USDA Forest Service
U.S. DEPARTMENT OF AGRICULTURE

Washington Office July 2024

Technical Guidance for Standardized Silvicultural Prescriptions for Managing Old-Growth Forests

Cover Photo: Old-growth stand of Douglas-fir. Siuslaw National Forest, Pacific Northwest Region.
Photo credit: A.Gray, U.S. Forest Service

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Introduction

Old-growth forests are a unique component of landscapes that provide and produce the suite of ecological benefits and services for which they are valued. They support biodiversity by providing essential wildlife and fisheries habitat. They also contribute to nature-based climate solutions through carbon sequestration. Old-growth forests can mitigate wildfire risks, enhance climate resilience, and enable subsistence and cultural uses. They also provide outdoor recreational opportunities and promote sustainable local economic development.

The USDA Forest Service (Forest Service) recognizes the significant values associated with old-growth forests and, over the past 30 years, has defined "old-growth forest" and developed policies and guidance for conserving old-growth forests on National Forest System lands.

On April 21, 2023, the Forest Service published a report on the definitions, identification, and initial inventory of mature and old-growth forests, as directed by Executive Order 14072. The initial inventory was conducted by applying working definitions of old-growth forest conditions for over 200 regional vegetation types to forest inventory and analysis field plot data. Definitions and inventories have been established for forests exhibiting old-growth conditions by National Forest System region. This initial inventory resulted in the Forest Service identifying an estimated 24.7 million acres of old-growth forest conditions on National Forest System lands.

Currently, Forest Service land management plans (forest plans) provide components (desired conditions, objectives, standards, guides) to conserve old-growth forests. On December 20, 2023, the USDA released a notice of intent to prepare an environmental impact statement to amend all 128 forest plans. The proposed amendment describes national intent to develop, maintain and improve amounts and distributions of old-growth forest conditions within national forest ecosystems and watersheds so that old-growth forest conditions are resilient and adaptable to stressors and likely future environments. It also strives to create consistent direction to conserve and steward existing old-growth forests, recruit future old-growth forest conditions, and then monitor their condition across planning areas within the National Forest System.

All silvicultural prescriptions must be in accordance with forest plan direction for old-growth forests. Silviculture prescriptions are a planned series of treatments designed to change current stand structure and composition to meet land management goals and objectives such as conserving and stewarding existing old-growth forest conditions and recruiting future old-growth forest conditions. Prescriptions are critical for reducing threats to old-growth forests by describing needed treatments such as mechanical thinning, harvest, prescribed fire, and improvement cutting to help reduce competition among individual trees, change fuel conditions, or alter species composition, thereby reducing the vulnerability of old-growth forests to disturbances. The primary purpose of silviculture treatments in old-growth forests should be to move the stand toward desired conditions or improve ecological integrity, or both, not be to grow, tend, harvest, or regenerate trees for economic reasons. The preference is to only use management actions when the stand is not moving toward desired conditions.

The silviculture manual (chapter 2470 of the Forest Service Manual), revised in 2023 and waiting approval in 2024, is a key guidance document that directs implementation of silvicultural practices on National Forest System lands. New language in the manual includes considerations for the stewardship of old-growth forests during development of silvicultural prescriptions. The direction in the manual is broad.

The objective of this technical guidance is to provide more detailed direction on preparing silvicultural prescriptions to maintain or restore ecological integrity (composition, structure, function, connectivity) and resilience of old-growth forests on National Forest System lands in the face of current and future disturbances and climate change. This guidance is intended for Forest Service resource managers and staff who conserve and steward old-growth forests. The guidance is organized in three sections: standardized silvicultural prescription process, principals of best management practices (appendix A), and an example of an old-growth forest prescription (appendix B).

Standard Silvicultural Prescription Process

A sequence of the following five steps is followed to complete the silvicultural prescription process for stewardship of old-growth forests:

1. Examination of forest stands.
2. Diagnosis of treatment needs.
3. Detailed silvicultural prescriptions (prescription of methods, techniques, and timing of silvicultural activities).
4. Monitoring of treatments over time to ensure the stand remains on trajectory to achieve the desired stand condition; and
5. Evaluation of treatment results.

While the five steps are the same as for the standard silviculture prescription process, elements in each step provided in this guidance are unique to old-growth forests.

Old-Growth Stand Examinations

Once it is determined the stand is old growth, the first step in developing silvicultural prescriptions for old-growth forests is stand examination. The objective of stand examination is to collect sufficient information to identify ecologically feasible management options to meet land management objectives, given the stand's structure, composition, condition, successional status, and site productivity, and to identify existing and emergent threats to forest health. It is important to consider the information gathered during the stand examination in the broader landscape context. Toward this end, a common stand exam in stands that are suspected of meeting old-growth conditions should include, at a minimum, the following data elements:

1. **Setting:**
    a. Existing vegetation reference
    b. Existing vegetation code
    c. Potential vegetation reference (where used)
    d. Potential vegetation code (where used)
    e. Species of management interest
    f. Setting disturbances
2. **Plot:**
    a. Latitude
    b. Longitude

c. Existing Vegetation Code

d. Plot History

3. Tree:

a. Tree status

b. Site and growth sample tree (the first live standing sample tree of each species encountered on the plot.

c. Species

d. Diameter

e. Height

f. Radial growth for growth sample trees greater than or equal to 3 inches in diameter

g. Height growth for growth sample trees less than 3 inches in diameter

h. Age for site and growth sample trees

i. Crown ratio

j. Log/Snag Decay Class for dead trees

k. Tree damage

4. Downed Woody:

a. Protocol options:

i. Brown's protocols

ii. Piece count

iii. Photo series

iv. Photoload sampling technique

Depending on a region's or national forest's old-growth forest definition (s), additional data may be required for collection.

