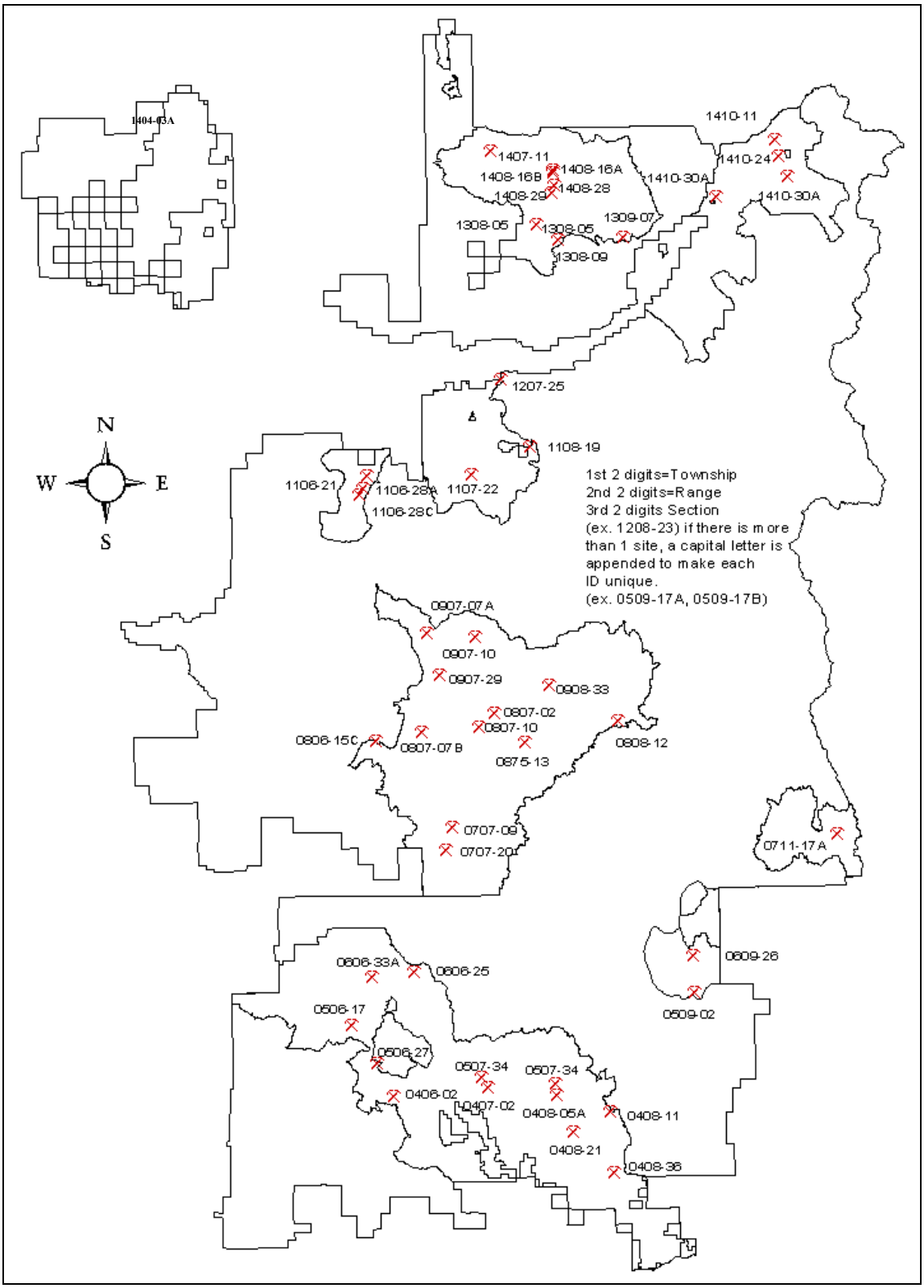
New quarries should be sited to minimize the impact on late-successional habitat. For example, quarry sites in early or mid-successional vegetation should be preferred to those requiring clearing of late-seral vegetation. Quarry development and operation with the potential to impact spotted owl habitat is subject to consultation with the USFWS.

An inventory of current and potential quarry locations is shown in Table 5-11 and Map 5-5. Quarries needed for 96 flood damage repair are marked in Table 5-11 with an asterisk.

