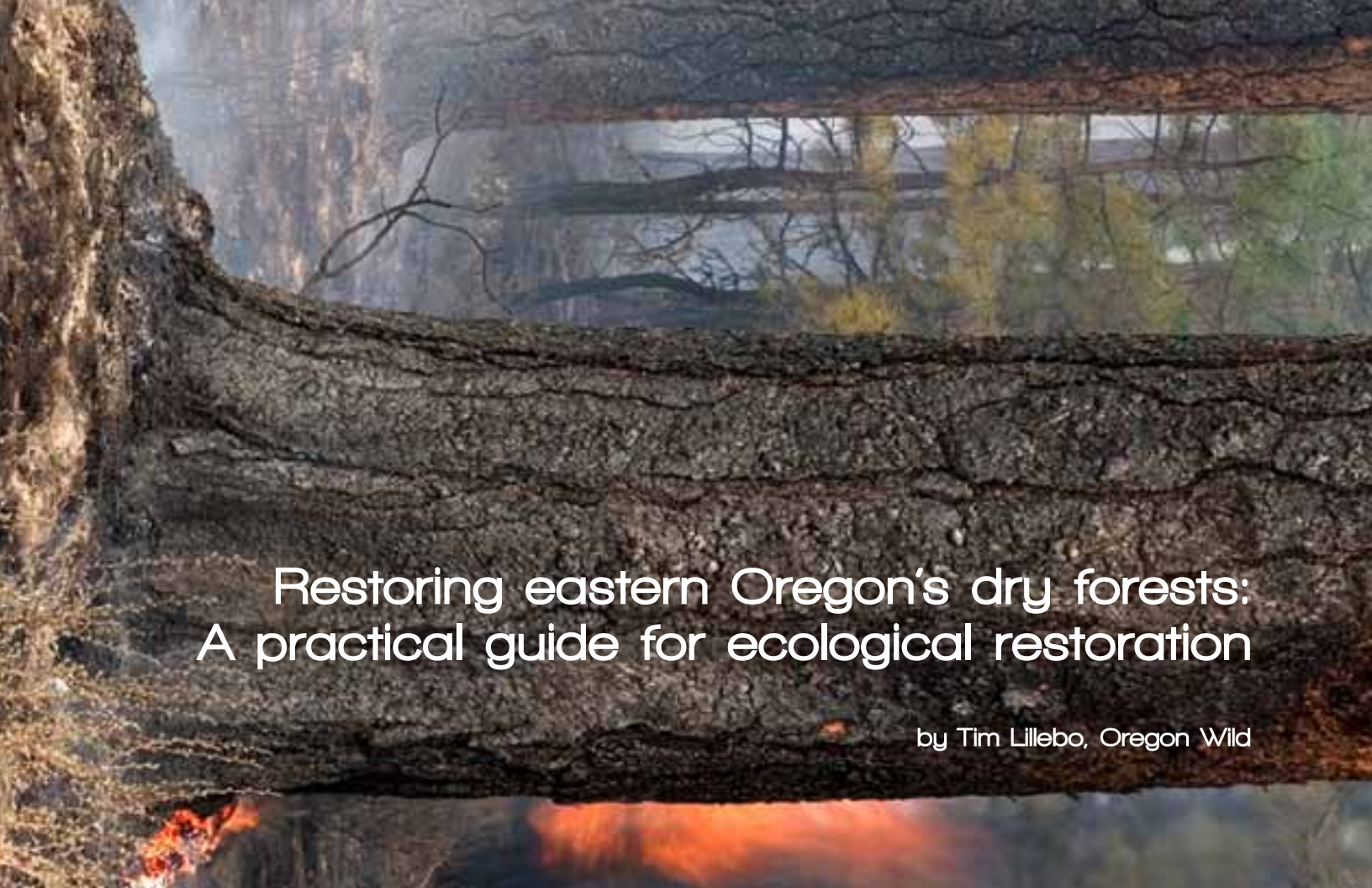

Restoring eastern Oregon's dry forests: A practical guide for ecological restoration

by Tim Lillebo, Oregon Wild

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Dry ponderosa pine forests are used by deer and other wildlife. *(Brett Cole)*

A publication of Oregon Wild (www.oregonwild.org), dedicated to protecting and restoring Oregon's wildlands, wildlife, and waters as an enduring legacy for future generations.