Threat analysis in terms of insect, disease, fire, invasive species and climate change risks would be supported by a combination of the measured stand characteristics listed above. The outcomes of these potential threats to old-growth forests depend on existing ecological conditions. Further, a landscape context should be considered in how each stand is evaluated to ensure that older forests are distributed to create resilient conditions to these threats.

Consider collecting tree data at an intensive level (rather than an extensive or a quick plot). Often, the largest cost of a stand exam is getting the crew to the plots. The additional cost of a higher intensity sample can be marginal. The benefits of increased precision, however, can be significant, especially if the analysis involves growth and yield projections or forest threat hazard analysis from the Forest Vegetation Simulator (FVS), either as a standalone tool or through the FSVeg Spatial Data Analyzer. FSVeg Spatial stores the delineated stand areas as polygons with their attributes, and links to the associated common stand exam in FSVeg. FSVeg stores the exam data about trees, fuels, downed woody material, surface cover, and understory vegetation.

Once the determination of the stand's status has been made as either old growth or not by regional or national forest processes, this status should be entered in FSVeg Spatial in either the local-table or the local-calcs-table as appropriate for the region.

The existence of a delineated stand layer is a prerequisite to conducting stand exams on forested lands. Stands should be appropriately delineated into contiguous units based on their relatively homogenous type, size, density, slope, aspect, elevation, and soils, then recorded in FSVeg Spatial. The common stand exam can then be conducted based on this delineated stand layer and then stored in FSVeg or appropriate national database. FSVeg Spatial can then be used to link stand polygons to their relevant common stand exam data in FSVeg. Summarized FSVeg common stand exam data can then be used to update FSVeg Spatial polygon attributes with the latest and best ground-based observations. During this attribution, it is encouraged to include the setting-level damages collected in common stand exam.

Diagnosis of Old-Growth Forest Treatment Needs

Diagnosis of treatment needs takes place after the silvicultural examination and is the most important step of the prescription process. The diagnosis phase considers and evaluates the site capability, current conditions, history, disturbance dynamics, likely future conditions, and land management direction within the context of the landscape relative to the desired stand conditions. For old-growth forests, the diagnosis should consider the durability (ability to exist for a long time without significant deterioration in quality or value), resilience, and resistance to fire, insects, and diseases. Additionally, the management direction should be informed by the relationship between the stand characteristics and the specific values of old-growth forests.

The diagnosis of old-growth forest treatment needs is a four-step process (see the flow chart in figure 1).

Step 1

First consider whether the old-growth stand in question meets the desired condition or currently has high ecological integrity and is expected to achieve land management objectives for conservation and stewardship of old-growth forest over the planned management period. This step should include assessment of vulnerability of old-growth forests to disturbances or stand development processes that change its current and likely future conditions.

Step 2

1. If the old-growth forest exhibits desired conditions and has high ecological integrity and is likely to be resilient to future conditions, then treatment may be deferred.
2. If the old-growth forest does not exhibit desired conditions or does not have high ecological integrity or is unlikely to be resilient to future conditions, consider treating the stand.

Step 3

If treatment is needed and Step 2b is applicable, consideration is given to stand modifications that move the stand toward desired conditions or improve ecological integrity.

Step 4

1. If stand modifications can move the stand toward desired conditions or improve ecological integrity, consideration is given to treatments to modify stand conditions consistent with the land management plan. Considerations for modification of the stand should use less intensive treatments such as stand tending treatments (prescribed fire, understory thinning, and so forth), intermediate treatments

(improvement, salvage, sanitation, and so forth), and uneven-aged methods (single tree selection). More intensive treatments such as even-aged methods (seed tree cutting and clearcutting) should be considered as the last resort. They should be used when they are the only option left to move the stand toward desired conditions or improve ecological integrity.

2. If stand modifications cannot move the stand toward desired conditions or improve ecological integrity, treatment should be deferred and allow the stand to naturally move toward desired conditions over time and appropriate action taken based on the monitoring and evaluation results.

All stands considered for treatment, including those with deferred treatments, should be monitored, and evaluated.

The following page shows a flow chart illustrating the process to determine treatment needs for old-growth forests.

