Midnight Restoration Project

Landscape Evaluation and Prescription

Photos by Derek Churchill

RESILIENT FORESTRY

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Contents

Acknowledgements

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The purpose of this document

This is a landscape evaluation and prescription for the Midnight Restoration Project area. In this context, a landscape is a collection of sub-watersheds composed of forest and non-forest patches. The Midnight planning landscape is approximately 67,000 acres in size, with individual patches ranging from about 10-200 acres.

A landscape evaluation describes how the current ecosystem conditions differ from the desired conditions.

A landscape prescription describes the management actions that are needed to move the ecosystem from its current conditions to the desired conditions.

Since these analyses are closely related, this document treats them as one unified task. The results of this analysis are answers to the following questions:

- How many acres of this landscape should be treated to restore the ecosystem?
- What kinds of treatment are needed?
- Where are the most important places to treat?
- Where might social, policy, and operational filters affect what work can actually be done?

These answers allow forest managers to clearly express the landscape restoration purpose and need. This is also a starting point for creating a proposal for management actions that will address the treatment need.

Executive summary

The Midnight Restoration Project landscape has a need for treatments to reduce forest density and change the spatial patterns of trees across about 8,850-12,500 acres, or 13-19% of the landscape. Among the three sub-watersheds that compose the Midnight planning area, about 20% of the treatment need is in Upper Twisp, about 50% is in Middle Twisp, and about 30% is in Little Bridge Creek. All of these acres are currently inhabited by young, dense forest with multilayered canopies. The goal of treatments would be to transition these forests to a more open canopy condition, restore surface fuel loads, and reintroduce the frequent fire that historically maintained this landscape.

There are opportunities to enhance habitat for wildlife focal species while performing this work. There is a need across the landscape to consolidate white-headed woodpecker habitat through restoration of open-canopy dry pine forests, especially in Little Bridge Creek. There are variable needs for northern spotted owl habitat, but an emphasis is retaining dense, complex forest where it will be sustainable into the future given threats from fire and drought. Parts of Upper Twisp and north-facing slopes of Middle Twisp offer the best options.

The majority of areas in need of treatment are outside of inventoried roadless areas, but some higher priority areas (500-1000 acres) fall within these zones. There is a significant need for treatment within late-successional reserves (LSR): potential treatment locations are roughly evenly split between LSR and Matrix. There is no way to address the landscape treatment need without treating in LSR.

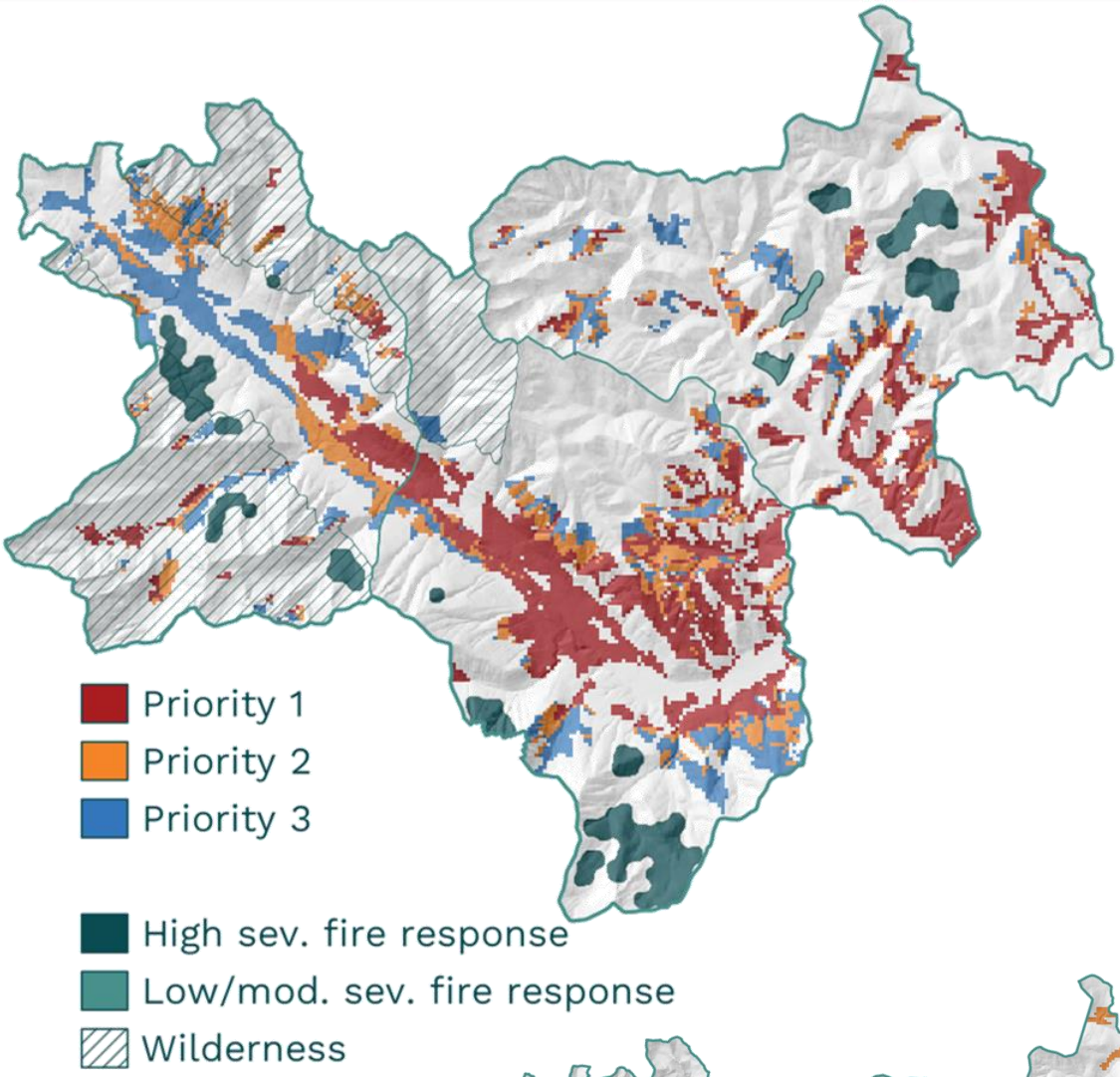
Given recent fires in the area (2018 Crescent and 2021 Cedar fires), there is a need for some specific post-fire management actions. About 8,000-15,000 acres are in need of post-fire recovery, including assessing natural regeneration and potentially planting additional trees. Within the Cedar fire footprint, about 150-300 acres would benefit from post-fire thinning of green and/or dead trees to leverage the work of wildfire in accomplishing restoration objectives.

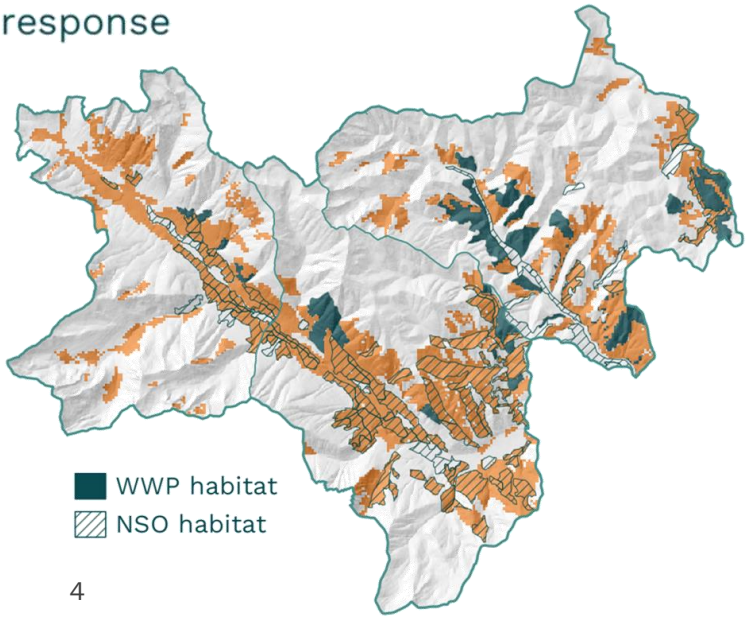
Summary table

Forest type	Treatment need	Notes
Dry forest	Thin 5,500-6,800 acres of dense young forest	Future condition: mostly open-canopy old forest of ponderosa pine and Douglas-fir, consolidate wildlife habitat patches
Moist forest	Thin 2,600-3,900 acres of dense young forest	Future condition: mostly open-canopy old forest of ponderosa pine, Douglas-fir, and western larch
	Maintain most northern spotted owl habitat	Fewer, more compact patches in most sustainable locations
Cold forest	Thin 750-1,800 acres of dense young forest	Grow into complex old forest with less subalpine fir, will also provide marten habitat