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Cover photo: Prescribed fire is used to manage dry eastern Oregon forests. *(Brett Cole)*

Contents

A healthy aspen stand mixed with ponderosa pines. *(Brett Cole)*

Why a restoration handbook?

The purpose of this booklet is to educate forest managers, the public, and participants in collaborative restoration groups about the type of forest restoration work many conservationists, including Oregon Wild, support and hope to see implemented on more of eastern Oregon's *dry forest** landscape. After decades of disconnect between forest management activities and social acceptance of these practices, common ground is now being built around ecologically-appropriate restoration, using sound science that benefits the health of forests and watersheds as well as community and industry infrastructure. If the principles and prescriptions in this book are followed, it is our hope that needed restoration in *dry forests* can be accomplished at larger scales with less controversy.

This booklet is not meant to be a comprehensive guide for ecological restoration – it is limited to the conservation and restoration of dry ponderosa pine and dry mixed conifer forest types.

Oregon Wild background

Founded in 1974, Oregon Wild works to protect and restore Oregon's wildlands, wildlife, and waters as an enduring legacy for all Oregonians.

Oregon Wild has been instrumental in securing permanent legislative protection for some of Oregon's most precious landscapes, including nearly 1.7 million acres of wilderness and almost 1,800 miles of Wild and Scenic Rivers, as well as being a leader in a campaign to protect more than 58 million acres of wildlands across the country.

Our conservation programs help protect pristine drinking water, unparalleled recreation opportunities, and fish and wildlife habitat across Oregon. Unfortunately, much of Oregon's *old growth* heritage forests have been lost to reckless logging and development. Oregon Wild works to promote a common sense vision for conserving our remaining intact mature and *old growth* forests while promoting restoration of ecosystems and watersheds damaged by past mismanagement.

* Italicized words can be found in the glossary.

Current conditions in eastern Oregon forests

The forests of eastern Oregon are diverse and beautiful. *Old growth* ponderosa pine in savanna-like settings; mixed conifer forests with Engelmann spruce, true firs, lodgepole pine, and western larch; vast landscapes of high desert with scattered juniper trees; and stands of glistening quaking aspen are all important components of healthy eastside forests.

Of the more than 10 million acres of National Forest lands in eastern Oregon, many have been seriously altered over the past century and a half. For example:

- Fire historically played a larger role in shaping eastside forest ecosystems, but natural fire regimes have been altered by fire exclusion and so-called "salvage logging" after fires. Lack of fire has led to changes in the types and amounts of vegetation, threatening the health of *old growth* forests.
- Livestock grazing across eastern Oregon has had major impacts on water quality, stream function, soil, wildlife, recreation, and natural vegetation – including forests.
- Clearcutting and selective logging of the largest trees have replaced hundreds of thousands of acres of *old growth* ponderosa pine forests with unnaturally dense stands of small trees with few remaining large ones – changing habitat functions and the natural dynamics of these forests.
- Thousands of miles of roads of various quality have been built to facilitate logging, grazing, and fire suppression – allowing weeds to spread, damaging streams, and fragmenting the landscape.

Old-growth ponderosa pines with grassy understory. *(Alan Cossitt)*

Old-growth pine with dense young trees in competition for resources. *(Chandra LeGue)*

Prioritizing restoration

Forests most altered by fire exclusion and other human activities should be the top priority for restoration treatments. Restoration activities in these areas are generally most likely to be supported by the public and have scientific consensus on needed treatments.

- Areas within *dry forest* types that still contain *old growth* trees, where restoration activities can maintain their health and make them more resilient to disturbance, should be prioritized.
- Both dry ponderosa pine and dry mixed conifer forest types that historically experienced low-severity fire are in need of restoration.
- Forest types that are cool/moist and cold that naturally have stand-replacing fire regimes have not been as affected by fire exclusion and should not be considered for *dry forest* restoration treatments.
- Mixed conifer forest types that are cooler and moister, and that naturally had a more mixed fire regime, may have been affected by logging and fire exclusion, but should be considered carefully before treatments are undertaken.
- Restoration activities that focus on removing small fuels in *dry forest* types near communities in the wildland urban interface (WUI) area should be prioritized for social benefits.
- Roadless and previously unlogged areas are generally healthier than areas that have been previously disturbed. Ecological restoration of these areas should focus on removal of small fuels and on the reintroduction of fire. No new roads should disturb these areas.