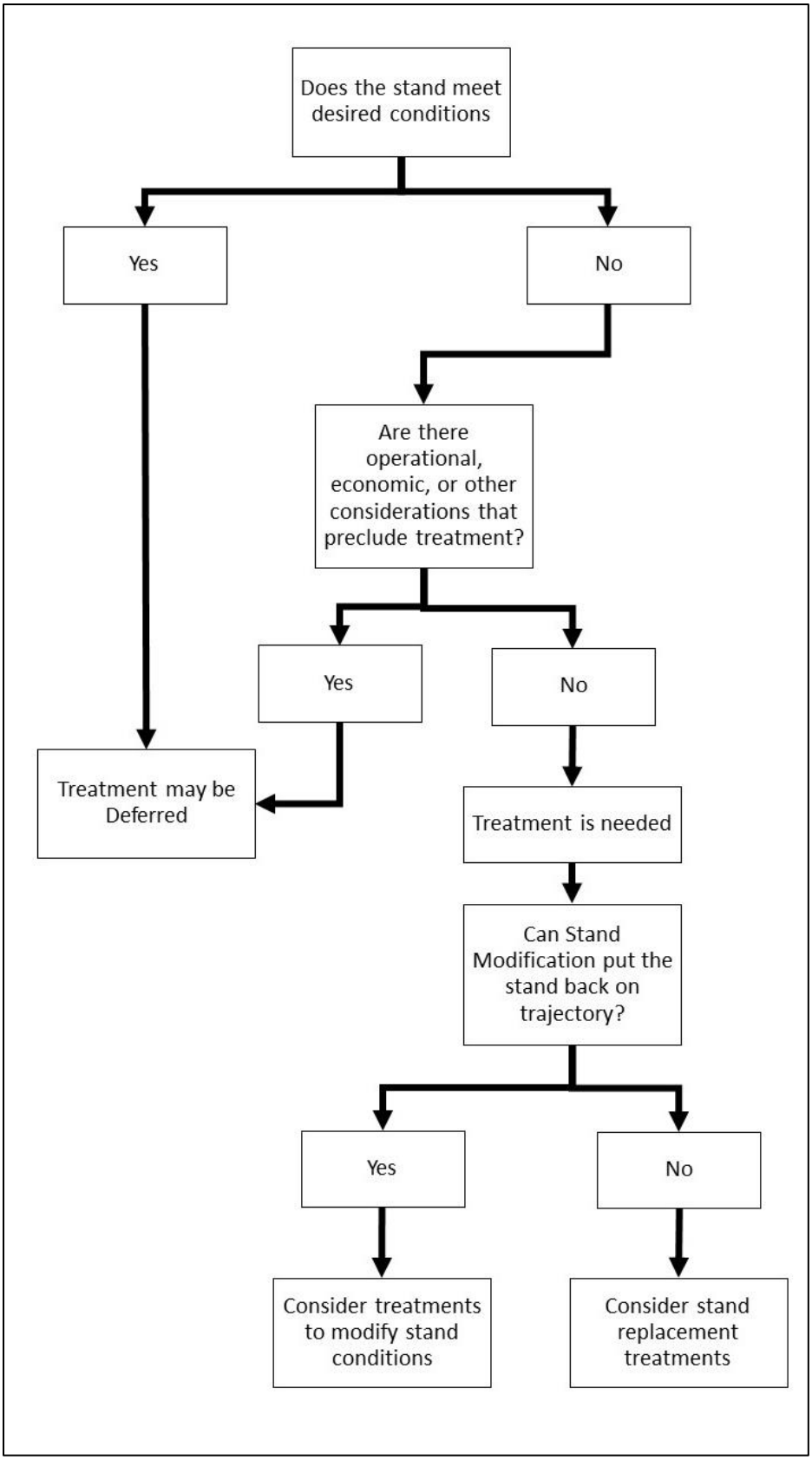

Figure 1. Illustration of the diagnosis of treatments needs process for old-growth forests

The diagnosis also includes the development of desired stand conditions (species composition, structural characteristics, snags per acre) at various time intervals throughout the life of the stand in accordance with land management objectives. In addition, it includes a comparison of existing versus desired stand conditions that may lead to alternative treatment needs.

Detailed Old-Growth Silvicultural Prescription

A detailed silvicultural prescription is a site-specific document that describes management activities needed to implement a silvicultural treatment or a sequence of treatments. Silvicultural treatments include mechanical thinning, harvest, prescribed fire, and improvement cutting that helps reduce competition among individual trees, change fuel conditions, or alter species composition thereby reducing the vulnerability of old-growth forests to stand-replacement disturbances. The prescription documents the results of implementing forest plan direction after completion of a project-level environmental decision. It also describes the desired future vegetation stand conditions in measurable terms as developed during the stand diagnosis phase. The stand desired condition is a basis for treatment, monitoring, and evaluation. In the case of old-growth forest prescriptions, the detailed document must carefully describe the specific threats faced by the old-growth stand, what stand characteristics suggest it is vulnerable to those threats, and how the prescription reduces the risk. The prescriptions must also maintain the old-growth forest characteristics and put the stands back on a trajectory toward desired conditions or improve ecological integrity. Appendix B provides one example of a silvicultural prescription that follows this process. A certified silviculturist must review and approve all silvicultural prescriptions (Forest Service Manual 2470).

Monitoring and Evaluation of Old-Growth Silvicultural Treatment

Monitoring and evaluating treatment effects (mechanical, prescribed fire) in old-growth stands allows regions and national forests to assess how management activities, or lack of, affect old-growth forest characteristics and move stands toward desired conditions over time. Additional treatment effects (such as wildlife response to management activities) can be monitored if appropriate data are collected.

There are multiple monitoring and evaluation levels that occur with old-growth forest conditions in Forest Service regions and across national forests. These include broad-scale monitoring at the regional level, forest plan monitoring, and finer scale, project level monitoring which supports the broader scale monitoring. Together, forest plan and project-scale monitoring help ensure that silvicultural treatments comply with forest plan components. They also support efforts to align with national direction and intent to:

- Improve conservation of old-growth forest conditions.
- Improve durability, resilience, and resistance to fire, insects, and disease within old-growth forest conditions across the National Forest System.
- Strengthen the capacity of existing and future old-growth forest conditions to adapt to the ongoing effects of climate change.
- Provide direction for geographically informed adaptive management strategies.

This guidance focuses on project-level monitoring. Project-level monitoring is key to ensuring that prescribed treatments were implemented (implementation monitoring) and achieve the desired outcomes (effectiveness monitoring). It helps determine whether:

1. Work was accomplished in accordance with the prescription.

2. Silvicultural and land management objectives were achieved.
3. The treated stand is progressing on its planned trajectory.
4. Remedial treatments are needed; and
5. Prescriptions can be improved.

This informs future treatment options and supports adaptive management approaches with the goal of improving and maintaining resilient old-growth forest conditions across the landscape now and into the future.

Potential Effectiveness Monitoring Questions

The potential effectiveness monitoring questions listed below are designed to be examples to help guide the development of effectiveness monitoring and evaluation questions for each project. Evaluation questions for old-growth forest management should check to ensure compliance with project objectives, land management plan components, and regional definitions. Effectiveness monitoring questions are used to ensure prescribed treatments achieve or move the target area toward desired conditions. Different and additional monitoring questions may be identified or developed during the project planning process.

If there are questions related to developing old-growth forest monitoring and evaluation questions, contact the regional silviculturist for that region.

Follow regional guidance for recording and documenting monitoring.