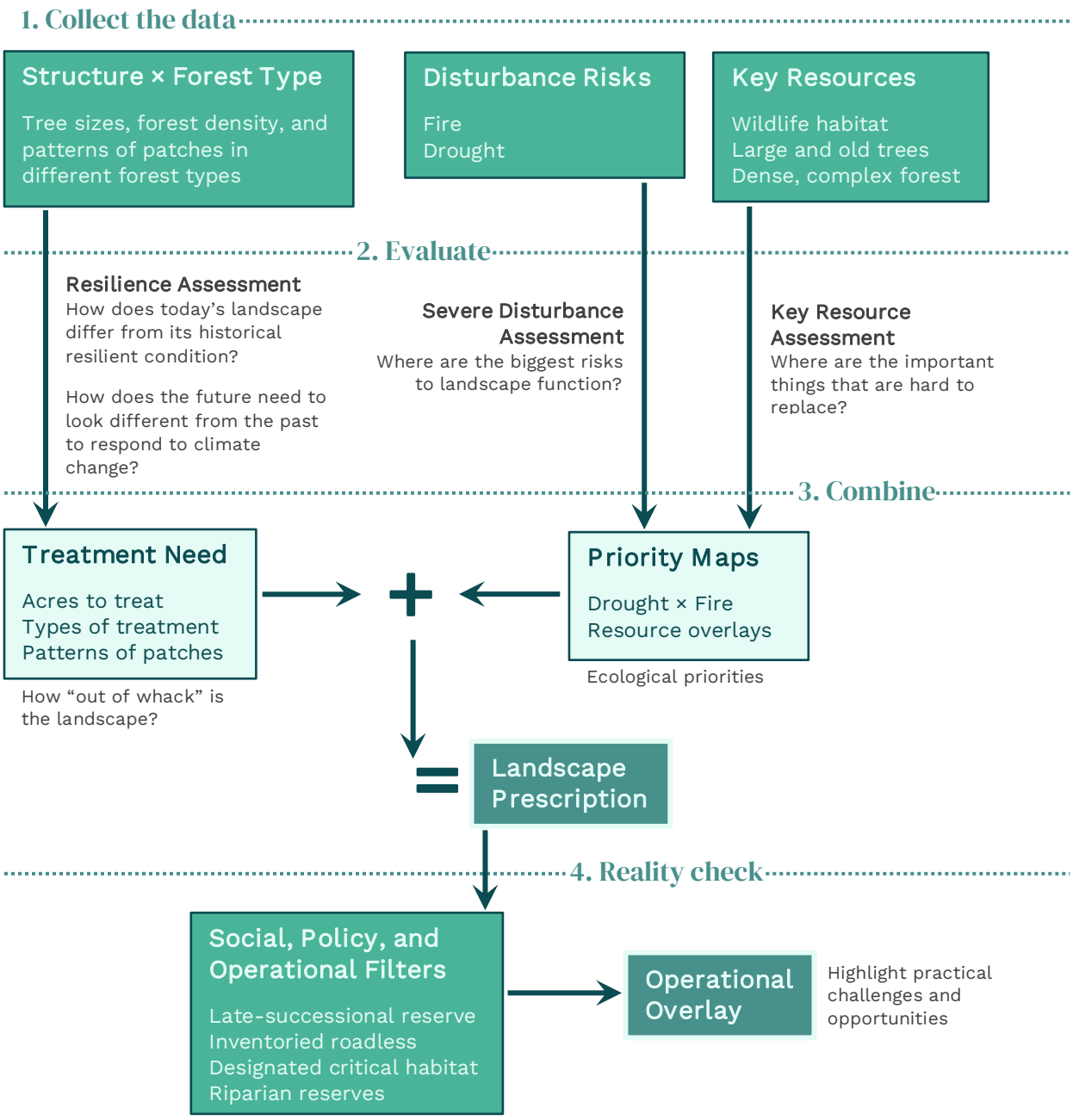
Summary map

This map shows a summary of the landscape prescription. Priority 1 represents the minimum number of treatment acres that would address the landscape need. Priorities 1 and 2 together address the maximum number of acres needed. Priority 3 represents lower priority acres that can be substituted when Priority 1 and 2 acres are ruled out for practical reasons. Habitat overlays for focal species are shown below for context.





How it works


1. Collect the data
Structure × Forest Type
Tree sizes, forest density, and patterns of patches in different forest types
Disturbance Risks
Fire
Drought
Key Resources
Wildlife habitat
Large and old trees
Dense, complex forest
2. Evaluate
Resilience Assessment
How does today's landscape differ from its historical resilient condition?
How does the future need to look different from the past to respond to climate change?
Severe Disturbance Assessment
Where are the biggest risks to landscape function?
Key Resource Assessment
Where are the important things that are hard to replace?
3. Combine
Treatment Need
Acres to treat
Types of treatment
Patterns of patches
How "out of whack" is the landscape?
+
Priority Maps
Drought × Fire
Resource overlays
Ecological priorities
=
Landscape Prescription
4. Reality check
Social, Policy, and Operational Filters
Late-successional reserve
Inventoried roadless
Designated critical habitat
Riparian reserves
Operational Overlay
Highlight practical challenges and opportunities

Incorporating Forest Restoration Principles

The analysis presented in this document is based on the Okanogan-Wenatchee Forest Restoration Strategy evaluation process. In support of this type of analysis, Hessburg and others published a 2015 article describing seven core principles for forest restoration in dry, fire-dependent ecosystems of the inland Northwest. This landscape evaluation and prescription follows the seven principles. Here, we explain how the management guidance from these principles is used in this analysis.

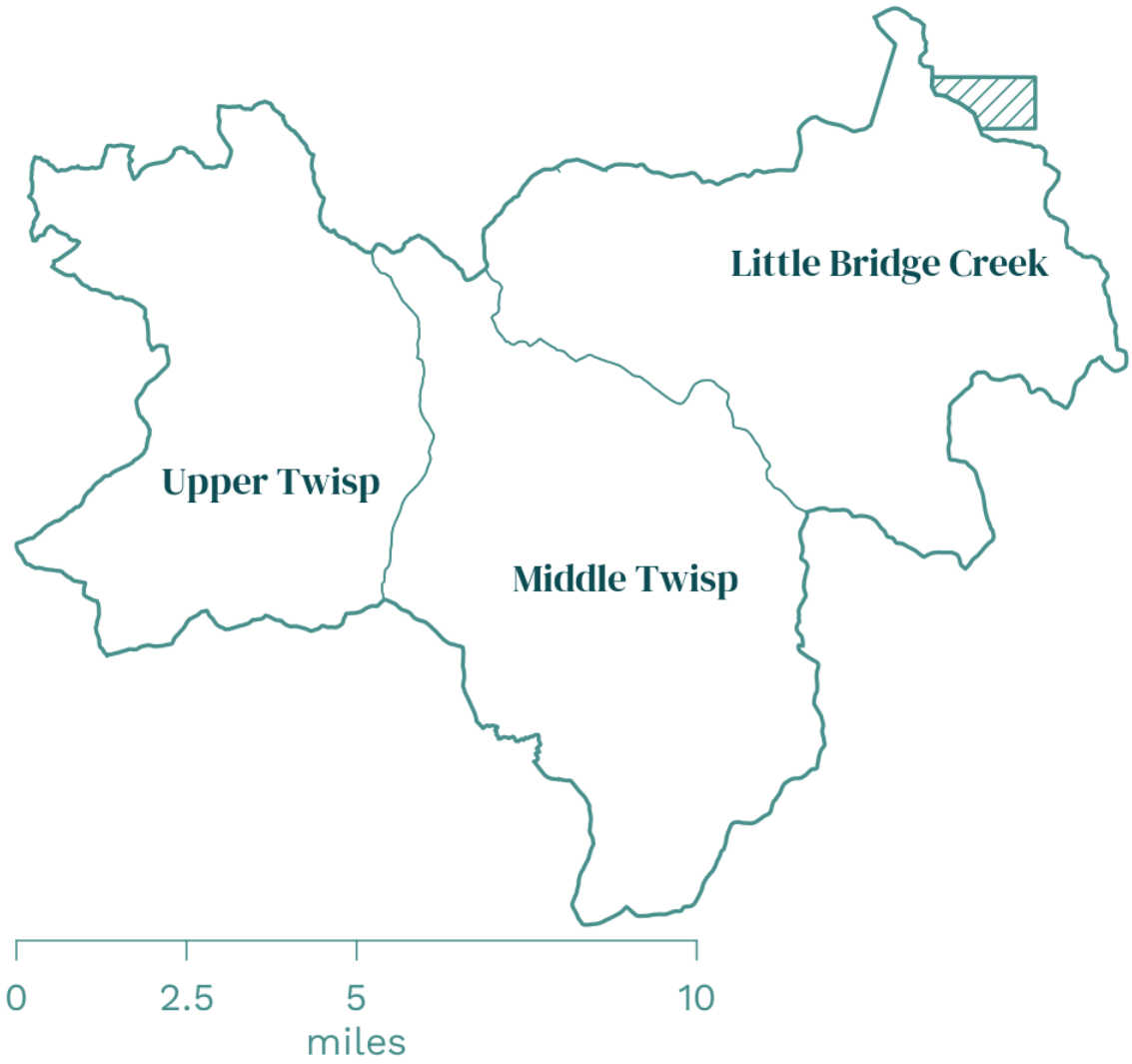
Guidance	How it is used here
Management must have coherent links across spatial scales from trees to landscapes to regions	This analysis is just one piece (i.e., the mid-scale) of landscape restoration planning. Planning areas like this one are identified in the context of the greater watershed/region. The next step is stand-level planning guided by this landscape prescription.
Use topography as a template to guide restoration	The Resilience Assessment (pgs 7-9), Drought and Fire Prioritization (pgs 10-11), and Large Tree Sustainability (pg 13) all aim to better match vegetation to the topographic template.
Restore disturbance regimes and vegetation patterns; the rest will follow	The Resilience Assessment (pgs 7-9) and Drought and Fire Prioritization (pg 10) are designed to put the right vegetation types in the right places and allow natural disturbances to re-establish.
Restore the natural configuration of forest patch sizes and patterns	The Resilience Assessment (pgs 7-9) is designed around comparing current forest patches to the sizes and patterns that would be found under resilient conditions.
Within stands, focus on restoring variable tree clump and gap patterns	This occurs at a finer scale than the Landscape Evaluation is concerned with, but the recommended treatments in the Landscape Prescription (pgs 17-19) are intended to accomplish this goal.
Retain and promote large trees, snags, and logs	The Large Tree resource (pg 13) makes this a priority.
Work across ownership and management allocations	This analysis applies social, political, and operational filters only as an interpretive lens after assessing the ecological needs of the landscape (pg 22).