This dry Ponderosa pine forest in the Fremont-Winema National Forest would benefit from small tree removal to reduce competition with old-growth trees. *(Doug Heiken)*

A restoration vision for eastern Oregon's dry forests

More than a century of livestock grazing, fire exclusion, and logging have left eastside landscapes in desperate need of restoration to more natural conditions. Oregon Wild supports science-based restoration programs that protect eastern Oregon's *old growth* forest heritage, as well as protecting communities in the WUI.

Restoration based on the best available science at a landscape scale is needed in eastern Oregon to help recreate more natural ecological processes and vegetation structure. This means reintroducing natural processes like fire and reducing the adverse effects of unnatural features and processes like roads, weeds, and grazing. At the same time, retaining ecologically important, and now rare, *old growth* trees is important. These trees have high ecological value and are often the most resistant to natural disturbances like fire due to their thick bark and high canopy. Protecting these existing old trees, while working to restore historic levels of large trees, is important for maintaining and increasing carbon storage to mitigate global climate change as well.

Comprehensive, landscape scale restoration goals should include a variety of activities, including:

- Reducing unnatural buildup of small fuels around homes and communities.
- Thinning out small trees and brush that have grown in as a result of fire exclusion and livestock grazing and are now posing a threat to *old growth* trees.
- Increasing the forested acres where fire (prescribed and natural) can be used as a tool to restore the natural role of fire in maintaining and renewing ecosystems.
- Watershed restoration activities such as restoring floodplain function, reconnecting streams and uplands, removing unneeded roads and culverts, controlling weeds, limiting livestock grazing, and restoring natural streamside vegetation for the benefit of streams and fish.
- Wildlife habitat activities such as restoring historic meadows and aspen stands, and recruiting and enhancing structure and habitat features like snags and dead wood.
- Preparing for climate change by protecting refugia, rebuilding landscape connectivity, restoring natural disturbance processes, and perpetuating high value structures such as large and old trees by making them more resilient to drought stress and fire.

The common sense approach of both protecting and restoring healthy forests and watersheds has gained increasing support in recent years and is leading to enhanced trust and agreement between forest stakeholders and federal land managers, less controversial projects, and more forest and watershed restoration work getting done on the ground. Restoration activities can help develop new restoration-based businesses and jobs and provide traditional wood products that sustain local communities.

The Glaze Forest restoration project: a case study

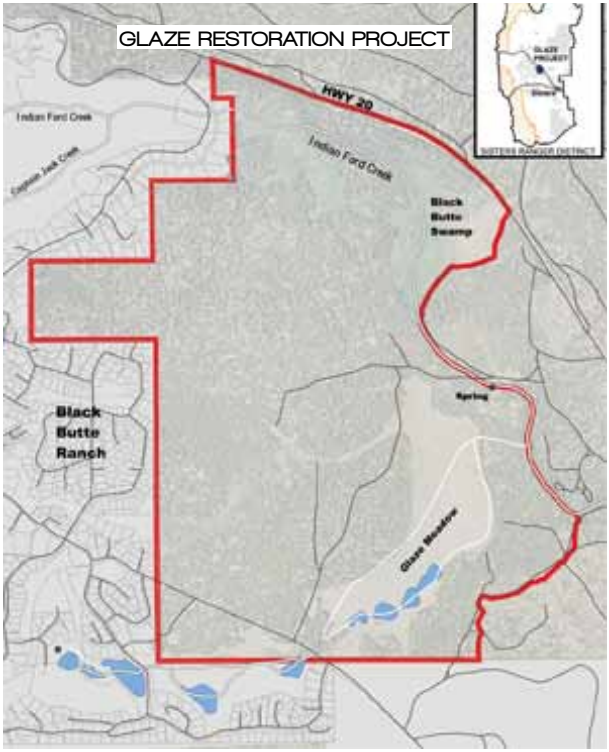
In 2005, Oregon Wild's Tim Lillebo began working with the Deschutes National Forest, local residents, other conservationists, and staff from the Warm Springs Tribes to design and carry out the Glaze Forest restoration project located along the eastern border of the Black Butte Ranch resort on Hwy. 20 northwest of the town of Sisters.