Potential effectiveness monitoring questions to answer and document for silviculture prescriptions and site-specific treatments in old-growth forests

1. How do the treatment areas compare to similar unmanaged areas over time?
    a. A similar stand nearby can serve as a reference point when assessing the effect of treatment.
2. Did the stand meet old-growth forest conditions prior to treatment? Does the stand still meet the old-growth definitions as defined in regional definitions after treatment?
    a. Does the stand continue to maintain old-growth desired characteristics?
3. Did the activity reduce stressors, potential threats or risks to old-growth forests as identified by the region for the old-growth community type the treatment is occurring in? How long is the stressor, potential threat(s) or risk reduced?
    a. Did the activity reduce potential for stand replacing fire?
    b. Did the activity reduce susceptibility to insect or disease?
    c. Did the activity reduce susceptibility to [*Insert stressor identified during regional threat assessment.*]?
4. How did the treatment affect the amount and stability of carbon stored?
    a. Is the treatment decreasing above ground carbon in the short-term with the intent of maintaining carbon on the site in the long-term?
    b. How did the treatment align with the project carbon assessment?

5. Did vegetation respond as desired?
    a. Are the grass, forbs, and shrubs those that would be typically found under the characteristic disturbance regimes?
    b. How does the vigor of the old-growth trees change post-treatment and over time?
    c. Are the stand structure characteristics closer to or meeting the old-growth forest structure characteristics for the vegetation type the treatment is occurring in?
6. If wildlife habitat is monitored, how did the activity influence ecological conditions that influence wildlife over time?
    a. Did it create, improve, maintain habitat?
    b. Did it provide important habitat components for [*Identify specific species being managed for*]?

Potential evaluation questions for silviculture prescriptions and site-specific treatments in old-growth forests

1. Is the prescribed treatment designed to create, restore, or maintain old-growth forests per regional definition?
    a. Is the old-growth type post-treatment forest the same old-growth type or has the type shifted to another old-growth type forest?
    b. Did the treatment shift the stand conditions, so the stand is no longer old growth?
    c. How did the treatment shift stand or landscape out of old growth?
        - Is the prescribed treatment enhancing stands to move toward old growth, maintaining old growth, or improving resilience of existing old-growth forests to disturbance and stressors?
2. Is the prescribed treatment meeting the land management plan desired conditions, objectives, standards, and guidelines?
3. Is the prescribed treatment meeting the project specific objectives?

Appendix A - Best Management Practices for Managing Old-Growth Forests

The following are selected best management practices for managing old-growth forests. These best management practices should be regarded as a set of recommendations for Forest Service resource managers and staff who conserve and steward old-growth forests to consider as they develop old-growth silvicultural prescriptions. These considerations may not apply to every situation.

- The primary purpose of silviculture treatments in old-growth forests should not be to grow, tend, harvest, or regenerate trees for economic reasons but should be to move the stand toward desired conditions and/or improve ecological integrity.
- Evaluation of potential threats based on current stand condition and stand trajectory provide information necessary to determine if silvicultural practices are needed. Silvicultural practices may be needed to promote and sustain ecological values of old-growth forests. Silvicultural practices often include treatments such as thinning, improvement cutting and prescribed burning. When needed, these treatments should reduce vulnerability of old-growth forests and increase resilience to natural disturbances including wildfire, climate change, insects, and diseases. Treatment is considered when current stand conditions make the stand more vulnerable to an existing or future threat and modification of those conditions can reduce those threats.
- Dialogue with stakeholders and Tribal Nations is critical in identifying and stewarding old-growth forests. Local and Indigenous knowledge should be integrated with scientific understanding in old-growth forest management. Include, when applicable, place-based meanings tied to cultural identity and heritage; local economies and ways of life; traditional and subsistence uses; aesthetic, spiritual, and recreational experiences; and Tribal and Indigenous histories, cultures, and practices.
- Where forest plans mandate diameter cap-cutting or an age limit to retain large diameter or old trees, forest plan amendments may be required to apply silvicultural practices essential to achieving or maintaining desired conditions or improving ecological integrity, or both.
- When designing silviculture treatments, the following considerations should be noted:
    - Consider the stand as it pertains to the broader landscape context and how it may contribute to old-growth forest conditions (as defined by region or national forest).
    - Old growth forests have substantial heterogeneity in the spatial arrangement of old trees, snags, large coarse woody debris, and varying patch sizes of structural diversity.
    - Large trees may be common but large size does not necessarily mean they are old trees.
    - Old-growth forest definitions vary according to forest dynamics, composition, structure, and disturbance regimes along a spectrum between forest types characterized by frequent small-scale disturbances, intermediate types of mixed-severity, and infrequent-types shaped by major disturbances (wildfire, insects, wind, drought) over large areas creating different successional stages. Forests are dynamic, and over time, a single stand will likely cycle through many age classes and successional stages due to disturbances, natural processes, and changing conditions. In some places, changing conditions (climate, human development, shifting communities of plants and animals caused by factors in addition to climate) may make older forests more sustainable in some places than in others, so any single stand should be considered in its broader landscape context.
    - When large tree densities meet or exceed desired conditions, thinning to increase heterogeneity and resilience should emphasize retention of the oldest and largest trees. Prescription for a

treatment will be based on evaluation of threats under existing conditions and conditions following a silviculture treatment.