Landscape evaluation overview

Each element of the landscape evaluation is presented in sequence. The elements are then brought together to form the final landscape prescription. The descriptions in this section are intentionally brief. For those interested in more detail, see the Midnight Restoration Project Data Detail Supplement.

The Midnight Restoration Project planning area is composed of roughly three sub-watersheds, shown below. The sub-watershed referred to as Little Bridge Creek throughout this document also includes sections of the Wolf Creek and Thompson Creek sub-watersheds.

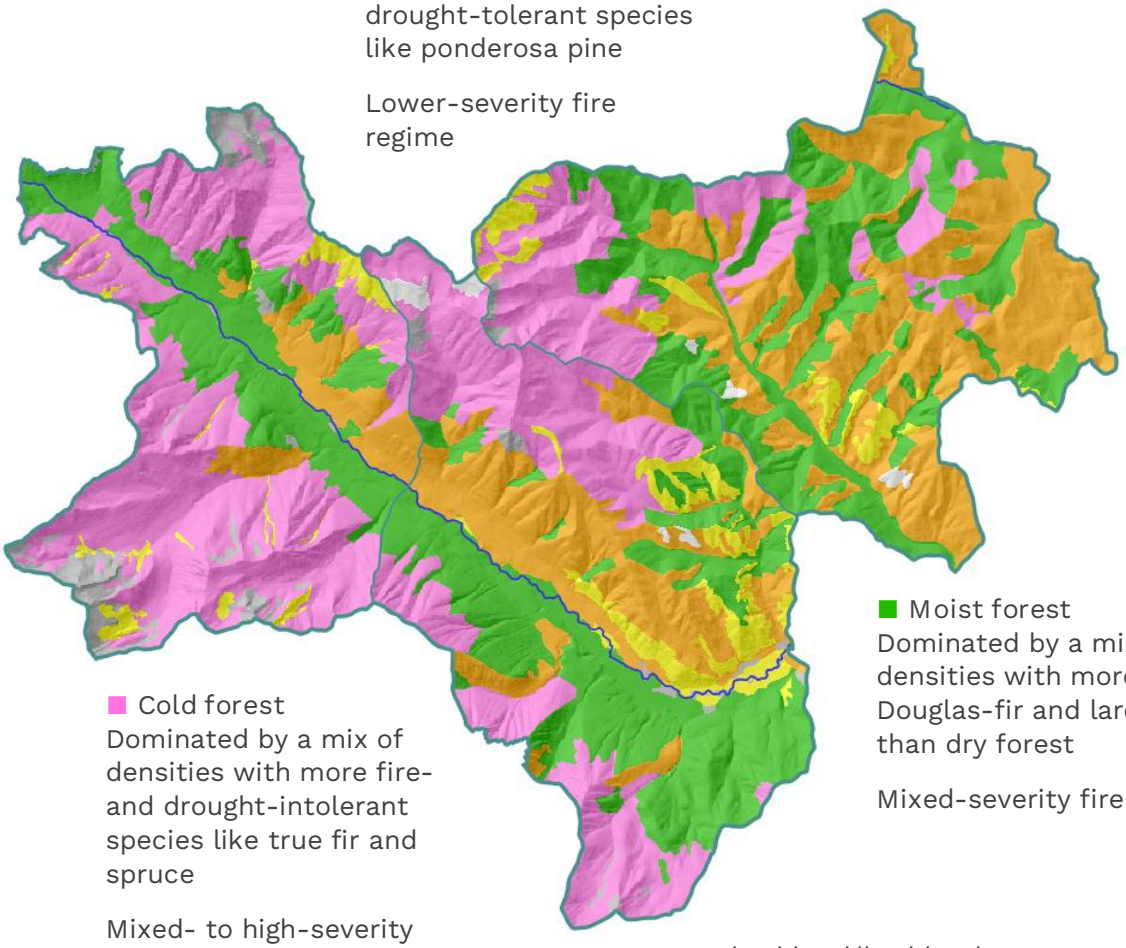
The hashed area northeast of Little Bridge Creek is part of the project area but was not included in this analysis due to data availability. This area is 565 acres, about 80 acres of which is dense forest on a dry site representing potential treatment stands. Separately from the Midnight Project, this area is also a focus for aquatic restoration.



Resilience assessment

Forest type

Different environments support different forest types. In a resilient landscape, species composition, forest structure, and disturbance regimes are tightly coupled with the environmental setting. This means that a restored forest looks different in a dry valley than it does high in the mountains. For this reason, the three major forest types are split apart when evaluating treatment needs. Below, each forest type is described in terms of its characteristic resilient conditions.



■ Dry forest
Dominated by an open canopy of fire- and drought-tolerant species like ponderosa pine

Lower-severity fire regime

■ Moist forest
Dominated by a mix of densities with more Douglas-fir and larch than dry forest

Mixed-severity fire regime

■ Cold forest
Dominated by a mix of densities with more fire- and drought-intolerant species like true fir and spruce

Mixed- to high-severity fire regime

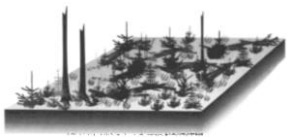
■ Shrubland/herbland
Areas without forest cover are dominated by shrubs and grasses

■ Non-vegetated
Water, rocks, and the like

Forest structure

The sizes, density, and pattern of trees is referred to as forest structure. The size and arrangement of patches of similar structure determines a lot about how an ecosystem functions: whether trees have enough water, how fire moves across the landscape, what habitat is available for wildlife, and more. Patches are the basic unit of analysis for this evaluation; we analyze the abundance, size, and pattern of different types of forest patches to understand how much of the landscape needs restoration and what kinds of work need to be done.

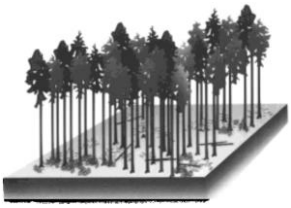
To simplify talking about forest structure, each patch is assigned a structure class. The seven structure classes used in this evaluation are:



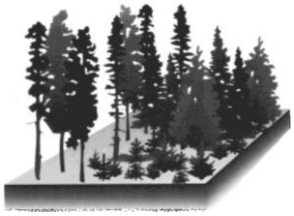
Stand Initiation

Earliest stages of a regenerating forest after severe disturbance

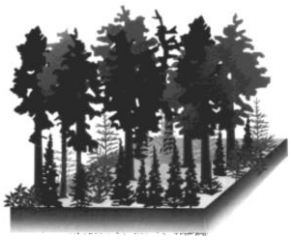
Stem Exclusion, Open Canopy
Young trees in a patchy open canopy, often interspersed with shrubs



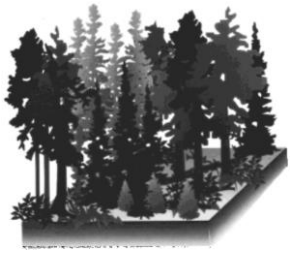
Stem Exclusion, Closed Canopy
Young trees in a dense closed canopy, often shading each other out



Young Forest, Multi-Story
Dense young forest with foliage from treetops all the way to the ground