To demonstrate the multifaceted benefits of ecological restoration in an area significantly impacted by past logging, the goals of the Glaze Forest restoration project were to:

- Restore *old growth* and *second-growth* forests and riparian areas with ecologically driven tree thinning, shrub mowing, and prescribed fire.
- Protect both the forest and nearby homes by restoring forest conditions more likely to support low intensity, stand-maintaining fire behavior characteristic of the ponderosa pine forest type.
- Improve the health of remnant *old growth* pine trees by removing the small, young trees and brush that had established during recent decades of fire suppression.
- Build trust among diverse interest groups through collaboration and partnerships to achieve ecosystem, community, and economic objectives.

Past-management and history

The Glaze Forest restoration project area is 1,200 acres of public land managed by the Deschutes National Forest that has been extensively managed in the past. Clearcutting in the 1930s, combined with nearly a century of grazing and fire exclusion has altered the landscape, leading to dense stands of young trees surrounding remnant *old growth* and aspen stands.



Despite past management practices, the area still has close to 400 acres with *old growth* ponderosa pines, and is home to a diversity of wildlife and rare plants. The area includes a large wet meadow, aspen groves in need of restoration, and stands of lodgepole pine.

The uncharacteristically dense conditions in many parts of the project area have resulted in increased fire risk and excessive competition and drought stress to older, more fire resistant trees.

U.S. Forest Service

Oregon Wild's goal with the Glaze Forest restoration project was to help the Forest Service show the public how to manage an ecosystem restoration project the right way, reducing fuels to protect homes, while also protecting the forest and wildlife.

Because of its proximity to 1,100 homes in the WUI, the remaining high quality *old growth* pines, and a diversity of wildlife habitats, the project provided a unique opportunity to showcase how collaboration between varied interests can reduce conflict, improve *forest health*, and reduce fire risk.

Using a pioneering collaborative process, the environmental analysis was completed and the Record of Decision signed on the Glaze Forest project in May 2008. The final decision authorized *mosaic variable density thinning* and numerous other restoration activities to benefit wildlife habitat, meadows, and aspen stands. Since 2008, project implementation has been ongoing. Sawlogs and biomass have been sold to help offset the cost of restoration work and produce economic benefits for the local economy.

Glaze Forest restoration: by the numbers

	Authorized in EA
Acres in planning area	1,200
Acres of thinning 2nd growth	416
Acres of thinning in old growth	458
Acres of thinning in aspen	79
Acres of meadow restoration	236
New temporary roads constructed	0
Trees larger than 21-inch diameter cut	0
% of trees to be cut that are <16 inch diameter	99
% of trees to be cut that are <8 inch diameter	80
Acres of prescribed fire	1,036

As of December 2011, restoration of 234 acres of *second-growth* forest and 63 acres of *old growth* had taken place. Completion of the project is expected by the end of 2014.

Trees marked for thinning in the Glaze Forest restoration project area. *(Chandra LeGue)*

A recently thinned area of the Glaze project. *(Chandra LeGue)*

Collaboration as a restoration tool

The process of collaboration used to develop the Glaze Forest restoration project was a long one, but ultimately very worthwhile. Decades of mistrust between community members and the Forest Service were hard to overcome. But dedication by the Sisters Ranger District to building relationships and trust resulted in Glaze being the first project in the District producing commercial wood products *not* to be appealed since 1996.

The successful collaboration hinged on several factors. First, diverse partners were engaged – from botanists and bird lovers, to timber contractors and nearby home owners, to conservationists and Tribal members. Second, the process of developing and analyzing the project (under the National Environmental Policy Act or NEPA) was open and transparent. It involved over 70 field tours and meetings with partners and interested parties. And third, the Forest Service listened to the collaborative group's comments and suggestions, allowing the collaboration to meaningfully inform and influence the prescriptions and ultimate decisions on the proposed action. For example, the group was involved in sample marking for proposed thinning, and subsequent discussion and alterations to the proposal before the decision was signed.