- Strive to retain habitat characteristics and refugia such as large trees with deformities, broken tops, large branches, and cavities whenever possible as well as downed wood and snags for wildlife habitat when treating in old-growth forests consistent with desired conditions and ecological integrity.
- Protect old-growth stands through strategic placement of treatments. Examples include:
  - ♦ Design treatments near old-growth stands to reduce fire, wind, and other hazards that may spread to old-growth forests.
  - ♦ Consider the spatial location of old-growth forests when designing projects that have a purpose of altering disturbance behavior.
- Maintaining resilient old-growth forests requires an understanding of how disturbance regimes have shaped landscape composition, structure, and function.
- Understanding of climate change and the interaction of climate with disturbance regimes may require silviculture prescriptions to be adapted.
- Stewardship of old-growth forests at the stand scale, with larger stands or contiguous patches being more valuable than small, fragmented stands.
- Where disturbance has severely altered old-growth forests and the forest is no longer old-growth, consider planting as necessary and when appropriate for the site or ensure timely stand establishment, development, and a progression toward old-growth forest conditions.
- Map old-growth stands located during project design to promote consistent management of those areas. Old-growth forests are dynamic and require periodic map updates.
- Evaluate trends in species composition and structure to identify pending mesophication (process by which fire removal from fire-dependent forests changes the species composition of the forest) uncharacteristic tree density and potential threats to frequent-disturbance forests. Remove encroaching species in old-growth forests to reduce their vulnerability or to increase their quality.
- To perpetuate old-growth forest components, encourage the development of old-growth forest conditions in areas where old-growth forest is lacking using site specific and forest level analysis.
- Consider maintaining old-growth forest refugia for climate adaptation.
- Consider that old-growth forests are dynamic and will not remain in fixed locations but will instead shift across the landscape over time.

Appendix B - **Example** of Old-Growth Silvicultural Prescription

The following **example** suggests a framework for writing an old-growth silviculture prescription following Forest Service Handbook direction (FSH 2409.17), and it is from an operational old-growth prescription. Formats for detailed silvicultural prescriptions vary across the National Forest System. The goal with this **example** is to identify the recommended analysis components that should be incorporated into prescriptions that are treating old-growth forest conditions. The components for treating old-growth forests may not typically be identified in a standard treatment prescription. They include the following:

- Associated characteristics (snags, large coarse woody debris, green tree replacement, and so forth).
- Details existing conditions identifying specific threats to old-growth forests and how the current stand characteristics are vulnerable to those threats.
- Describes the desired future conditions based on land management plan components (desired conditions, objectives, standards, and guidelines). The desired future conditions elements should be in a qualitative and/or quantitative form regarding the old-growth forest definition for the vegetation type where the treatment is occurring (prescription being written for) such as species composition, structure, basal area, downed woody debris, and so forth.
- A comparison table of existing conditions to desired conditions.
- Monitoring elements for evaluation (compliance with project objectives, land management plan components, regional definitions), implementation (prescribe treatments were implemented) and effectiveness (desired outcomes achieved).

Detailed Silvicultural Prescription
Prescription Template for Old-Growth Forests

[*Name*] National Forest

Date:
Original-Revision number:
Treatment: improve cut, prescription burning
Silviculturist Signature: Smokey Bear, Certified Silviculturist
Prepared by:

Project Name and Sale Name:	Environmental Decision:	Environmental Document Number (PALS Number):[1]	Environmental Project Decision Date:
Smokey Bear Vegetation Project Little Jumper	Smokey Bear Collaborative Vegetation Management Environmental Assessment	57341	May, 2021

1.-Planning Administrative Reviews and Litigation System, a Forest Service database

Unit(s):	Acres:	Parent Stand(s):	Home Org	FACTS SUID: (Including AU Org)[1]
53A	126	A160300300001	xxxxx	0XXX01A160300300000 A160300300

1.-FACTs is the Forest Activity Tracking System, SUID is the sub-unit and AU is the activity unit.

Habitat Type(s)/Broad PVT[1] Group, Zone:	Slope, Aspect and Elevation:	Logging System:	Productivity Class:	Management Area (MA):	Land Suitability Class:
Habitat type: 322 PSME/CARU/ARUV PVT: Warm dry Zone: Western Montana	30 percent Southeast 5,627 feet	Ground based, Yard tops	5	MA 2	500

1.-PVT is the potential vegetation type, examples include PSME - Douglas-fir; CARU- pinegrass, and ARUV- bearberry.

Community at Risk:	Community Wildfire Protection Plan (CWPP):	Wildland Urban Interface present:	Condition Class Fire Regime:	Fuel Model (FM) and Fire Group
Any Town, USA	CWPP	Yes	I; 0-35 years Low/mixed severity	FM 9 /TL8 main carrier is moderate load of long needle litter and a mix of scattered grass and shrub. Spread rate moderate; flame length low to moderate.

Objectives: Management area, project objectives; see the environmental decision

MA 2-01- Vegetation management activities (including timber harvest, thinning, and prescribed fire) have a dominant role in affecting the composition, structure, and pattern of vegetation and maintaining or trending vegetation and wildlife habitat toward the desired conditions. Natural disturbances, such as unplanned fire, insects, or disease, have a minor influence on vegetation conditions.

Project objectives: Reduce Douglas-fir, increase ponderosa pine, reduce high density forests in the warm-dry type, lower risk, and loss of trees to insects and diseases and increase forest resilience across the landscape especially in late successional old-growth stands.

Existing Condition

(Stand structure, past treatments, age classes, size classes, species composition, basal area, trees per acre, insect or disease presence, snags per acre, regeneration, shrubs, down wood, litter/duff, canopy base height)

The unit was harvested in 1997 and had a broadcast burn the following year in 1998. Another improvement cut followed in 2006. There are scattered remnant ponderosa pine and groups ranging in diameter from 21 to 40 inch diameter at breast height. Stand structure is trending toward uneven-aged structure (see comparison table below). Ponderosa pine is approximately 50 to 60 percent of the stand and Douglas-fir is 40 percent or less dependent on the aspect. Basal area ranges from 40 to 120 feet squared per acre of basal area. Generally, the Douglas-fir in the overstory exhibits top kill or have large branch die-back because of multiple years of consecutive spruce budworm defoliation. Dwarf mistletoe is very heavy throughout the landscape in Douglas-fir and with many Douglas-fir having a Hawksworth rating of 4 or greater. Mountain pine beetle is endemic across the landscape. Currently, beetle hazard ratings are moderate to high hazard. The understory consists of varied groups ranging from sapling to pole size in dispersed cohorts. A majority of the Douglas-fir understory has large mortality from spruce budworm. There are portions of the unit mainly in the draws which were not logged or slashed. These areas have moderate amounts of Douglas-fir and ponderosa pine in the understory. There is scattered bitterbrush throughout the unit with varied amounts of willow. Pinegrass is scattered throughout the unit.