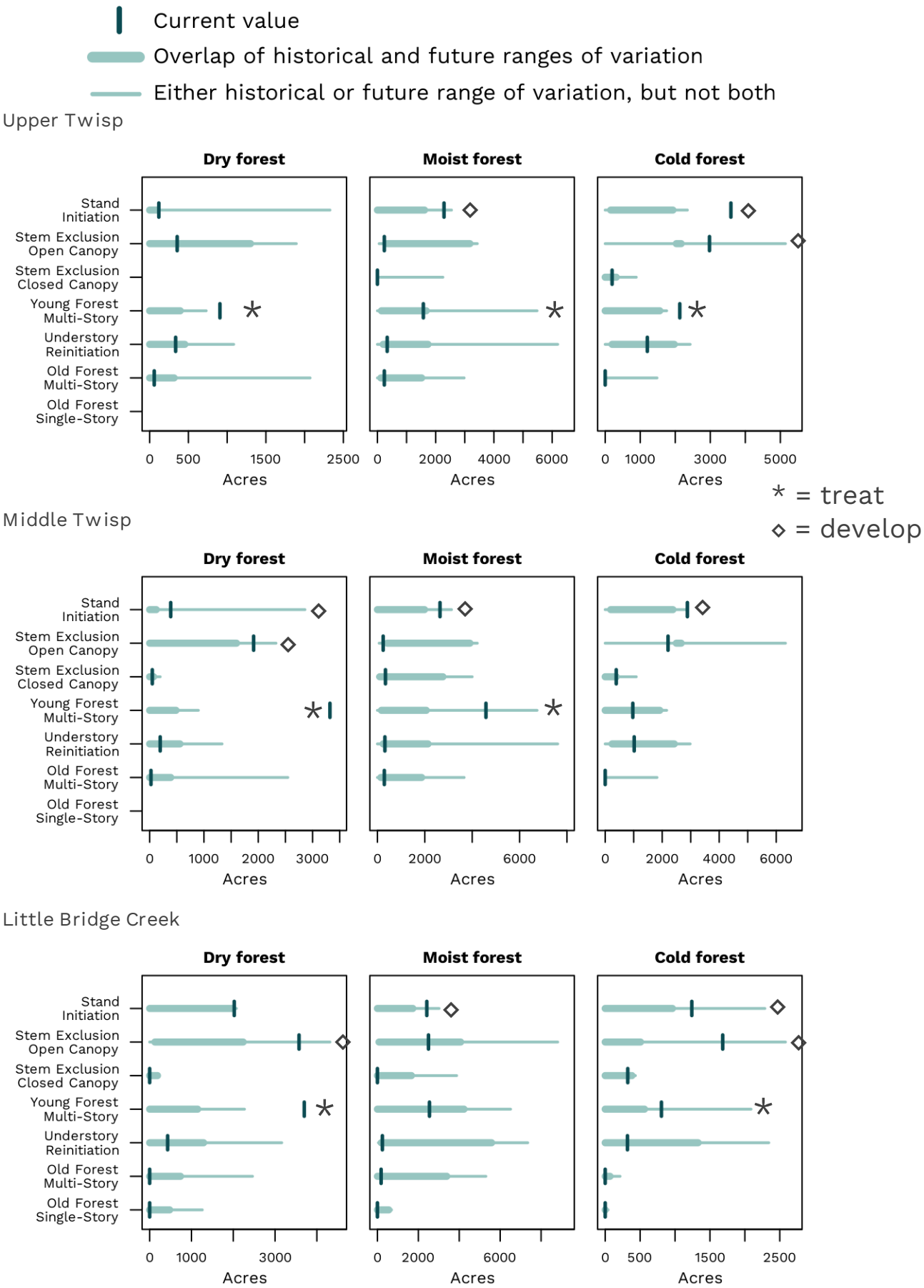
Understory Reinitiation
Young/mature trees with a relatively dense canopy over a separate layer of small trees



Old Forest, Multi-Story
Old trees with dense canopy and continuous foliage from the treetops to the ground

Old Forest, Single-Story
Old trees with open canopy and a large gap between the ground and the lowest branches

Past research has identified ranges of forest structure associated with landscape resilience for historical forests and for future conditions, incorporating ongoing and expected climatic changes. The following charts compare current conditions for each sub-watershed within the planning area to these ranges of variation. The horizontal bars represent the range of resilient conditions under historical and future climates. The small vertical bars represent the current acreage of each structure class in the sub-watershed. Where the current acreage is too high, a * indicates a departure that will be recommended for treatment in the landscape prescription and a ◇ indicates a departure that requires letting the forest develop over time, potentially including treatment to maintain or direct the development. Where the current acreage is too low, the goal is to create more of that class as a result of treatments or to let patches grow over time to develop into the given structure class.

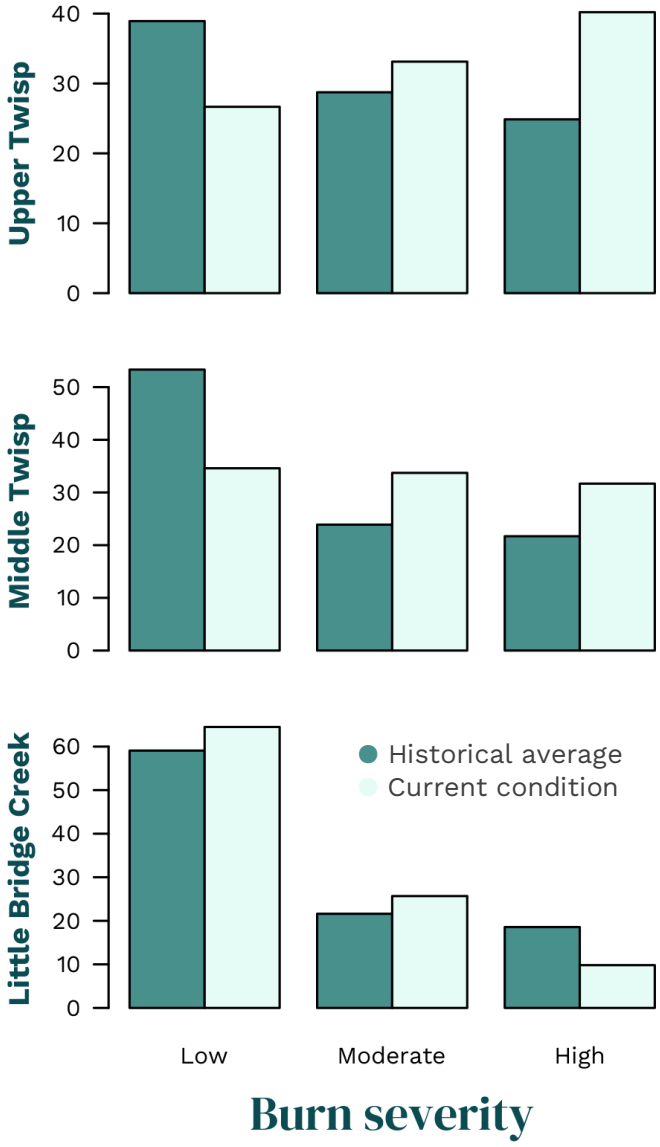

Current value
Overlap of historical and future ranges of variation
Either historical or future range of variation, but not both
Upper Twisp
Dry forest
Moist forest
Cold forest
Stand Initiation
Stem Exclusion Open Canopy
Stem Exclusion Closed Canopy
Young Forest Multi-Story
Understory Reinitiation
Old Forest Multi-Story
Old Forest Single-Story
0 500 1500 2500
0 2000 4000 6000
0 1000 3000 5000
Acres
* = treat
◇ = develop
Middle Twisp
0 1000 2000 3000
0 2000 6000
0 2000 4000 6000
Little Bridge Creek
0 1000 3000
0 2000 6000
0 500 1500 2500

Severe disturbance assessment

Fire

Fire is a key factor shaping western forest landscapes. In this evaluation, it is a priority to reduce the risk of high-severity fire, especially where it endangers key resources such as old trees or critical habitat.

The Midnight Restoration Project planning area has burned relatively recently (see “Post-fire management” section). Based on current vegetation conditions, Upper and Middle Twisp are primed to burn at higher severities than would have occurred historically, while Little Bridge Creek is set to burn at lower severities on average.