A sampling of groups involved in Glaze project collaboration

Deschutes, Crook, and Jefferson County governments
City of Sisters
Oregon Department of Forestry
Oregon Department of Fish and Wildlife
Black Butte Homeowners Association
Confederated Tribes of Warm Springs
Ochoco Lumber
Pacific Stewardship LLC
American Forest Resources Council
Audubon Society
Sierra Club
Oregon Wild
Friends of the Metolius
The Nature Conservancy
Black Butte Ranch Fire Department
Central Oregon Partnership for Wildfire Risk Reduction

Importantly, even after the decision was signed the collaboration continued. Each year interested parties are invited to see the latest work, review monitoring results, and express questions or concerns. Whenever possible, concerns are addressed and modifications made to improve the project outcomes.

The Glaze project provides a model for how to implement the type of restoration that is needed across the *dry forests* of eastern Oregon. Going forward, the benefits of the collaborative process as demonstrated in this project can be multiplied as lessons learned are applied more widely across the region. For example, the 15,000 acre Sisters Area Fuels Reduction Project (SAFR), also on the Sisters Ranger District of the Deschutes National Forest, was widely supported, in part because it used collaboration and the restoration concepts developed at Glaze.

Diverse stakeholders gather for a field tour of the proposed Glaze Forest restoration project. *(Maret Pajutee)*

Restoration concepts and prescriptions

Oregon Wild, working in partnership with the Forest Service, the Warm Springs Tribes, and a consulting forester, designed the following principles for restoration and prescriptions for the Glaze Forest restoration project.

Where and why to apply these restoration prescriptions

Purpose and goals of restoration

These principles and prescriptions were designed to help restore ecological structure, processes, and functions based on the *historic and natural range of variability* for dry ponderosa pine and dry mixed conifer forests and associated vegetation types. Two of the major goals of forest restoration are to restore historic levels and health of *old growth* trees, and to restore conditions that can sustain natural low-intensity fires. In applying restoration principles and prescriptions, it is important to consider the appropriate mix of treated and untreated areas across the landscape.

Cool/moist and cold forest types

Restoration treatments in cool/moist and cold forest types that naturally have stand replacing fire regimes are outside the scope of this guidebook. Any active management in these forests should be carefully scrutinized to ensure (1) that treatments in these areas are in fact needed, (2) that proposed treatments will be effective, and (3) that treatments will not remove scarce habitat for species that depend on these forest types.

Dry forest types

These principles and prescriptions can be applied across eastern Oregon in dry ponderosa pine vegetation types. They can be used in stands containing *old growth* trees with dense ingrowth of younger trees, or in heavily logged *second-growth* stands to restore *old growth* structure.

Dry forest types typically had a fire return interval of 10–30 years. Fire suppression and exclusion has resulted in several missed fire cycles, leading to an unnatural buildup of young trees. Historically, *age class cohorts* were generally established about every 20 years (based on regional research on *old growth* ponderosa pine forests). In a stand where the oldest trees are 400 years old, there may be 20 different age classes. During the recent period of fire exclusion, however, fewer cohorts were established so stands have become structurally simplified.

One of the aims of restoration in *dry forests* is to account for and try to replicate the natural variation that would result from natural processes like tree growth and random disturbance events like fire, wind, and insects over time.

With appropriate techniques, on-the-ground impacts can be kept to a minimum, as in the Metolius Thin on the Deschutes National Forest. *(Chandra LeGue)*

Four steps to restoration

Step 1: Design comprehensive restoration goals

At a landscape scale, create or utilize existing comprehensive restoration goals and priorities for the project area. For example, be sure restoration goals are informed by current forest plans, watershed analyses, threatened and endangered species recovery plans, and updated best available science. Use the historic *range of variability* as a guide, but also consider the future *range of variability* expected as a result of novel disturbance processes and climate change. This will help managers identify the right mix of benefits from treated and untreated areas.