Table 5-11 Quarries in LSRs

ID Number	Quarry Name	Status
1106-21	Nilast	Possible use in repair of 26 Road, then rehab.
1106-28A	Red Springs	Possible use in repair of 26 Road, then rehab.
1106-28C	Squires Folly	Possible use in repair of 26 Road, then rehab.
1107-22	Iron Mountain	Future use expected; clearing in plantation.
1107-01*	Ames	Current & future use; important rock source.
1108-19*	Squatter	Current & future use; important rock source.
1207-25	Siler M	One more entry will require clearing of about¼ acre; then close and rehab.
1410-11	Carlton Creek	Possible future use.
1410-14	Summit Creek	Possible future use.
1410-24	Yellowjacket	Future development requires clearing <1/2 acre.
1410-30A	Ohana	Current & future use; some clearing may be needed.
1309-07	Willame	Possible future use
1308-09	Boundary	Future use expected; important rock source.
1308-05	Siltstone	Within a plantation.
1408-28*	Road Apple	Already cleared; future use expected.
1408-29*	Skate 3	Will need clearing of about ½ acre; important rock source.
1408-16A/B	Switchback	Little future development expected, but will be used as a stockpile site.
1407-11	Mesatchee	Clearing of ~1/4 acres needed for future use.
1408-30	Silver Pass	Possible future use.
1504-35	Wildcat	Clearing of ~1/4 acres would be needed.
707-09	Upper House Rock	Fed. Hwy.) Good long term source for area. May need some clearing of reprod (20+ years old). Could also rehab some of the stockpile areas.
807-7B	125	Large centralized pit. Expected use for resurfacing 25 road and other roads in the area.
807-10	Upper Cussed Hollow	Limited amount of rock. Could use and rehab under 1 contract.
807-02	Trail D	Large quarry. North part should be rehabbed as it is now causing sediment problems to stream. South part should be retained for use in the area.
875-13	Alec Creek	Long term use. Should not require future clearing.
907-7A	Lower Spur	limited volume. May want to rehab
907-10	Upper Hungry	Long haul to area from other sources. Prime use in road repair and restoration.
606-25	Dry Creek	Excellent long term site with little to no clearing needed for future use.
506-17	Slab	Good rock but could utilize Soda Peak for needs in the area.
506-27	Soda Peak	Good long-term talus source. No clearing needed.
407-02	Carson Guler	Could rehab most of the site. Use as waste area. Backup source to Big Butte.
408-36	Brushy Bear	Limited amount of rock. Could use and rehab on 1 contract.
509-02	Mann Butte	Large source of marginal quality rock. Very light colored which has been a concern. Use as spot rock and level C and D roads.
609-26	Lower Peterson	Undeveloped source but good quality for the area. Would require clearing before development.
711-17A	Bunnell Butte	Cinder cone. Some potential use in the future and possible source for Bureau of Indian Affairs uses in the western portion of the Yakama Reserve. Also potential geologic interest area showing cross section of a cinder cone.
1404-03A*	Sound View	Proposed for use for 1996 Flood damage repair. Utilizes existing roads and landings located within an existing plantation. Not in GIS.

Map 5-5 Quarry Sites in LSRs



5-16 Special Forest Products Collection

Regulation of commercial harvest is an option to be considered under the Northwest Forest Plan if these activities conflict with LSR objectives. The NWFP states that special forest product activities must be evaluated to determine whether these activities have adverse effects on LSR objectives. Sales of these products must ensure resource sustainability and protection of other resource values, such as special status plant and animal species. Where these activities are extensive, we are directed to evaluate whether they have significant effects on late-successional habitat (ROD p. C-18).

Need for Change

Many wild mushrooms, mosses, lichens and medicinal plants found on the Forest are considered "species of concern". Many of these products are also of high economic value in the Pacific Northwest. Issuance of permits for these products should be based on supporting scientific information with consideration to local species abundance and distribution. Some studies (Liegel et al. 1996) indicate harvesting of morels and chanterelle appear to have minimal effect on the resource. However, increased intensity of harvest for other high value species may be reaching the point of valid concern with possible degradation to the resource. The Forest and others resource agencies have ongoing matsutake studies (Pilz et al. 1996) that will be considered as new and conclusive information becomes available.

Mushroom Harvest

Impacts to the food web. The greatest concern from mushroom harvest focuses on impacts to the food web. Diets vary among mammal species, and many species have documented preferences for certain fungi. Chanterelles are not a favored species. Matsutake are sought after by large and small mammals, including bear, deer, and elk. Truffles, which fruit underground, emit odors that attract mammals. Some mammals prefer these species to above ground fruiting species (Maser et. al 1985).