Harvest fuels were yarded to the road in the 1997 and 2006 harvest. Fuel measurements were completed in 2020 and there was an average of 7.0 tons per acre of total fuel and coarse woody debris averages 0.2 tons per acre. Most of the fuel loading is in fine fuels. There is an overall low to moderate spread rate and flame length. Canopy base heights are variable from low to very high depending on stand structure, as most live crowns start around 30 feet for trees greater than 16 inch diameter at breast height. Most of the unit has interlocking crowns.

See Comparison of Existing Conditions to Desired Conditions table below for more detail.

Note: This is an example of an existing condition description. Existing condition descriptions in prescriptions can have greater detail.

Desired Future Condition

(The desired future condition should tier to land management plan components. For example: stand structure, age classes, size classes, species composition, basal area, trees per acre, insect or disease resilience, snags per acre, shrubs, down wood, litter/duff, canopy base height, and so forth.)

The desired condition FW-DC-TE&V-01 recognizes the importance of both maintaining existing old-growth forest and fostering the long-term development of old-growth forest. Old-growth forest is dynamic; old-growth forest will be lost to stand-replacing wildfire and other disturbances, but it will also be gained through natural succession of vegetation. Forest plan direction for old-growth forest supports the enhancement of the successional process toward old-growth that could be achieved in some stands through management activities. The forest plan uses the Old-Growth Forest Types of the Northern Region (Green et al 1992, errata 2011) to provide definitions of old-growth for the forested vegetation types occurring on the forest. In areas where the project purpose includes addressing old-growth forest conditions (for example, the size, shape, structure, and connectivity of old-growth forest patches), management approaches (FW-STD-TE&V-03; FW-GDL-TE&V-09) include the following for warm-dry potential vegetation type with presence of ponderosa pine:

- Mosaic of stand conditions such as stocking, age class, and species composition relative to historic range of seral and climax tree species
    - Within the potential vegetation group strive to maintain 15 To 25 percent seedling/sapling, 15 to 35 percent pole, 10 to 30 percent mature, and 20 to 50 percent over-mature structural stages based on the ICBEMP scientific findings (USDA Forest Service 1996).
- Largely multi-storied and two-aged trending toward uneven-aged structure.

  - ♦ Non-uniform, relatively open community of late seral ponderosa pine and Douglas-fir sustained through prescribed fire and timber harvest at frequencies consistent with natural fire returns.
- Species composition of approximately 70 to 85 percent ponderosa pine and 15 to 30 percent Douglas-fir.
- Stand density, between 60 to 120 basal area (feet squared per acre), depending on aspect.
- Reduce densities and inter-tree competition to help increase resilience to drought that may be associated with future climates and meet desired conditions with respect to fire behavior.
- Maintain key cover areas for dependent wildlife. Maintain wildlife travel corridors to provide a more continuous level of connectivity between habitat features.
  - ♦ 20 to 25 percent retention of seedling/sapling groups of 100 foot in diameter or larger (or consult wildlife biologist) for hiding cover and flammulated owls.
- Retain existing snags, broken-topped live trees, and down logs to provide for a variety of wildlife species. See Comparison Table for specific numbers.
- Retain large diameter trees as snag replacements and seed sources as they represent a unique component of the potential vegetation group that typically survived low severity fires.
- See the "Comparison of Existing Conditions" section for specific numbers.

Comparison of Existing Conditions to Desired Conditions
(This section is important because this determines the purpose and need for treatment).

Component	Existing Condition Characteristics	Does it meet desired future conditions?	Desired Condition Characteristics
Late Seral Trees (trees per acre, size, age, condition)	Many large diameter trees are present mainly ponderosa pine greater than 21 inches diameter at breast height. Diameters range from 21 to 40 inches diameter at breast height. Age within unit is 170 to 320 years old. Basal area of late seral trees is approximately 120 feet squared per acre.	Yes	Green et al. Old-growth Type A/B; Maintain at a minimum 8 or more trees per acre greater than 21 inches diameter at breast height with a minimum age of large trees equal to or greater than 170 years or greater. Primary species in the age and size class are ponderosa pine with some Douglas-fir represented (if applicable).
Associated Wildlife Characteristics for Old-Growth Forest Type	Mixed composition and coverage of browse species. Species present include native grasses, serviceberry, and snowberry. The brush is not heavily browsed. New shoots and growth. Large percent cover of grass species; mainly pinegrass. Noxious weeds are present.	Varies	High value species in high coverage. Increases in native grasses with little to no exotic species. Vigorous shrub species exhibiting new shoot growth and re-sprouting. Treat the noxious weeds. Woodpecker habitat – trees with woodpecker holes. Groups of seedling/saplings greater than 100 feet in diameter scattered through unit for hiding cover and flammulated owl habitat.
Tree Species Composition, Density, Age, Successional Stage, and Structure	Varies depending upon fire history. Generally, stands are heavy to ponderosa pine. Varied amounts of Douglas-fir. Ponderosa pine stands are beginning to exhibit some multi-storied and multi-layered stand appearance. Augmenting with openings to produce regeneration of ponderosa pine will likely be necessary to meet desired future conditions.	Varies by stand	Species composition should meet land management plan standards and guides. Ponderosa pine would represent the majority of the overstory conifer trees species composition. Reduced tree densities in the understory and middle story. Promote or enhance ponderosa pine understory over Douglas-fir. A mosaic of stand structures is highly desirable. The age of the dominant trees on the landscape should be 170 to 600 or more years old.