Step 2: Apply principles for forest restoration

Use the following principles to guide all restoration thinning activities:

- Establish diversity across the landscape by identifying an optimal mix of different restoration treatments as well as untreated stands.
- Retain all *old growth* trees of all sizes or species. "Old" trees are generally presettlement, circa 1870s–1880s, and are identified based on *old growth* characteristics.
- Where large trees are in short supply, retain all the largest trees (and all trees 21" *DBH* and over) in the stand regardless of age or species.
- Retain and restore the historic mix of tree species and sizes/ages. Retain underrepresented species like aspen, mountain mahogany, other hardwoods, and sugar pine.
- *Thin from below*, generally retaining the largest trees in the stand, retaining patches with a variable range of tree density (low, medium, and high *basal area*).
- Establish diversity and complexity within stands by thinning to create a "gappy/patchy/clumpy" mosaic of variable patches 1/4–2 acres in size.
- Protect or create "living room size" clumps of 2–10 trees – clusters of mature and old pine growing together as cohorts – with 3–4 clumps per acre.
- Retain significant amounts of wildlife trees, including those with broken or forked tops, crooked or leaning trees, mistletoe trees, snags, and course wood. Recruit historic levels of snags and dead wood through retention of green trees in variable densities.
- Within treatment areas, leave untreated wildlife and plant corridor areas in patches covering 10–20% of the area, strategically placed for birds, wildlife, cover, and structural diversity.
- Protect riparian areas from entry by mechanized equipment and livestock. Consider a mix of light thinning and unthinned areas outside the protected zone to promote deciduous trees and shrubs, large wood development, and characteristic fire.
- In order to avoid impacts from building new roads, focus treatments on areas accessible from existing roads.

"Living room size" clumps of old-growth ponderosa pines should be protectedduring prescription layout. *(Chandra LeGue)*

Step 3: Lay out the treatment prescription

Using the restoration principles above, follow this process to lay out the treatment prescription:

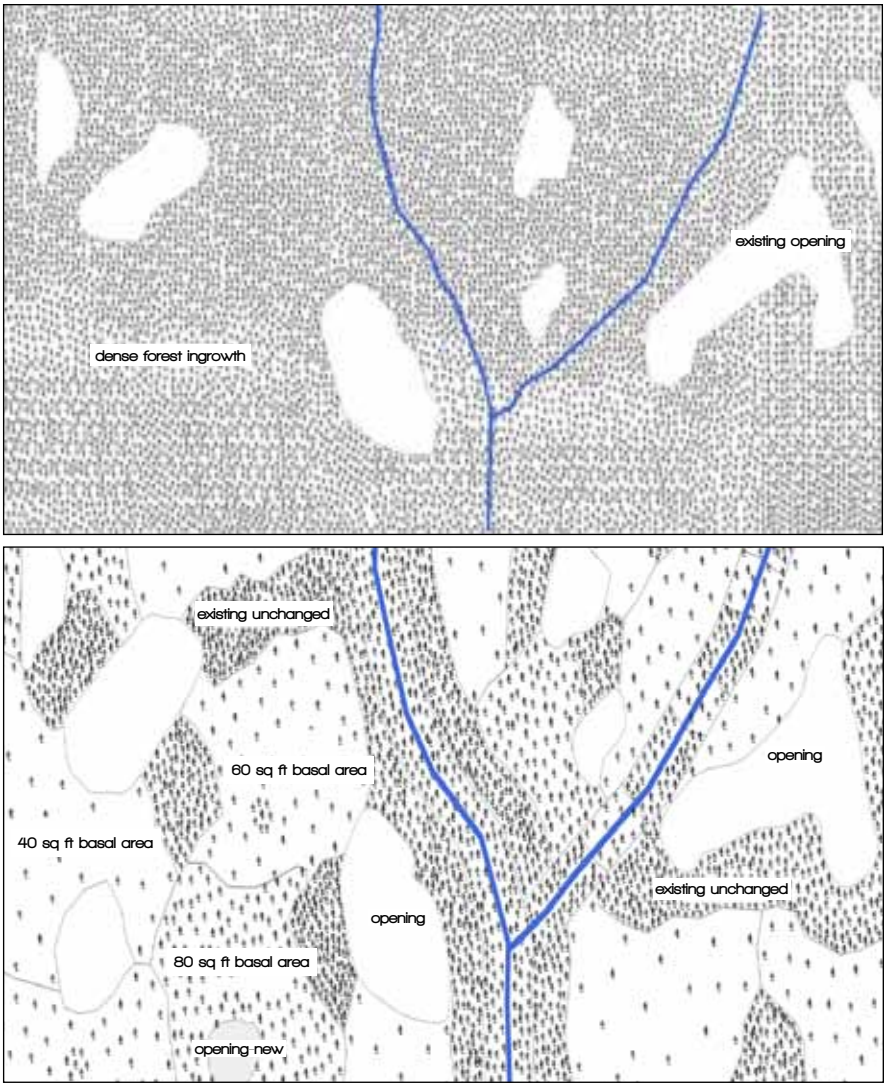
1. Map existing *old growth* and historic levels of old trees and openings. Describe *cohorts*.
2. Determine possible wildlife and flora connectivity corridor "leave" areas.
3. Retain all trees with *old growth* characteristics of all sizes and species.
4. Strategically identify and mark "leave" patches of dense ingrowth for wildlife cover on 10–20% of the project area.
5. Identify existing and probable past openings. Leave existing openings and thin some young cohorts to 40 square feet *basal area* to achieve desired extent of openings.
6. In stands with *old growth* trees, locate and mark medium age cohorts and thin to 80–100 square feet *basal area*, leaving the largest trees in the cohort (generally 60–120 years old) in clumps and uneven spacing for future *old growth* recruitment. In all stand types, leave variability in *basal areas* from 40–140 square feet (larger trees or more productive areas can carry more *basal area*)
7. Using variable density techniques, thin young cohorts of smaller trees (1–60 years) to 40–60 square feet *basal area* for future *old growth* recruitment.
8. Where *old growth* trees are present, thin younger cohorts around these trees to 1–2 drip lines width (donut thin), leaving occasional larger trees within the drip to be replacement *old growth*.