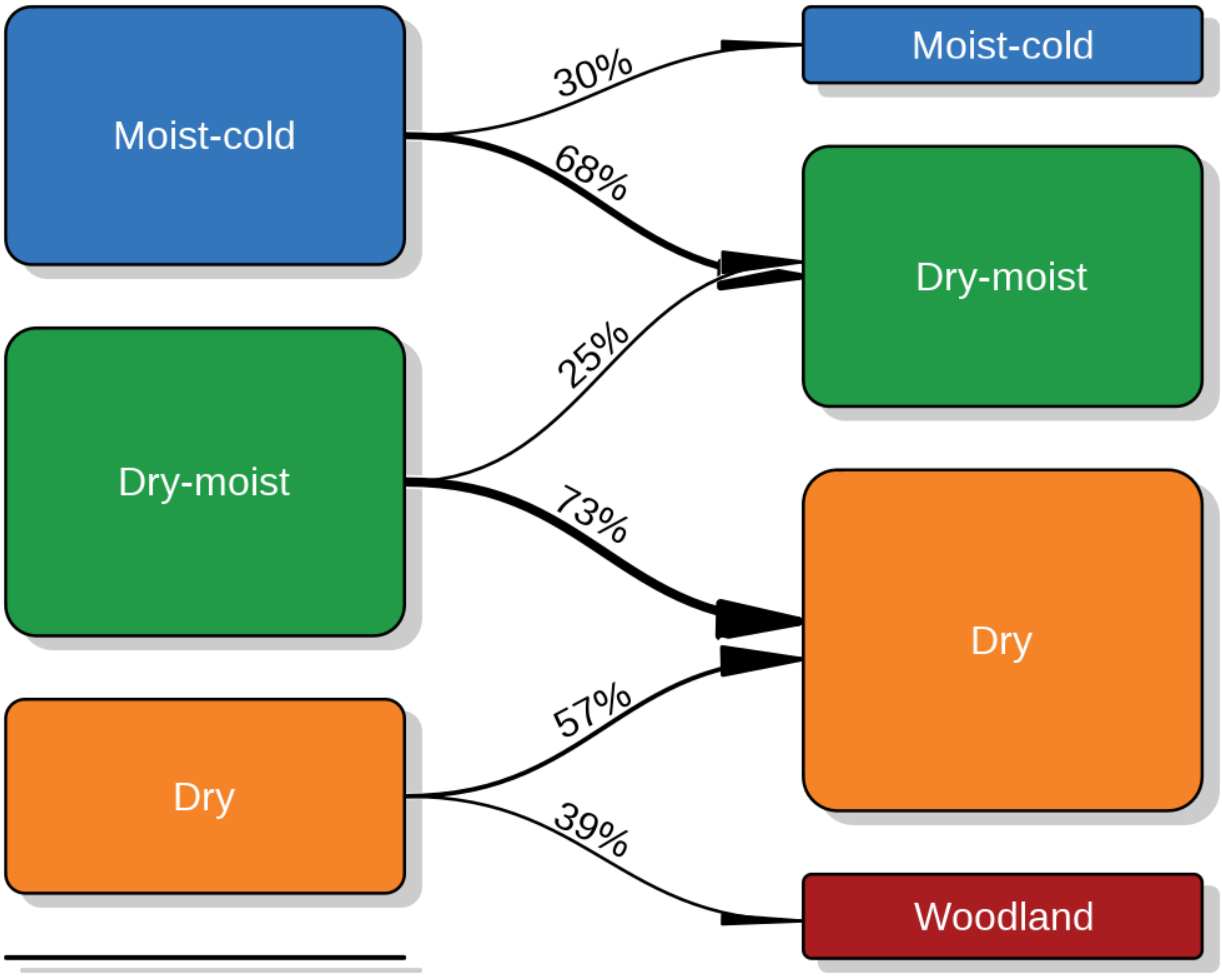


Drought

As climate changes, suitable zones for a given forest type have begun and will continue to shift around. If natural vegetation changes do not keep up with climate shifts, local forest conditions can become stressed as they are no longer supported on a site. In this evaluation, it is a priority to anticipate forest type shifts and treat to re-align vegetation with its environment.

Across the planning area, over one-third of Dry Forest is expected to become Woodland (or grass/herb land) by ca. 2055. Even more strikingly, three-quarters of the moist and transitional forest ("Dry-moist" below) is expected to become Dry Forest.

Forest Type Transitions



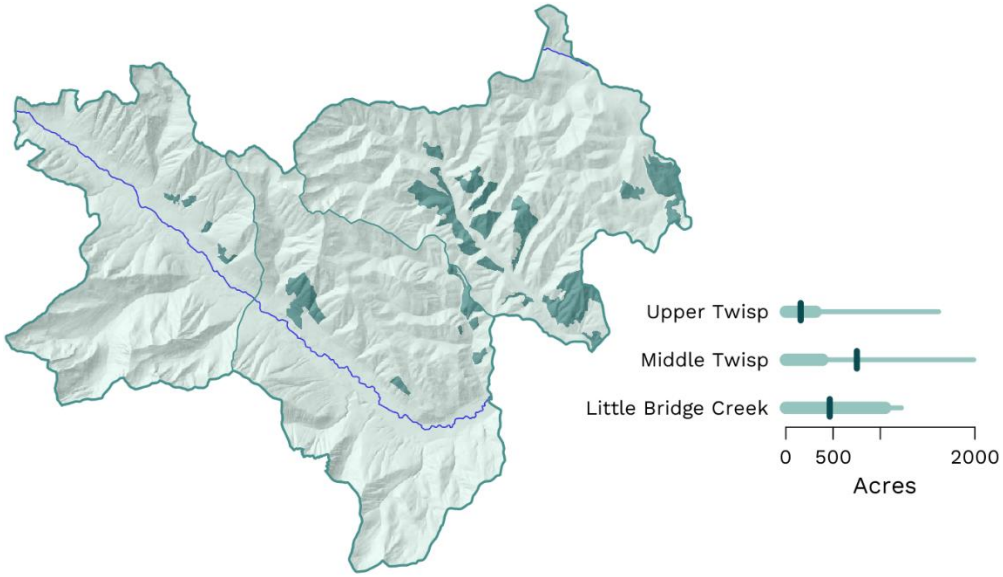
Key resources

Wildlife habitat

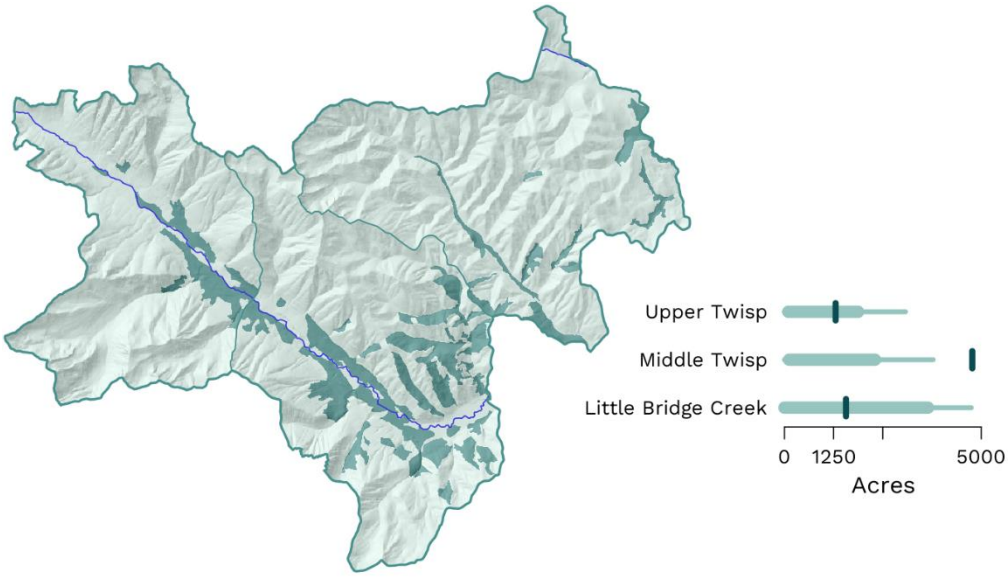
Some wildlife species use habitats that take a long time to develop and are hard to replace. It is a priority in the landscape evaluation to protect and restore habitat for certain species. However, protection and restoration may look different for different species.

For this planning area, we focused on two species: the white-headed woodpecker (WWP) and the northern spotted owl (NSO). The WWP uses open pine forests with solitary large trees, while the NSO uses dense forests of tall trees. Protecting WWP habitat is likely to involve thinning and prescribed fire treatments, while protecting NSO habitat is more often accomplished by treating around the most important locations to provide a buffer from fire.