Component	Existing Condition Characteristics	Does it meet desired future conditions?	Desired Condition Characteristics
Insects and Disease	Beetles are present. Risk of a mountain pine beetle epidemic occurring and major losses in standing green trees is high especially in the old-growth forest. Moderate to high beetle hazard. Dwarf mistletoe Hawksworth rating is greater than 4. Spruce budworm is very prevalent and causing high mortality in multistoried Douglas-fir areas.	No	Low levels and endemic populations of mountain pine beetle is desired. Reduced dwarf mistletoe occurrence across the landscape especially in Douglas-fir dominated stands. Reduced level of spruce budworm within the Douglas-fir stands.
Fuels	Fuel model 9 and TL8. Fine fuel loading varies greatly (average 4.5 tons per acre, range 0 to 8 tons per acre) depending on stand's developmental stage with minimal large (greater than 10 inches diameter at breast height) fuel, course woody debris. Crowns interlocked; ladder fuels spotty to overly dense in Douglas-fir rather than the desired ponderosa pine.	No	Continuous stands of interlocked crowns are broken up with small openings and areas of greater than 25-feet-wide spacing to reduce the risk of stand replacing fire. Modifying fuels will change to FM 2 and TL1 to meet fuel loadings less than 1 ton per acre of fine fuels while maintaining at least 5 tons per acre of course woody debris greater than 10 inches diameter at breast height with overall fuel loading at 10 tons per acre or less. Ladder fuels reduced however, keeping structure through maintaining some regeneration (seedling/sapling) patches (primarily ponderosa pine). Grouping of different cohorts across the unit.
Associated Characteristics for Old-Growth Forest Type (snags, broken top trees, coarse woody debris)	There are 2 to 3 trees per acre of large snags (greater than 10 inches diameter at breast height) and very few large diameter (greater than 10 inch diameter at breast height) downed logs.	No	Increase the number of large snags present – 10 inch diameter at breast height and 5 trees per acre; greater than 15 inches diameter at breast height and 3 trees per acre; greater than 20 inches diameter at breast height and 1 tree per acre. Maintain large diameter (greater than 10 inches diameter at breast height) downed woody debris at 5 to 10 tons per acre.

Diagnosis and treatment alternatives

(Does the existing condition meet the desired future condition? Yes or no? If no, do we need to defer treatment, modify existing condition, or stabilize? Various individual or combinations of vegetation management tools (for example, burning, non-commercial or commercial treatments) may be valid. Explanation and chosen treatment should support the purpose and need of the project and meet the objectives. Document in this section the rationale for treatment.

Diagnosis Matrix

Treatment Options (Question asked)	Response Yes or No	Detailed Rationale Note: the detailed rationales are examples. More in-depth rationale could occur in an operational prescription.
Currently Meets Desired Conditions?	No	The current species composition, snags, coarse woody debris, insects and diseases hazard, does not meet desired future conditions. Threats are specific to old-growth forests from insects and diseases and wildfire.
Can Treatment Be Deferred?	No	Deferring treatment would increase insects and fire risk beyond acceptable levels. Would also result in stand moving further from the desired future conditions.
Prescribed Burning Only?	No	Prescribed burning alone would not meet any objectives.
Non-Commercial Thinning?	Yes	The unit as a whole is past a stand improvement treatment and treating the few groups of understory would not meet desired future conditions.

Treatment Options (Question asked)	Response Yes or No	Detailed Rationale Note: the detailed rationales are examples. More in-depth rationale could occur in an operational prescription.
Intermediate Harvest?	Yes	Feasible for this type of treatment to move stand toward desired future conditions. Will maintain resiliency of old-growth stand while still maintaining old-growth characteristics for this forest type. Thinning to reduce interspecific competition, increase species richness, and group thinning increase age class diversity will reduce the risk of unacceptable loss.
Uneven-aged Management?	No	Currently the stand is old-growth and trending toward uneven-aged.
Preferred Option		**Intermediate Treatment:** Improvement cut and prescribed burning. Stocking reduction through intermediate improvement harvest followed by prescribed under-burning would create a more open stand, mimic historical disturbance regimes and reduce the risk of stand replacement fire. These treatments would retain and promote old-growth forest attributes and function and promote winter range value.

Activities: (Add the sequence of activities required for the preferred treatment as identified in the stand diagnosis)
Note: This is an example and not a complete list of activities.

Activity (Example Activities below. Delete-update as applicable)	Program Area	Activity Code	Local Qualifier	Planned Year	Unit of Measure (Acres)	Method Code	Equip. Code	Fund Code	Work Agent	Purpose Code
Silvicultural Stand Examination	Silviculture	4310	Old-growth exam	2020	126	920	000	NFSE	FA	N/A
Stand Diagnosis	Silviculture	4320	N/A	2020	126	100	000	NFSE	FA	N/A
Silviculture Prescription	Silviculture	4331	N/A	2021	126	100	000	NFSE	FA	N/A
Improvement Cut	KP6	4210	N/A	2022	126	420	424	XXXX	PR	FTI
Yarding	KP6	1120	AF-yardtops	2022	126	420	424	PPPP	PR	FTI
Rearrangement of Fuels	KP3	1150	NF-slashing	2023	126	200	111	NFHF	CT	FTI
Post Treatment Vegetation Monitoring	Silviculture	4346	Post harvest-old-growth monitoring	2023	126	930	000	NFSE	FA	N/A
Broadcast Burning	KP6	1111	Activity fuels	2024	126	300	302	BDBD	FA	FTF
Post Treatment Exam	KP3	1182	Fuels monitoring	2024	126	901	901	NFHF	FA	N/A
Post Treatment Vegetation Monitoring	Silviculture	4346	Old-growth monitoring	2024	126	930	000	NFSE	FA	N/A
Underburn, Maintenance Burn	KP3	1113	Natural fuels	2031	126	300	302	NFHF	FA	FTM
Post Treatment Vegetation Monitoring (Old-growth forest monitoring)	Silviculture	4346	Old-growth monitoring	2031	126	930	000	NFSE	FA	N/A

Activity, Contract Specifications and Notes: Decision Notice- Finding of No Significant Impact Design Features and Forest Plan Requirements

Note: This is an example and not a complete list of activities or description.