Step 4: Implement restoration projects and monitor the results.

In the implementation phase, use best practices to minimize impacts to sensitive species, soil, *old growth* trees, and waterways. If possible, employ multi-party monitoring with diverse stakeholders and experts to ensure that restoration results met the goals set forth in project planning. Apply any lessons learned through monitoring to future restoration project planning.

White-headed woodpeckers benefit from dry forest restoration. *(Don Baccus)*

Riparian areas should be protected and restored throughout the landscape. *(Chandra LeGue)*



Before and after schematics showing prescription implementation. *(Oregon Wild)*

Sample marking done with the collaborative group in the Glaze Forest restoration project area. *(Maret Pajutee)*

Lessons for successful ecological forest restoration

A great deal of progress has been made towards finding common ground on a restoration vision for eastern Oregon's dry forests. Land managers and other stakeholders can learn from past successes and build on the progress that has been made in projects like the Glaze project, and move towards a new management paradigm for eastern Oregon's forests that will conserve and restore healthy old growth trees and forests at a landscape scale.

To move forward towards this goal, forest managers must:

- Focus on treating areas where there is scientific and social consensus for forest management.
- Utilize the best available science to inform restoration priorities and readily incorporate new scientific developments in planning efforts.
- Modify model prescriptions as needed according to site-specific conditions.
- Prioritize restoration treatments in dry ponderosa pine and dry mixed conifer forests that have significantly altered natural processes, such as *old growth* stands with dense ingrowth of small trees, dense young stands that have been previously logged, and small fuels close to homes and communities.
- Collaborate with conservation groups, local government, tribes, and other stakeholders throughout the development of projects.
- Generally adhere to existing rules that protect trees 21" *DBH* and larger, but allow, on a site-specific basis, removal of large but young shade-tolerant trees (e.g., white fir) when they are in direct competition with larger and older shade-intolerant trees (e.g., ponderosa pine).
- Protect all trees with *old growth* characteristics of all sizes and species.
- Use principles of "*mosaic-variable density thinning*" to restore forests to natural resiliency and provide for diversity.
- Use methods that minimize soil disturbance, such as using low impact machinery and operating on snow or frozen ground when feasible.
- After *mosaic thinning*, use prescribed fire to help reintroduce the natural role of fire in the ecosystem.
- Implement high priority habitat and watershed restoration activities along with thinning and fire.
- Monitor results and maintain an open dialogue during implementation. Modify and adjust practices as needed to address concerns identified by monitoring.