Small mammals, such as the northern flying squirrel (*Glaucomys sabrinus*), rely on mycorrhizal fungi (primarily those which fruit underground, e.g., truffles) for over 90 percent of their food supply (Maser et. al 1978, 1985). In turn, these mammals are primary prey for species such as the northern spotted owl.

Sustainability of mushroom harvest. Based on long-term and short-term studies and anecdotal evidence, it does not appear that repeated harvest of mushrooms has a significant negative effect on productivity in subsequent years. However, removal of forest litter, coarse woody debris, and other water-holding substrates can inhabit fruiting. Exposure of mycelium (underground, vegetative part of the mushroom) during raking or other ground-disturbing activities can reduce productivity or cause local mortality of mycelial mats. Avoiding compaction associated with trampling and minimizing removal of moss, leaf litter, and substrate around mushrooms is critical to maintaining microclimate and sustained harvest.

A long-term study on the Mt. Hood National Forest suggests there is not a marked reduction in mushroom productivity after harvest of chanterelles (Novelle 1995). This study is based on data collected over a ten year period. Precipitous declines in mushroom production in Europe have been thought to be correlated to air pollution and associated acid rain, rather than harvest (Gulden et al. 1992).

Individual mushroom species vary in their degree of association with seral stage; some species are only found in late-successional and old-growth forests, while others colonize earlier and reach peak abundance in younger stands. Chanterelles and matsutake fruit in abundance in mid-age stands (Pilz, pers. comm.). The inclusion of these species in the Survey and Manage component of the Northwest Forest Plan (ROD Table C-3, Strategy 4) reflects concern with varieties that may be closely associated with late-successional and old-growth forests. Harvest of these species (especially chanterelles) in earlier seral stages is unlikely to have a significant negative impact on the prey base of mammals associated with late-successional forests.

While truffle harvest occurs on the Forest, commercial harvest of these species is thought to be limited, due to a relatively small commercial market at this time. The price per pound to pickers of Oregon black truffle (*Leucangium carthusiana*) averaged $75 in 1992; with harvests that year totaling over 4,000 pounds in Oregon alone. About 7,000 pounds of the Oregon white truffle (*Tuber gibbosum*) were harvested in Oregon and Washington in 1992 (Amaranthus and Pilz 1996). These values are small relative to other species which may range over a million pounds harvested annually in the Pacific Northwest (e.g., chanterelles, Novelle 1995). However, they may represent a growing market, with greater potential impacts to small mammals and a higher level of ground disturbance associated with harvest. Raking the forest floor is the conventional method of harvest of truffles in the Pacific Northwest. At one site, raking an areas two years in a row appeared to virtually eliminate truffle production the third year (Trappe 1990). While some species of truffle occur in late-seral stands, the Oregon white truffle is associated with Douglas-fir, usually in stands between 8 and 65 years (Arora 1986).

Incidental harvest and impacts to species of concern. Other concerns include incidental harvest of NWFP Table C-3 Strategy 1 species; these include truffles and other species that may be collected during commercial or personal use harvest. Some of these species are known from only one or very few sites; many are located in recreational sites, especially campgrounds (O'Dell, pers. comm.). The likelihood of incidental harvest of these extremely rare species may be low. Monitoring harvest activity and identifying areas of potential concern may be appropriate to minimize this risk.

Effects of thinning on mushroom production. Silvicultural treatments, such as thinning may affect mushroom productivity. According to Trappe and Cholgan (unpublished data, 1995), forest thinning can reduce productivity of below-ground fruiting fungi in 60 to 70 year old Douglas-fir stands. Little information exists on how other mushroom species respond to thinning treatments. However, several studies are underway to investigate the effect of silvicultural treatments on mushrooms. On the Olympic Peninsula, a study initiated in 1993 is in progress to compare chanterelle production in 60-year

old stands, thinned and unthinned (Amaranthus and Russell 1995). On the Umpqua National Forest, a study is planned to do silvicultural treatments to enhance matsutake production. Information from these studies may lead to opportunities to manage for larger sustained yields, if these treatments also accomplish other LSR objectives.

Other concerns. Restrictions on mushroom harvest in LSRs on adjacent forests could lead to increased demand in harvest on the Gifford Pinchot National Forest.