White-headed woodpecker habitat



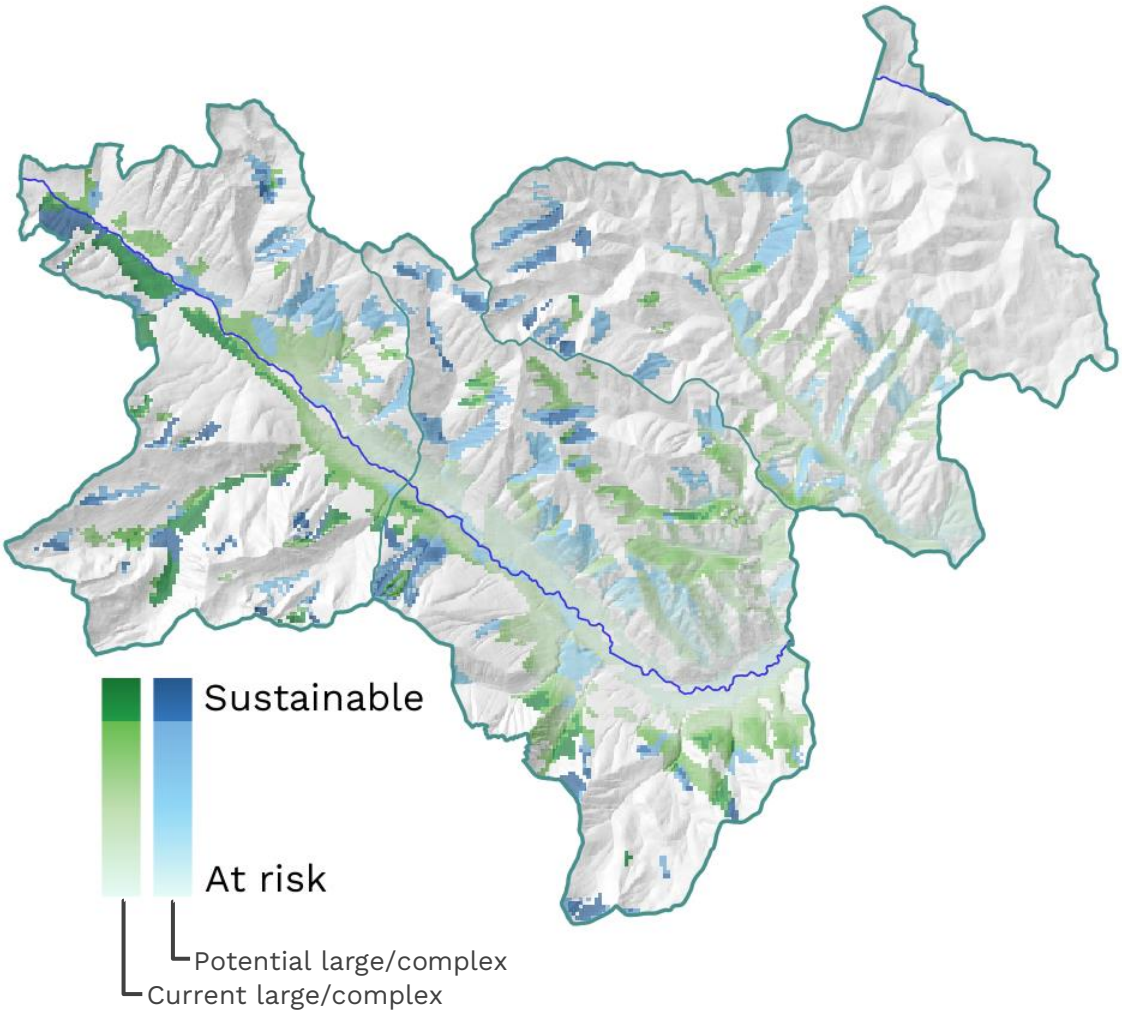
Northern spotted owl habitat



Large tree complex forest

Large trees perform a disproportionate amount of work toward many ecosystem services compared to small trees. They are more resistant to disturbances, they sequester more carbon, and they can regulate thousands of gallons of water per day. Large trees growing in dense, complex forests are an important element of the forest landscape, providing a unique and varied habitat for a range of organisms. However, dense, complex forest on too dry of a site can lead to very high risks for mortality from drought and fire, so it is important for these patches to be sited in sustainable locations given current and future climate.

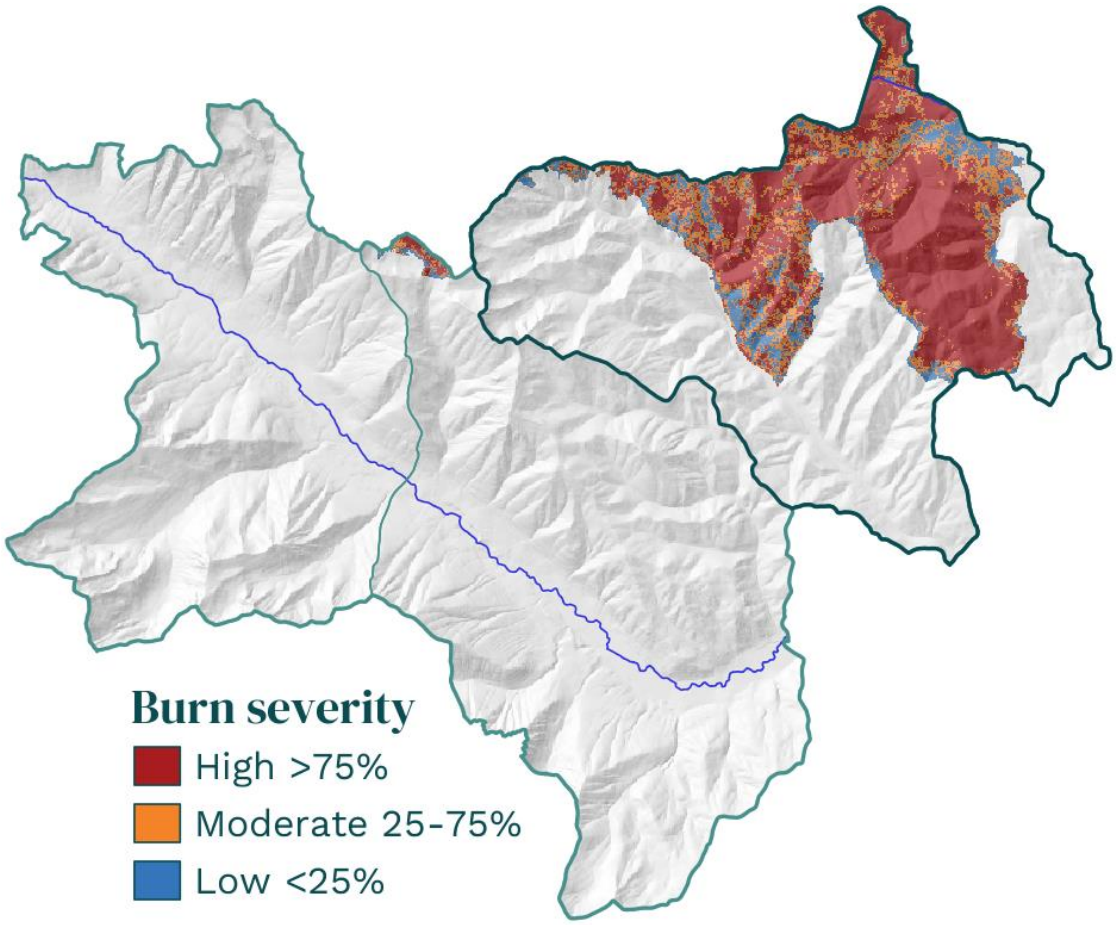
In this evaluation, an emphasis is placed on protecting sites with large trees in complex forest where this structure will be sustainable into the future.



Work of wildfires

Wildfires do ecological work. Some of what happens during a wildfire is helpful for landscape restoration, like consuming surface fuels, thinning the forest canopy, and selecting for fire-resistant trees. Other fire effects result in additional need for restoration, particularly large high-severity patches where future regeneration is uncertain.

The Little Bridge Creek sub-watershed burned in the 2021 Cedar Fire:

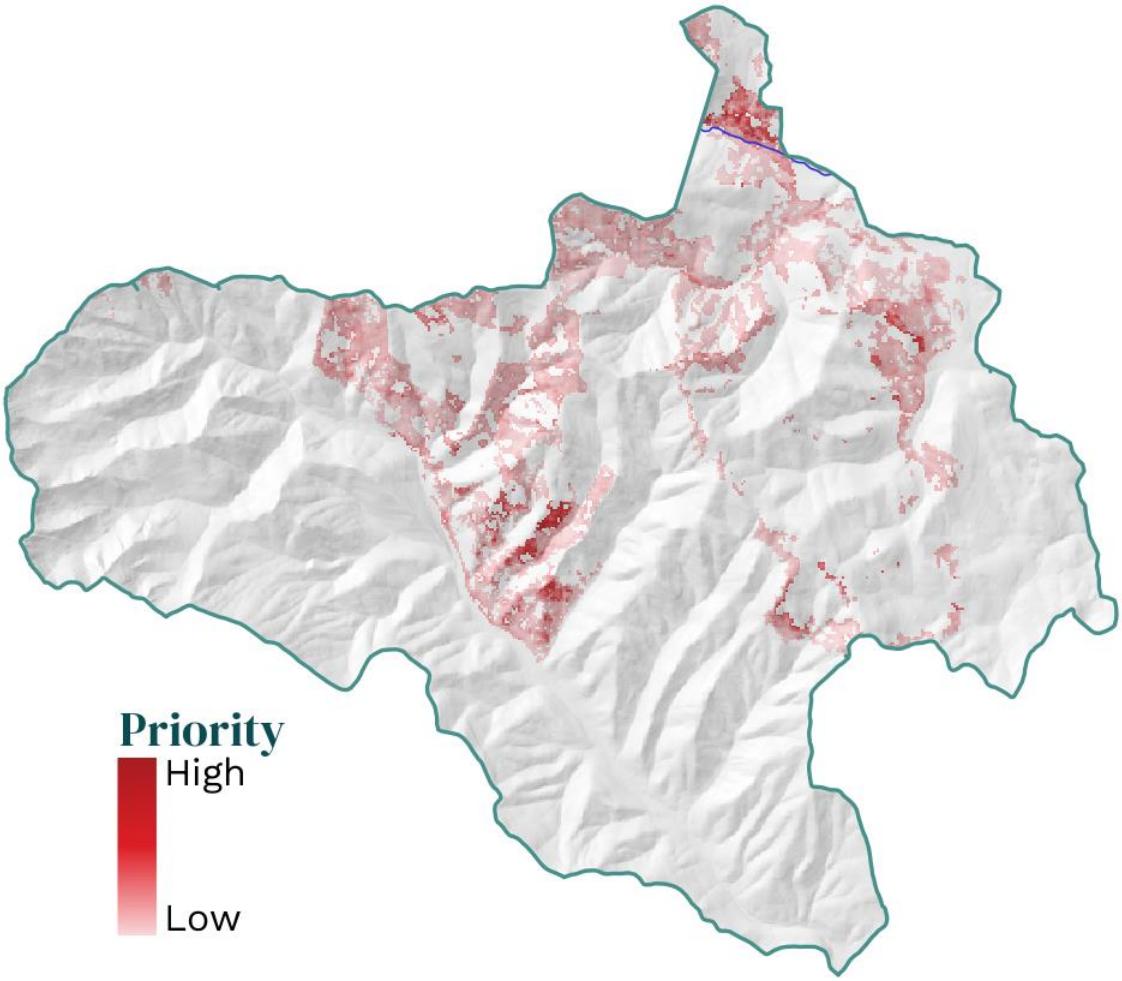


As part of this landscape evaluation, we are analyzing the immediate fire effects to incorporate short-term fire response into the landscape prescription. In low- and moderate-severity burned areas, the focus is to finish the job that wildfire started. Priorities are areas where the pre-fire forest had high density or species ill-suited to the site, and the prescribed work will be to further reduce fuel loads and shift species composition.

In high-severity burned areas, the focus is on ensuring forest regeneration into the future. We distinguish between areas where we expect that climate will or won't continue to support forest. In places where regenerating forest cover is unlikely, the goal is to transition to native grasslands or shrublands. Where forest cover is sustainable, to goal is to determine the most important locations to plant trees to ensure forest recovery.

Low- and moderate-severity areas: finish what wildfire started

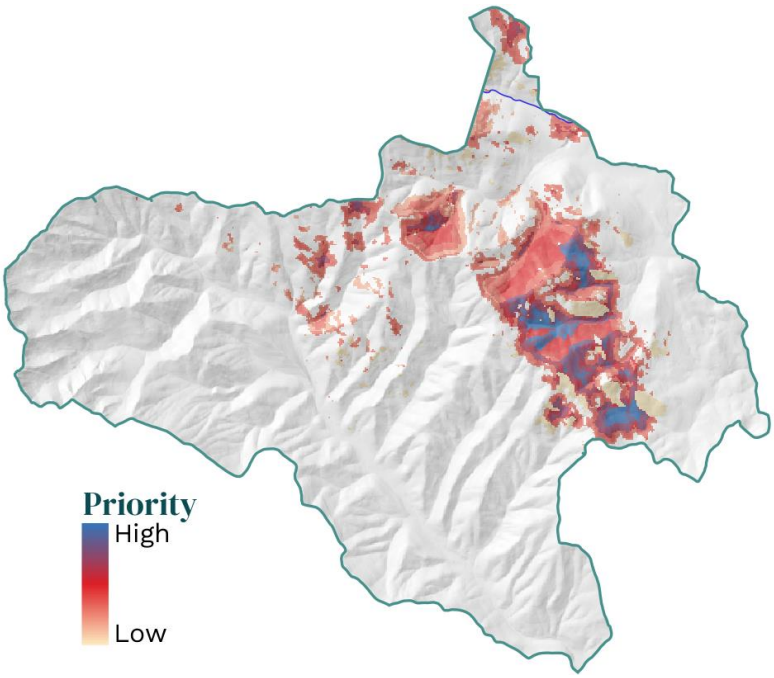
High priority locations shown here should be considered for post-fire management to leverage the work that wildfire has begun. Just like pre-fire forest restoration treatments, this work would include thinning green and/or dead trees with a focus on re-establishing resilient density, spatial patterns, and species composition. The difference here is that the fire has already accomplished some of the work, presenting an opportunity to create larger patches of restored landscape with lower costs than usual.



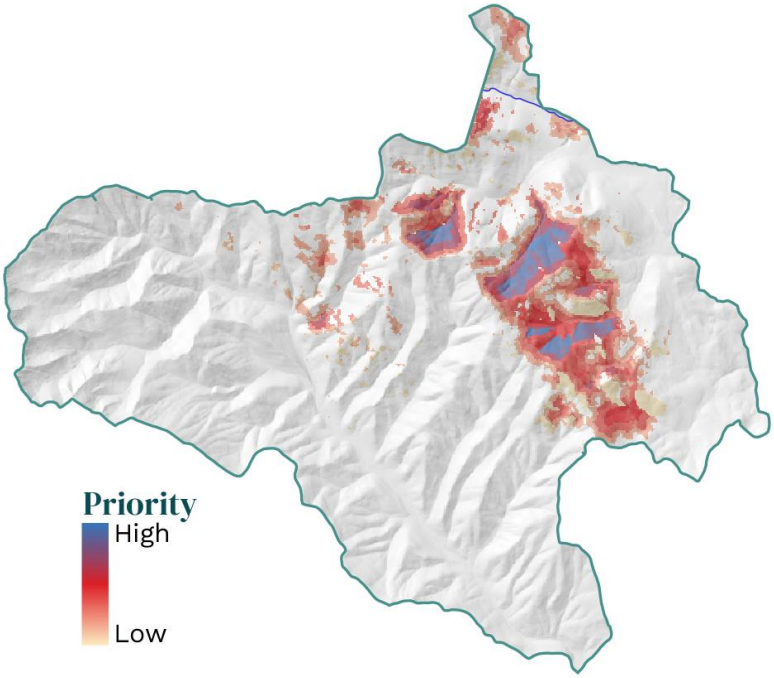
High-severity burned areas: replant to ensure continued forest cover

The following two maps show areas where fire killed all or almost all of the trees across large areas. Without tree planting, these locations may take a very long time to become forest again. In some places, it might not happen at all.

Priorities on the first map emphasize dry places, showing where planting trees could help resist some climate change effects by establishing seedlings in strategic borderline locations.



Priorities on the second map emphasize places expected to have adequate water into the future. This is where planted trees are most likely to be successful.



Landscape prescription

Treatment types and amounts

The treatment needs described here come from analyzing forest structure within different forest types. The lines that begin “Treat X acres…” indicate the kind of work that is usually accomplished with mechanical thinning treatments. The other lines indicate needs that require some other kind of management, such as planting and protecting seedlings.

A cheat sheet for the abbreviations used in this table is included at the end of the document.

Upper Twisp

Forest type	Treatment need	Notes
Dry forest	Treat 500-700 acres of YFMS, break up large patches	Shift some to medium-sized SEOC patches, favor PP • Consolidate WWP habitat, grow into OFSS Shift some to medium-sized UR patches, favor DF Consolidate NSO habitat and grow into OFMS
Moist forest	Treat 100-500 acres of YFMS, break up largest patch	Shift to medium-sized SEOC patches, grow into OFSS Favor PP, WL
	Maintain NSO habitat	Grow/connect larger patches
	Facilitate growth of SECC from SI	Protect from HS reburn
Cold forest	Treat 500-1,300 acres of YFMS, but retain and build larger patches	Shift to UR, grow into OFMS Marten habitat
Cold and Moist forest high-severity burn areas	Goal of 4,000-6,000 acres of forest recovery	Avoid very large patches growing into SECC
	Assess amount and species of regeneration, plant fire/drought-adapted species if needed	
	Protect desirable patches of regen from high-severity reburns	
	Promote small-medium sizes patches of shrub/herbland; allow creation with reburns	

Middle Twisp

Forest type	Treatment need	Notes
Dry forest	Treat 2,500-3,000 acres of YFMS, break up large patches	Shift some to medium-sized SEOC patches, favor PP • Consolidate WWP habitat, grow into OFSS Shift some to medium-sized UR patches, favor DF Consolidate NSO habitat and grow into OFMS
Moist forest	Treat 2,500-3,400 acres of YFMS, reduce number of patches	Shift some to medium-sized UR patches, grow into OFMS Shift some to medium-sized SEOC patches, favor PP, grow into OFSS
	Reduce NSO habitat	Fewer, more compact patches in most sustainable locations
	Facilitate growth of SECC from SI	Protect from HS reburn
Cold and Moist forest high-severity burn areas	Goal of 2,000-5,500 acres of forest recovery	Avoid very large patches growing into SECC
	Assess amount and species of regeneration, plant fire/drought-adapted species if needed	
	Protect desirable patches of regen from high-severity reburns	
	Promote small-medium sizes patches of shrub/herbland; allow creation with reburns	

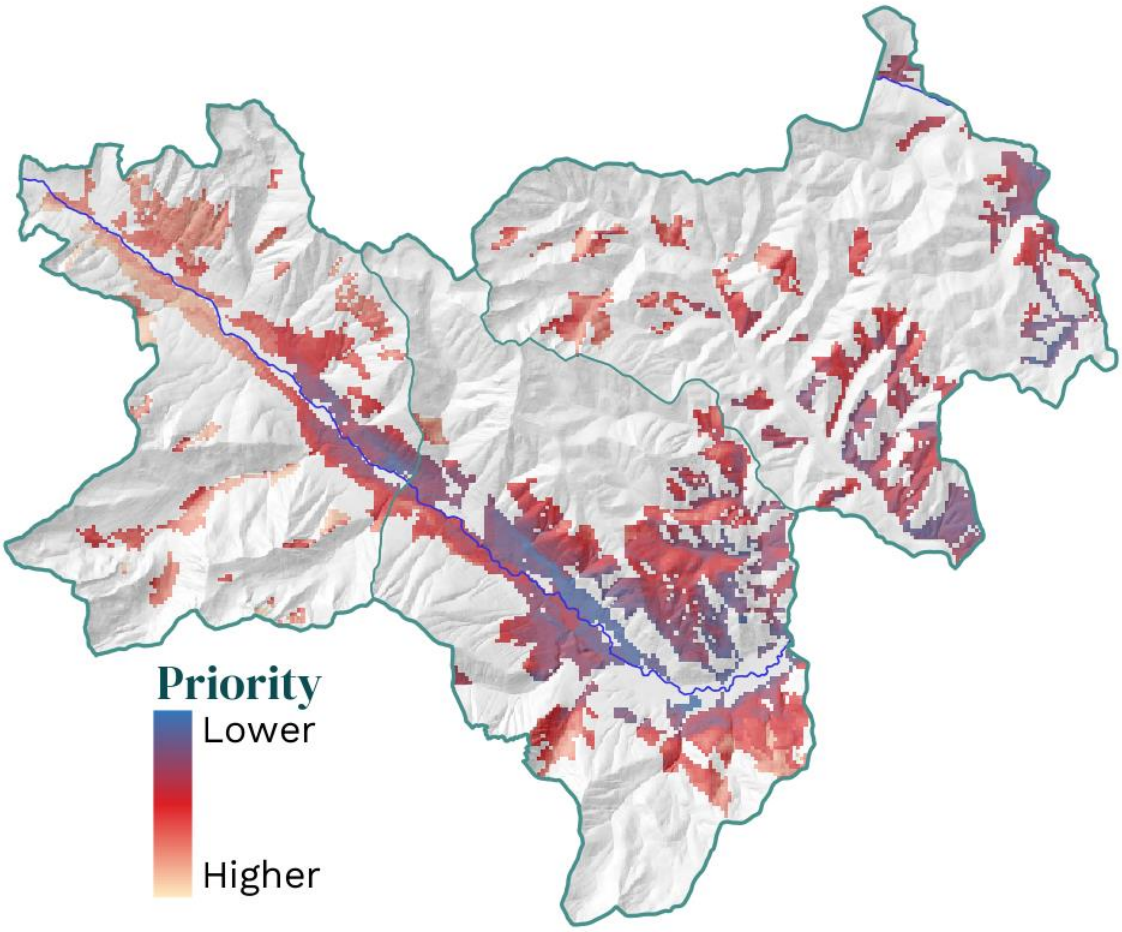
Little Bridge Creek

Forest type	Treatment need	Notes
Dry forest	Treat 2,500-3,100 acres of YFMS, break up large patch	Shift to medium-sized SEOC patches, favor PP • Consolidate WWP habitat, grow into OFSS
Moist forest	Maintain NSO habitat	Grow and connect more compact patches
	Facilitate growth of SECC from SI	Protect from HS reburn
Cold forest	Treat 250-500 acres of YFMS, break up largest patches	Reduce SAF, favor AL, LP, PP Shift to UR, grow into OFMS
	Break up largest patch of marten habitat into smaller patches	
Cold and Moist forest high-severity burn areas	Goal of 2,000-3,500 acres of forest recovery	Avoid very large patches growing into SECC
	Assess amount and species of regeneration, plant fire/drought-adapted species if needed	
	Protect desirable patches of regen from high-severity reburns	
	Promote small-medium sizes patches of shrub/herbland; allow creation with reburns	

Treatment priorities

This map shows locations where treatment could help meet the needs identified in the table above, with colors to signify lower or higher priority. Higher priority areas are those where treatment could do the most to reduce risks to the forest from fire and drought.

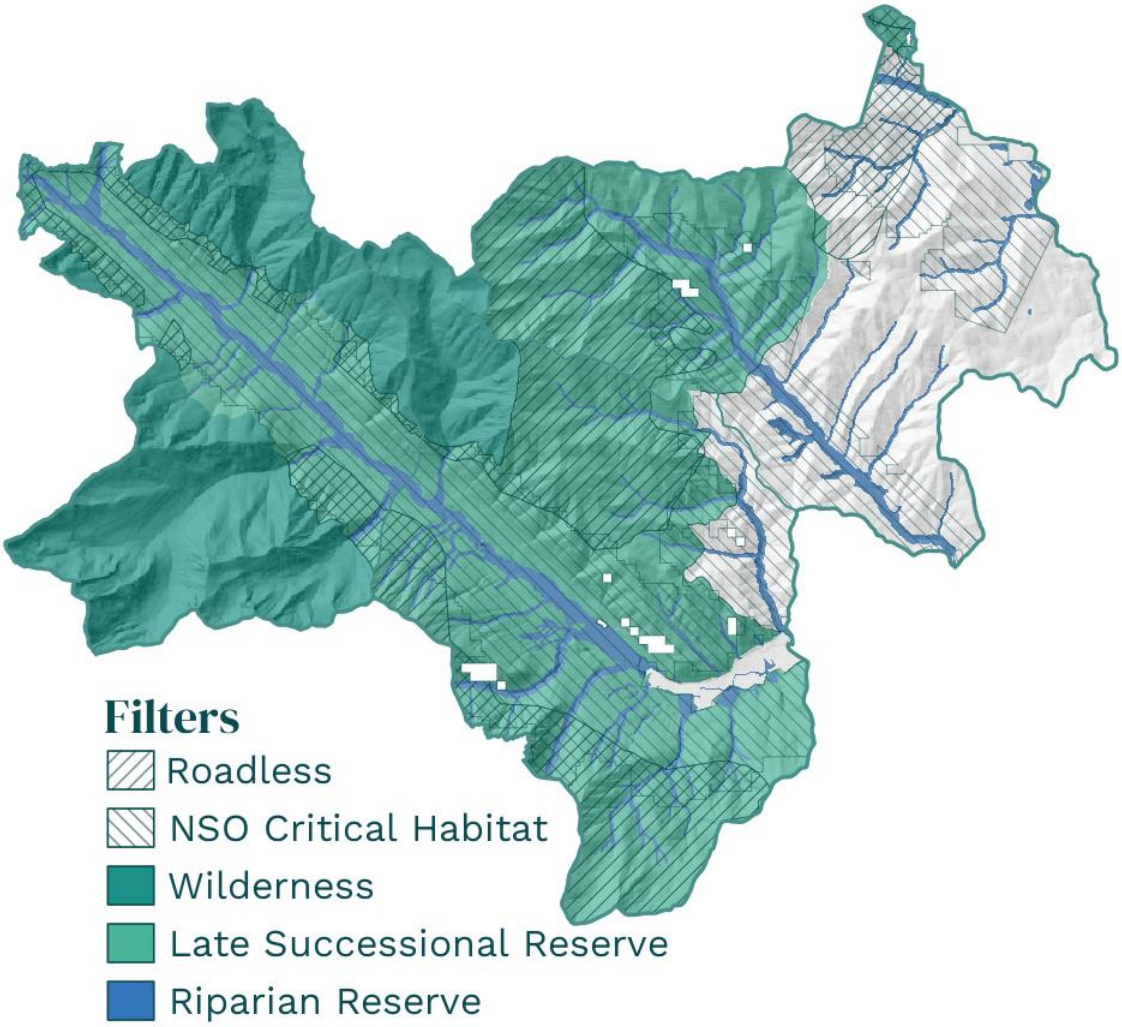
This priority map, which combines forest resilience with risk of severe disturbance, can also be overlaid with the Wildlife habitat and Large tree and complex forest maps to see how these key resources interact with other facets of forest restoration. For example, spotted owl habitat in the Middle Twisp valley and the southern part of Little Bridge Creek has a higher treatment priority and less sustainability for large tree complex forest compared to habitat in the Upper Twisp sub-watershed.



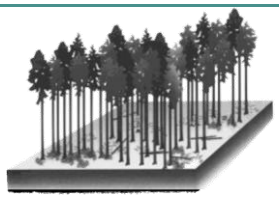
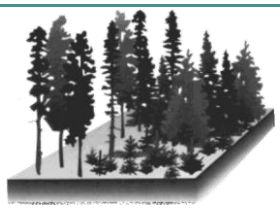
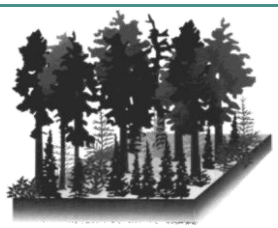
Social, policy, and operational filters

The landscape evaluation and prescription is focused on the ecological needs of the landscape. But ecological needs aren't the only thing determining management actions. The needs of society, law and administrative regulation, and practical constraints on operations in the forest all place filters on what work is realistically achievable and where.

This map shows some of the most important filters present on this landscape. Other than Wilderness, all of the filters shown do allow varying degrees of active management, including selling logs as byproducts of restoration treatments. When designing a forest landscape restoration project, it is up to the project team to balance the ecological needs of the landscape with social sentiment and the regulatory environment.



Abbreviations cheat sheet

Abbreviation	Meaning	
Stand development stages		
SI	Stand initiation	
SEOC	Stem Exclusion, Open Canopy	
SECC	Stem Exclusion, Closed Canopy	
YFMS	Young Forest, Multi-Story	
UR	Understory Reinitiation	
OFMS	Old Forest, Multi-Story	
OFSS	Old Forest, Single-Story	

Other abbreviations	
WWP	White-headed woodpecker (*Leuconotopicus albolarvatus*)
NSO	Northern spotted owl (*Strix occidentalis caurina*)
PP	Ponderosa pine (*Pinus ponderosa*)
LP	Lodgepole pine (*Pinus contorta*)
AL	Alpine larch (*Larix lyallii*)
WL	Western larch (*Larix occidentalis*)
DF	Douglas-fir (*Pseudotsuga menziesii*)
SAF	Subalpine fir (*Abies lasiocarpa*)
HS	High severity, in reference to fire effects