A recently thinned area of the Glaze project. *(Maret Pajutee)*

Minimizing unintended impacts

Management activities, even with the goal of ecological restoration, can have undesirable impacts on the environment. These impacts should be avoided and minimized to the extent possible through careful planning and implementation:

- Leave one third to one half of the landscape untreated to mitigate impacts from treatments and to allow for a different type of restoration and habitat.
- Impacts on raptor nests and other sensitive wildlife habitat can be avoided by carefully surveying for and preserving trees with nests and habitat structures, and by project timing.
- The spread of invasive weeds can be minimized by requiring clean equipment and vehicles, minimizing soil disturbance, and maintaining native ground cover, canopy cover, and vegetation diversity.
- Streams should be protected from heavy equipment and loss of trees and shrubs that provide shade and structure.
- To protect soil and streams, "temporary" roads should be avoided or kept to a bare minimum and fully decommissioned as soon as possible to avoid extended impacts.
- Try to avoid soil impacts whenever possible. Ways of doing this include keeping use of ground-based logging and machine slash piling to a minimum, and requiring equipment operation over snow or frozen ground when feasible.

Logging over snow in the Glaze Forest restoration project. *(Maret Pajutee)*

Prescribed fire is used to reduce fuels and restore a more natural vegetation structure in dry ponderosa pine forests.*(Brett Cole)*

Elk use forest openings and cover in dry forests. *(U.S. Forest Service)*

Prescribed fire and other restoration efforts can improve aspen stands. *(Chandra LeGue)*

Osprey and other raptor nests and perches in snags and live trees should be protected. *(Brett Cole)*

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Glossary

Term	Definition
Age class cohort	A distinct aggregation of trees originating from a single natural event or regeneration activity, or a grouping of trees, as used in inventory or management.
Basal area	The area of the cross section of a tree stem, including the bark, generally at breast height (4.5 feet above the ground).
Dry forests	Forest types generally in warm, dry microclimates that include plant association groups dominated by ponderosa pine and other early seral conifers. These forests typically had a historic fire return interval of 10–30 years.
DBH	Diameter of a tree measured at breast height, about 4.5 feet from the ground.
Forest health	A condition that enables a forest to be resistant and resilient to uncharacteristic disturbance events; and to support natural ecosystem and hydrologic function and structure, including viable populations of native wildlife. Forest health should not be confused with tree health. A healthy forest should have numerous dead and dying "wildlife trees."
Historic/natural range of variability	Ecological conditions and their range of variability under conditions that are relatively unaffected by people, at a specific geographic and temporal scale.
Mosaic thinning or variable density thinning	A method of thinning that leaves a patchwork of different tree densities, unthinned areas, and small openings to enhance structural diversity at a variety of scales to mimic natural forest structure and processes. This method also retains old growth trees and other biological legacies.
Old growth	A structurally complex forest stand typically containing several of the following characteristics: wide variation of tree species, sizes, and ages; multiple canopy layers; moderate to abundant levels of snags and dead wood; canopy gaps and understory patchiness; and trees with old growth characteristics such as large size, advanced age, thick bark, asymmetric crown architecture, and large branches.
Second-growth	A forest stand that has been either replanted or been allowed to regrow after the original stand was logged or completely burned by natural fire.
Thin from below	A method of thinning in which the smallest trees are removed and the largest dominant trees are retained.

About the author

Tim Lillebo *(Maret Pajutee)*

A lifelong Oregonian, Tim Lillebo has worked with Oregon Wild for over 35 years. Based in Bend, Tim protects eastern Oregon roadless areas and *old growth* forests. He travels widely to participate in resource advisory and collaborative groups, working with conservationists, timber industry representatives, federal officials, and local elected leaders.

A former timber faller and woods worker, Tim has intimate knowledge of the land. His effective organizing efforts led to passage of the Oregon Wilderness Act of 1984 and the Oregon Resources Conservation Act of 1996. He is the primary architect of the Glaze Forest restoration project – a model *old growth* restoration program in the Deschutes National Forest in central Oregon. An avid elk hunter and hiker, Tim has a B.S. in Biology from Lewis and Clark College.

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