Special Forest Products Management Recommendations

Native American Indians having treaty rights will continue to exercise those rights on lands now designated as late- successional reserves.

Monitoring of use rates, products purchased by buyers, and long-term research projects should continue.

Products considered low-risk or where removal is neutral to LSR objectives include floral and Christmas greenery and harvest of berries. Incidental uses associated with recreational activity, and gathering of plants and firewood from road right-of-ways are also considered low risk.

Permits (commercial and personal use) should continue to be utilized as a management tool to ensure special forest products harvest is consistent with LSR objectives.

Because available information indicates they may be an important food source for small mammals, commercial permits may not be issued for matsutake and boletes mushroom harvest within LSRs. Restrictions on harvest should adapt to the findings of research and monitoring of mushroom-wildlife relationships.

Numerous studies are underway that should provide valuable information on appropriate management for harvest of fungi in late-successional reserves. These studies should be continued, be expanded where possible, and results incorporated into adaptive management of the LSRs.

Personal and recreational use permits should be given preference over commercial permits for products where little or conflicting information exists concerning species abundance, distribution and ecological role.

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5-17 Special Uses

Special uses, authorized under special use permits, in each LSR are described in Chapter 4 at the LSR scale. Current uses within LSRs can be grouped into four categories.

Linear developments include roads, power and telephone lines, water pipelines and a water diversion. The NWFP recognizes existing uses in these categories as valid uses (ROD p. C-19). Permits for new easements will be granted only after it is determined that the proposed route is consistent with LSR objectives, minimizes impacts to late-successional habitat and that alternate routes which avoid the LSR and late-successional habitat within the reserve have been considered.

Electronic sites operated under special use permit in the LSRs include radio repeater sites and data telemetry installations. These are small sites affecting one-quarter acre or less. The NWFP considers these sites valid existing uses. Permits to operate new sites will be granted after it is determined that they are consistent with LSR objectives.

Residences and facilities under permit within LSRs range from a caretaker's residence to a 46 unit summer home tract in the Wind LSR. The Cispus Learning Center in the Woods LSR also falls in this category. The NWFP allows this type of existing development to remain. Routine maintenance, including felling hazard trees is allowed. Developments of new residences and facilities in LSRs will be considered on a case-by-case basis. They will be planned to have the least possible adverse impact on late-successional habitat and related species (ROD p. C-17).

There is one apiary (beehives) situated in the Wind LSR under an annual permit. Risk to native bee populations will be considered through the NEPA process prior to renewing the permit.

There are **mining claims** in Lewis, Nisqually, Mineral, and Quartz LSRs. These include placer claims which involve operation of suction dredges in stream channels and lode claims which usually involve tunneling into the hillside. Gold is the mineral being sought in all claims in LSRs. The impacts of ongoing and proposed mining actions will be assessed and mineral activity permits will include appropriate stipulations related to all phases of mineral activity (ROD p. C-17). Exploration and mining activities will be conducted consistent with the General Mining Act of 1872 and applicable Forest Service regulations.

5-18 Element 4 LSRs - Owl Activity Centers

Owl activity centers are considered by the NWFP as unmapped Late-Successional Reserves. There are 123 owl activity centers within the Matrix and AMA. Within the Matrix and AMA, Forests are directed by the NWFP to retain 100 acres of the best northern spotted owl habitat as close to the nest site or owl activity center as possible (ROD p. C-10).

Interim owl activity centers were established by placing 100 acre circles centered on known owl nests or activity centers. When habitat manipulating activities are planned within one mile of the activity center or nest site, the circular configuration will be refined to identify and include the best 100 acres of spotted owl habitat as close to the nest site or activity center as possible. The refined configuration will be stored in the Forest's GIS system.

Since these are one of the five categories of LSRs, NWFP standards and guidelines will apply to owl activity centers. Like mapped LSRs, their boundary will not be buffered, although management around these areas will be designed to reduce the risk of stand replacing disturbances.

Treatments Description

Thinning and other structure enhancing treatments should be infrequent since the selection of the best spotted owl habitat will usually result in the designation of functional late-successional habitat. Where there is a premium on internal habitat, plantations and younger stands may be included within the refined owl activity center. In these situations Young Stand Thinning (p. 5-1) and Commercial Thinning (p. 5-6) may be appropriate.

Salvage within the owl activity centers will conform to the standards prescribed by the NWFP (ROD p. C-13 to C-16) and Treatment 5-11 Salvage and Risk Reduction.