4310 Silviculture Stand Examination — Collection of stand and site data needed to prepare treatment diagnosis and field verify old-growth forest requirements.

4320 Stand Diagnosis — Preferred option for treatment: improvement cut, prescribed fire, and understory treatments based on existing conditions, and land management plan direction.

4331 Silviculture Prescription — Document prepared and then approved by a certified silviculturist describing management activities needed to implement silvicultural treatments and sequence.

4210 Improvement Cut — Removal of less desirable species to improve the composition and quality of the stand while maintaining old-growth forest characteristics. Refer to marking guides.

1120 Yarding — Yard tops only as the stand is deficient of large coarse woody debris.

1150 Rearrangement of Fuels (Slashing) — (Species preference, best tree description, size limit less than X inches diameter at breast height, scrub slashing, slash pull back, duff mound raking).

After harvest the silviculturist, wildlife biologist and fuels specialist jointly will determine understory needs (natural fuels, not activity from harvest) and amend the prescription.

4346 Post Treatment Vegetation Monitoring—Collection of data to evaluate effectiveness of treatment and ensure old-growth forest requirements are maintained after treatments, harvest and burning.

Associated characteristics and burn objectives summary table for old-growth forests

(Note: this is an example of associated characteristics and burn metrics used in old- growth forests)

Associated Characteristics For Old-Growth forests (Using land management plan components)

Type	Size	Detailed Rational
Snags (Minimum)	10 inch diameter at breast height, 5 trees per acre; greater than 15 inches diameter at breast height, 3 trees per acre; greater than 20 inches diameter at breast height, 1 tree per acre.	Species identified to reserve: western larch, ponderosa pine, Douglas-fir. Refer to land management plan and fire group requirements (FW-GDL-TE&V-09).
Coarse Woody Debris	5 to 10 tons greater than 10 inches diameter at breast height. Retain an average of 5 to 10 tons per acre of coarse woody debris greater than 10 inches diameter at breast height.	Integrate with total fuel loads as guided by fire groups (FW-STD-TE&V-03) forest plan requirements for FG 6: 5 to 10 tons per acre. Large coarse woody debris greater than 10 inches diameter at breast height will not be intentionally burned.
Green Tree Replacement	4 greater than 15 inches diameter at breast height; 2 greater than 20 inches diameter at breast height.	Large trees, dead tops with Comandra blister rust, and so forth (FW-GDL- TE &V-09).

Burn Summary Objectives Used For Burn Plan

Objective	Amount	Notes
Desired Burn Area	70 to 90 percent of total acres	Left blank
Allowable Opening Size	1 to 5 percent of total acres	Opening sizes could range from 1 to 5 acres scattered across the unit, not more than 10 total acres created.

Objective	Amount	Notes
Maximum Desired Residual Tree Mortality	Greater than 20 inch diameter at breast height equals less than 1 percent.	Windspeeds should average 5 to 10 miles per hour with gusts up to 15 miles per hour. Sustained winds over 20 miles per hour will increase mortality.
Maximum Desired Residual Tree Mortality	12 to 18 inches diameter at breast height equals 1 to 20 percent.	Left blank.
Maximum Desired Residual Tree Mortality	7 to 12 inch diameter at breast height equals 1 to 35 percent.	Left blank.
Maximum Desired Residual Tree Mortality	Less than 1 to 7 inches diameter at breast height (see notes).	Seed/sapling equals Douglas-fir mortality greater than 40 percent mortality, ponderosa pine less than 40 percent mortality.
Desired Shrub Top Kill	Greater than 60 percent of shrubs over 50 to 100 percent of the burn area.	Willow can have greater mortality, less in bitterbrush.
Desired Litter and Duff Reduction	20 to 40 percent reduction in litter over 20 to 80 percent of the burn area.	If duff is more than 5 inches of build up at root collar may need to implement procedures so cambium does not cook.
Site Scarification	Bare mineral soil shall be less than 40 percent across the unit.	Burn prescriptions should be designed to maintain at least 60 percent of the ground cover following harvesting and burning. Ground cover includes litter, duff, coarse woody debris, rocks, live vegetation, lichens, and moss. This is a mitigation measure found in the environmental assessment on page II-19.
Canopy Base Height (crown lifting)	Lift understory crowns no more than one-third of their total live crown.	Bole scorch is acceptable on up to 15 percent of the residual Douglas-fir trees greater than 12 inches diameter at breast height. Live crown ratios on ponderosa pine can be reduced up to 25 percent and Douglas-fir total live crown can be reduced up to 70 percent. In order for Douglas-fir to be killed during the burn, bark must be burned into and the outer bark characteristics are lost

National Fire Plan Operations and Reporting System (NFPORS) Management Objectives

Fuel objectives met?	If yes, estimate acres	Primary fuels objective?	Non-Hazardous Fuels Objectives?	Were non-hazardous fuels objectives met?	If yes, estimate acres	Non-hazardous fuels objective
Yes	Whole Unit	Moving toward desired	Yes	Yes	Whole Unit	Moving toward desired

Project Design Criteria and Layout Notes:

(See decision notice for design features and mitigation measures)

Map:

Marking Guides:

Evaluation and Effectiveness Monitoring Questions: