



ECOLOGICAL MONITORING PLAN

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EXECUTIVE SUMMARY

Oak and prairie ecosystems once spanned the Pacific Northwest from northern California to British Columbia but now persist on roughly 10% of their historic extent. In Oregon, only about 25% of historic oak habitat and 1% of native prairies remain (Prairie, Oaks, and People 2024). The Umpqua Basin retains some of the most extensive remaining Oregon white oak (*Quercus garryana*) and California black oak (*Q. kelloggii*) forests, yet these habitats continue to decline due to conifer encroachment, invasive species, fire exclusion, and land conversion.

The Umpqua Oak Partnership (UOP) Monitoring Plan provides a transparent, collaborative framework to track restoration implementation and evaluate ecological outcomes identified in the UOP 2025–2035 Strategic Action Plan (SAP). It is aligned with the Klamath-Siskiyou Oak Network (KSON) Ecological Monitoring Plan (2023) to ensure consistent methods, data sharing, and regional comparability across southern Oregon and northern California.

The monitoring framework centers on three objectives:

1. Track spatial extent of treatments and project implementation.
2. Measure treatment-induced changes in Key Ecological Attributes (KEAs).
3. Measure landscape-scale Ecological Outcomes.

Using shared datasets, field monitoring, and adaptive learning, the Partnership will evaluate how restoration treatments shift habitats from current to desired conditions. Results will guide implementation reviews, investment decisions, and adaptive management.

BACKGROUND AND MONITORING FRAMEWORK

The Umpqua Oak Partnership (UOP) is a coalition of tribal, federal, state, and local partners committed to restoring and protecting oak and prairie ecosystems in the Umpqua Basin. The Strategic Action Plan outlines a 10-year roadmap to restore priority habitats—prairie, oak savanna, oak woodland, and mixed oak-conifer forest—through actions such as conifer thinning, prescribed fire, understory restoration, invasive species control, and landowner support.

The Strategic Action Plan prioritizes four oak habitat types—prairie, oak savanna, oak woodland, and mixed oak-conifer forest—and focuses on:

- Restoring and expanding oak habitat through forest thinning, fuels management, prescribed fire, understory restoration, and invasive species control.
- Supporting landowners with technical assistance and access to landowner incentive programs.
- Integrating indigenous stewardship and ecological knowledge.
- Monitoring progress using key ecological indicators to adapt strategies over time.

The following 25-year objective, outlined in the Strategic Action Plan, describes the measurable ecological changes the Partnership seeks to achieve across the Umpqua Basin. This objective is directly tied to the Key Ecological Attributes (KEAs) defined in the Viability Assessment Framework and form the basis for the monitoring indicators and metrics in this plan.

By 2050, restore, maintain, and protect a resilient and interconnected network of oak and prairie habitats across the Umpqua Basin that supports native biodiversity, enhances fire-adapted ecosystems, sustains ecocultural values, and contributes to long-term climate resilience.

The Strategic Action Plan applies a viability assessment framework that identifies eight KEAs and associated indicators to measure ecological health and restoration effectiveness. This Monitoring Plan operationalizes that framework.

The Monitoring Plan is a living document designed to:

- Acquire, manage, analyze, and share data needed to evaluate restoration success.
- Align with regional monitoring standards.
- Provide feedback loops for adaptive management at stand, project, and landscape scales.

VIABILITY ASSESSMENT FRAMEWORK

To ground monitoring in ecological function, the Partnership used a viability assessment framework—a structured approach for defining what healthy oak and prairie systems look like. This process identified the ecological conditions necessary for long-term viability and informed the goals and objectives of the UOP Strategic Action Plan.

Through the viability assessment, partners selected eight KEAs that represent essential components of oak and prairie ecosystem integrity, such as canopy structure, native understory composition, fire regime, and presence of oak-dependent bird species. Each KEA has one or more indicators used to measure current condition, desired future condition, and response to restoration.

Our approach to developing goals and objectives for the Strategic Action Plan builds on the viability assessment which includes:

1. Defining Key Ecological Attributes to describe both current and desired conditions for each habitat type;
2. Identifying indicators to measure those conditions;
3. Establishing benchmarks for what constitutes “Good” condition;
4. Assessing each habitat’s current and desired future condition using a qualitative ranking of Poor, Fair, or Good.

[Appendix 1. Viability Assessment - Current and Future Conditions](#) presents the results of the viability assessment, which evaluates the current and desired conditions of each KEA across major oak habitat types in the Umpqua Basin. The color-coded rankings (Poor, Fair, Good) illustrate habitat conditions relative to desired ecological states and tie directly to long-term conservation objectives.

MONITORING OBJECTIVES

The UOP Monitoring Plan is designed to evaluate progress toward the 25-year objectives of the Strategic Action Plan by tracking outputs and ecological outcomes through three complementary objectives. These objectives correspond to the spatial, functional, and landscape scales at which oak and prairie systems respond to restoration. [Table 1. Monitoring Plan Framework for the Umpqua Oak Partnership](#) summarizes the core components of this Monitoring Plan including each KEA, along with indicators, metrics, and measurement scales. These indicators will be used to assess immediate ecological responses to restoration as well as conservation progress over the next 25 years. Outputs in this table link this Monitoring Plan to the Strategic Action Plan

Table 1. Monitoring Plan Framework for the Umpqua Oak Partnership

Output	25-Year Objective	KEA	Indicator	Metric (scale)
Expanded extent and improved continuity of priority habitat types across the landscape	Increase the amount of oak conifer by 4,350 acres (7%); increase the amount of prairie; and maintain the current amount of oak savanna and oak woodlands.	Amount on landscape (size)	Total area by subbasin	Acreage of each target habitat (landscape)
Improved condition of plant communities by restoring native understory cover, increasing recruitment and diversity of smaller and regenerating oaks, retaining and protecting potential legacy trees, and boosting acorn yield	Maintain or improve the condition of oak savanna and woodlands so that at least 5,240 acres of oak savanna and 8,543 acres of oak woodlands support >25% cover of high-diversity native understory	Plant community (condition)	>25% native understory cover with high structural and compositional diversity, adequate structural conditions for the persistence of rare species, and minimal cover of state or federally-listed noxious weeds	Diversity, composition, and structure of understory plant communities; extent and abundance of rare species populations; extent and abundance of noxious weed populations (stand)
	Maintain or improve the condition of oak woodland and oak conifer habitat, so that at least 17,086 acres of oak woodland and 31,071 acres of oak-conifer habitat support abundant younger age-class oaks, retain at least 90% of legacy oaks, and ensure accessible, high-quality acorn crops.	Young oak trees (condition)	Abundant younger age class oaks	Relative abundance of current to modeled age structure based on size (stand)
		Legacy oak trees (condition)	Abundant and high-quality acorn crops	Acorn crop abundance and viability (stand)
		Acorn crop (condition)	Non-encroachment of 90% of existing and potential legacy oaks	Percent or categorical: encroached, overtopped, or pierced oaks (stand)
Reduced woody fuel load and reintroduced low-severity fire	Maintain or improve the condition of oak woodland and oak conifer habitat, so that at least 17,086 acres of oak woodland and 31,071 acres of oak conifer are characterized by a low load surface behavior model.	Fuel load (condition)	Low load surface fire behavior model (based on flame length, radial spread, suppression difficulty)	Surface Fire Behavior Fuel model; Canopy base height and canopy closure (field metrics) (stand)
Reduced woody fuel load and reintroduced low-severity fire	Increase the amount of oak habitat burned within the last 36 years (Fire Regime Class 1), so that at least 5,241 acres of oak savanna, 8,543 acres of oak woodland, and 15,535 acres of oak-conifer fall within Fire Regime Class 1.	Fire regime (condition)	Proportion of landscape (e.g., subbasin (HUC6)) oak targets within fire frequency interval (existing) and severity (actual and predicted), relative to desired KEA fire regime condition for oak targets	Time since disturbance and/or fire; severity of past disturbance and proportions of severity classes (landscape)
Improved habitat conditions to increase focal bird species populations and diversity	Maintain or improve the condition of oak habitat so that more acres of prairie, 10,481 acres of oak savanna, 17,086 acres of oak woodland, and 31,071 acres of oak-conifer have >75% of focal bird species present.	Breeding birds (condition)	>75% of focal bird species present	Presence and abundance of focal species; avian community composition (stand)
Increased acres permanently protected from conversion	By 2035, permanently protect 2,000 acres of oak and prairie habitat through conservation easements, fee title acquisition, and other voluntary land protection tools.	Amount on landscape (size)	Total area by subbasin	Acreage in permanent protection (landscape)
Increased number of landowners managing for oak habitat	By 2035, enroll at least 510 private landowners in conservation programs within priority areas to expand oak stewardship on private lands.	Amount on landscape (amount)	Number of landowners enrolled in NRCS, ODFW, OSU, SWCD, and other programs.	Number of landowners (landscape)

Objective 1: Spatially Track Restoration Implementation

This objective establishes a shared spatial database to track where oak restoration is planned, underway, or completed across the Umpqua Basin. Mapping treatment locations, types, and status provides the foundation for all other monitoring and evaluation activities under the UOP Strategic Action Plan. The database will house UOP-funded treatments, key planning layers, and—where possible—restoration and disturbance data from other organizations and ownerships. This centralized system will support project coordination, progress reporting, and landscape-scale analysis, while improving efficiency in data collection, outreach, and adaptive management.

Objective 2: Measure Treatment-Induced Changes in Key Ecological Attributes (KEAs)

This objective is the core of the UOP Monitoring Plan. It evaluates how restoration actions are improving oak habitat conditions at the stand, project, and landscape scales—answering questions such as whether we are protecting the best, restoring the rest, reintroducing fire to oak ecosystems, and expanding oak habitat across Douglas County. Using a set of eight Key Ecological Attributes (KEAs) and associated indicators, the Partnership will measure treatment effectiveness and track progress toward desired future conditions for each oak habitat type. For every KEA, the plan outlines indicators, metrics, sampling design, data collection and QA/QC protocols, and analysis methods to ensure consistent, reliable evaluation of ecological change.

Objective 3: Measure Landscape-Scale Ecological Outcomes

This objective evaluates whether collective restoration and protection efforts are improving oak and prairie conditions across the entire Umpqua Basin. Using spatial datasets and indicators such as total habitat area, canopy structure, and disturbance patterns, the Partnership will track trends in habitat extent, connectivity, and resilience. The goal is to maintain or increase oak and prairie acreage by reducing key stressors—such as conifer encroachment, invasive species, and land conversion—and by promoting fire and restoration at meaningful ecological scales. This landscape perspective helps determine whether site-level successes are translating into durable, system-wide conservation outcomes.

MONITORING SCALES AND USE OF PLAN

Monitoring occurs across nested spatial scales that link site-level restoration actions to landscape-level outcomes. Understanding these scales provides the foundation for interpreting results across Objectives 1–3.

MONITORING SCALES

- Stand scale (10s of acres): Direct treatment units with uniform vegetation conditions.
- Project scale (>10,000 acres): Aggregations of treated and untreated areas.
- Landscape scale: Regional analysis of habitat condition, fire flow, and resilience.

ADAPTIVE MANAGEMENT AND DATA USE

Monitoring results will inform annual implementation reviews and be shared with the full Partnership. Landscape-scale objectives in this Plan are intentionally aligned with those of the Klamath-Siskiyou Oak Network to ensure consistency in conservation priorities, metrics, and outcomes across shared geography. By using common geospatial datasets and methods, both partnerships can efficiently track large-scale changes in oak habitat extent, condition, and connectivity over time. This approach enables simple, repeatable mapping exercises that visualize progress, identify emerging opportunities or gaps, and support regional coordination. It also allows partners to evaluate the cumulative impact of individual projects within a broader ecological context.

USE OF THE MONITORING PLAN

Use of this Monitoring Plan is strongly encouraged but not mandatory for all partners. However, when projects are funded through or administered by the Umpqua Oak Partnership, adherence to the monitoring framework outlined in this plan will be required to ensure consistent tracking, reporting, and evaluation across funded activities. This approach promotes transparency, comparability, and shared learning while allowing flexibility for partners to apply additional or alternative monitoring methods that align with their own organizational or programmatic needs

MONITORING OBJECTIVES AND ACTIVITIES

This section describes how the Umpqua Oak Partnership (UOP) will evaluate progress toward the ecological goal and 25-year objectives outlined in the Strategic Action Plan. The monitoring framework integrates three complementary objectives that together track implementation, effectiveness, and outcomes across spatial and ecological scales:

1. Objective 1 – Spatially Track Restoration Implementation: Where and what work is occurring.
2. Objective 2 – Measure Treatment-Induced Changes in Key Ecological Attributes (KEAs): How restoration is changing ecological conditions.
3. Objective 3 – Measure Landscape-Scale Ecological Outcomes: Whether collective efforts are improving habitat conditions basin-wide.

Each objective builds on the previous one to create a nested, adaptive approach to monitoring — linking site-level treatments to landscape-scale change. Together, these objectives provide a transparent, science-based method to evaluate how restoration actions are advancing the Partnership’s shared ecological goals.

OBJECTIVE 1: SPATIALLY TRACK TREATMENT PLANNING AND PROJECT IMPLEMENTATION

Monitoring Questions: Where is UOP oak restoration planned and what is the current status of each treatment unit? Within a project area, where have other organizations implemented restoration or where has natural disturbance occurred?

Purpose: While basic in concept, the spatial tracking of restoration treatments provides the foundation for many components of UOP’s SAP including ecological monitoring. Well-designed databases will facilitate effective, efficient data collection and timely reporting on UOP metrics and indicators, enabling project management, outreach, engagement, and future monitoring investments. The database will house data for all UOP-associated treatments, relevant project planning feature datasets (e.g., oak target) to facilitate review of project design and project scale impacts. In intensively monitored landscapes we will also work to identify, and map treatments implemented by other organizations and ownerships and natural disturbance to enable landscape scale interpretation. Documentation of the types and locations of restoration treatments will be facilitated by a UOP member to be determined.

OBJECTIVE 2: MEASURE TREATMENT-INDUCED CHANGES IN KEY ECOLOGICAL ATTRIBUTES

Monitoring Questions: Have restoration actions improved oak habitat condition at the stand and project scales? Specifically:

1. Have we protected the best and restored the rest?
2. Have we returned prescribed fire to the oak landscape?
3. Have we implemented oak restoration and protection across ownerships at both landscape and

- property scales?
4. Have we increased oak habitat across Douglas County?

See [Table 1: Monitoring Plan Framework for the Umpqua Oak Partnership](#).

Purpose: This objective is the core of the UOP Monitoring Plan. It evaluates how restoration treatments are improving ecological conditions and contributing to long-term conservation goals. Objective 2 evaluates how restoration treatments influence the ecological condition of oak and prairie habitats at the stand, project, and landscape scales. It focuses on measuring treatment effectiveness—how management actions shift habitat from its current to desired condition.

This section applies the Key Ecological Attributes (KEAs) identified through the Viability Assessment Framework to evaluate those changes over time. Each KEA is associated with indicators, metrics, and sampling designs that measure ecological response to restoration. Collectively, they allow partners to determine whether treatments are achieving intended outcomes such as restoring fire processes, improving native understory composition, enhancing wildlife habitat, and increasing the extent and resilience of oak ecosystems.

Stand-scale monitoring tracks immediate, on-the-ground changes in vegetation and structure within treated areas, while project- and landscape-scale analyses assess broader cumulative outcomes across ownerships and habitat types. Together, these measurements provide a transparent and science-based means to assess progress toward the UOP's 25-year objectives and overall ecological goal.

KEA 1. Acreage – Amount on Landscape

Monitoring Question: Have we maintained or increased the amount of target acres?

Indicator: Total area by subbasin.

Metric: Acreage of each target habitat.

Approach Summary: Use LEMMA and LANDFIRE datasets, or new datasets as they come available, to classify and quantify oak habitat targets across the basin.

Scale and Frequency: Measured at project and landscape scales; updated approximately every six years

Note: Provides a landscape-level measure of habitat extent and overall success in maintaining or expanding oak and prairie systems. Because of the ability of restoration treatments to increase landscape-level heterogeneity and thus species richness (Latif et al. 2020), it is beneficial to evaluate treatment success at multiple scales.

KEA 2. Condition - Plant Community

Monitoring Question: Have we improved the condition of the plant communities by restoring native understory cover and reducing invasive species?

Indicator: >25% native understory cover with high structural and compositional diversity, adequate structural conditions for the persistence of rare species, and minimal cover of state or federally listed noxious weeds.

Metric: Species diversity, composition, structural heterogeneity of understory plant communities; extent and abundance of rare species populations; extent and abundance of noxious weed populations

Approach Summary: Use FIREMON Species Composition methods and Intuitive Controlled surveys to

document changes before and after treatments.

Scale and Frequency: Stand and project scales; sampled pre- and post-treatment.

Note: Plant community monitoring will be used to assess how treatments (thinning, burning, and seeding) shift compositional and structural conditions in understory plant communities, including exotic species invasion, rare species responses, and establishment of existing or seeded native species. We will assess understory plant communities using the following indicators: 1) percentage of native understory cover, 2) structural and compositional diversity, 3) the persistence and abundance of focal species identified in the strategic plan, and 4) cover of state or federally listed noxious weeds.

KEA 3. Condition - Oak Trees (Legacy Trees)

Monitoring Question: Have we retained and protected potential legacy oak trees from encroachment?

Indicator: Non-encroachment of 90% of existing and potential legacy oaks.

Metric: Percent or categorical of legacy oaks considered encroached, overtopped, or pierced.

Approach Summary: Use 0.1-acre plots following Rogue Forest Partners Vegetation and Fuels Protocols.

Scale and Frequency: Stand scale, repeated pre- and post-treatment; project-scale evaluation as sufficient portions of each project area are treated.

Sampling Design: Sampling design for this KEA will follow the methods in Rogue Forest Partners (2021). Plots will be circular and will cover 1/10 of an acre. Sample plots will be located using a spatially balanced random sample design. Random points will be assigned using the Generate Random Points tool, Data Management toolbox, ArcPro 3.0.3 with a minimum distance between plots that allows for good dispersal and fit of plots within the unit. Plots falling on roads or landings will be moved to the interior of the vegetation type by 2x plot radius but plots falling in skips, openings, or other vegetation types within the unit perimeter will be measured. In noncommercial units, plots will sample 10 points for every 100 ac of project area, generally resulting in a 10% frequency sample. The sample frequency in areas with significant diversity in forest types or structures may be increased to 15 points for every 100 ac. For units < 100 ac, a minimum sample threshold of 5 points should be used. In commercial stands, monitoring plots will be located using a systematic sampling approach in accordance with USFS stand exam protocols. In these cases, the sampling density will be 1 plot for 5 acres, with at least 3 plots per unit for smaller units, generally resulting in a 20% frequency sample unless treatments are <100 acres and relatively uniform in nature (e.g., plantations) sample density will be reduced to (10%) one plot for every 10 acres. Plots will be sampled no more than one year prior to treatments, and resampled at least one year after treatments.

KEA 4. Condition - Oak Trees (Young Trees)

Monitoring Question: Have we increased recruitment and diversity of smaller regenerating oaks?

Indicator: Abundance of younger age-class oaks.

Metric: Relative abundance of current compared to modeled age structure (based on size); i.e., count of species by DBH and height

Approach Summary: Count and classify oak seedlings and saplings using FIREMON Tree Data protocols within subplots nested in vegetation plots.

Scale and Frequency: Stand scale, repeated pre- and post-treatment; project-scale evaluation as

sufficient portions of each project area are treated.

Sampling Design: Sampling design for this KEA will follow the methods in Rogue Forest Partners (2021). Plots will be circular and will cover 1/10 of an acre. Sample plots will be located using a spatially balanced random sample design. Random points will be assigned using the Generate Random Points tool, Data Management toolbox, ArcPro 3.0.3 with a minimum distance between plots that allows for good dispersal and fit of plots within the unit. Plots falling on roads or landings will be moved to the interior of the vegetation type by 2x plot radius but plots falling in skips, openings, or other vegetation types within the unit perimeter will be measured. In noncommercial units, plots will sample 10 points for every 100 ac of project area, generally resulting in a 10% frequency sample. The sample frequency in areas with significant diversity in forest types or structures may be increased to 15 points for every 100 ac. For units < 100 ac, a minimum sample threshold of 5 points should be used. In commercial stands, monitoring plots will be located using a systematic sampling approach in accordance with USFS stand exam protocols. In these cases, the sampling density will be 1 plot for 5 acres, with at least 3 plots per unit for smaller units, generally resulting in a 20% frequency sample unless treatments are <100 acres and relatively uniform in nature (e.g., plantations) sample density will be reduced to (10%) one plot for every 10 acres. Plots will be sampled no more than one year prior to treatments, and resampled at least one year after treatments.

Notes: This metric will inform the status of oak recruitment, their potential to become legacy trees, presence of encroaching vegetation, and the ability of a site to provide acorns as a first food to indigenous peoples and as forage for wildlife into the future.

KEA 5. Condition - Oak Trees (Acorn Crops)

Monitoring Question: Are acorn crops abundant and viable, supporting wildlife and first foods?

Indicator: Abundant and high-quality acorn crops.

Metric: Acorn crop abundance and viability.

Approach Summary: Follow KSON Acorn Monitoring Protocol; tag and monitor individual trees over multiple years.

Scale and Frequency: Tree and stand scales; annual sampling during acorn season.

Sampling Design: To be determined

Lead for pilot study: Klamath Bird Observatory

Note: Acorn monitoring will follow KSON's Acorn monitoring plan (Stephens 2024). The goal of acorn monitoring will be to quantify the number of acorns on the landscape in relation to interannual and individual tree variation.

KEA 6. Condition - Fuel Loads

Monitoring Question: Have surface fuel loads been reduced and low-severity fire potential increased? Has low severity fire been reintroduced?

Indicator: Low load surface fire behavior fuel model (based on flame length), fuel continuity (based on surface fuels, canopy base height, and canopy closure)

Metric: Surface Fire Behavior Fuel model; Canopy base height and canopy closure (field metrics)

Approach Summary: Apply Rogue Forest Partners Fuels Field Protocols; record conditions pre- and

post-burn.

Scale and Frequency: Stand and project scales; before and after treatments.

Note: We will assess fuel load conditions using a surface fire behavior model as an indicator, with a goal of low surface fuel load. By modeling the impact of current surface fuel loads on fire behavior, we can adaptively manage thinning methods and better predict potential fire severity.

Sampling Design: Sampling design for this KEA will follow the methods in Rogue Forest Partners (2021). Plots will be circular and will cover 1/10 of an acre. Sample plots will be located using a spatially balanced random sample design. Random points will be assigned using the Generate Random Points tool, Data Management toolbox, ArcPro 3.0.3 with a minimum distance between plots that allows for good dispersal and fit of plots within the unit. Plots falling on roads or landings will be moved to the interior of the vegetation type by 2x plot radius but plots falling in skips, openings, or other vegetation types within the unit perimeter will be measured. In noncommercial units, plots will sample 10 points for every 100 ac of project area, generally resulting in a 10% frequency sample. The sample frequency in areas with significant diversity in forest types or structures may be increased to 15 points for every 100 ac. For units < 100 ac, a minimum sample threshold of 5 points should be used. In commercial stands, monitoring plots will be located using a systematic sampling approach in accordance with USFS stand exam protocols. In these cases, the sampling density will be 1 plot for 5 acres, with at least 3 plots per unit for smaller units, generally resulting in a 20% frequency sample unless treatments are <100 acres and relatively uniform in nature (e.g., plantations) sample density will be reduced to (10%) one plot for every 10 acres. Plots will be sampled no more than one year prior to treatments, and resampled at least one year after treatments.

KEA 7. Condition - Fire Regime

Monitoring Question: Have fire regimes been restored within oak habitats to natural frequency and severity intervals, specifically Fire regime I?

Indicator: Proportion of landscape (e.g., subbasin [HUC 6]) occupied by oak targets within the natural Fire Regime disturbance frequency interval and severity class (LANDFIRE; Barrett et al. 2010) relative to desired KEA fire-regime conditions for oak habitats.

Metric: Proportion of landscape within desired fire regime by severity class and time since disturbance.

Approach Summary: Model expected fire behavior and compare to historical conditions using LANDFIRE and spatial analysis.

Scale and Frequency: Project and landscape scales; analysis repeated approximately every 6–10 years.

Note: Fire regimes quantify the spatial, temporal, and characteristic severity of fire disturbance. Dramatic changes to the structure and composition of oak ecosystems have resulted from the interruption of natural fire regimes beginning in the 1850s, due to fire suppression, the forcible removal of Indigenous peoples who used fire to manage the land, and agricultural conversion. A literature review of local historical fire regimes will help assess historical conditions of fire intensity and return interval.

Study Design: To broadly measure progress toward restoring fire regimes, as described by Barrett et. al (2010, Table 1), we will model expected fire behavior (surface, passive, or crown fire) as a surrogate for fire severity, grouped by oak targets by subbasin as an indicator. Assessing the post-treatment landscape expected fire severity and disturbance frequency, relative to historic fire regimes will measure treatment success and inform future prescriptions. Landscape-scale modeling will be conducted using LANDFIRE 2022, Monitoring Objective 1 datasets (for mapped treatments and natural disturbance), and other regional fire-history data. Expected fire behavior (surface, passive, or crown fire) will be modeled as a surrogate for fire severity, grouped by oak target and subbasin. Disturbance severity will be inferred from modeled fire type, where surface fire = low severity, passive crown fire = moderate severity, and crown fire = high severity. Analyses will be stratified by oak target type and HUC-6 subbasin to maintain

spatial balance and evaluated on a recurring 10-year cycle, aligning with LANDFIRE update intervals and major restoration phases. Results will be compared against natural fire-regime frequency and severity intervals to assess progress toward desired conditions and to inform future prescriptions.

KEA 8. Condition - Breeding birds

Monitoring Question: Have we improved habitat conditions to increase focal bird species diversity?

Indicator: >75% of focal bird species present (5 prairie; 6 oak savanna; 8 oak woodland; and 9 mixed-oak conifer). Increase in densities of target species identified in the Strategic Plan.

Metric: Percentage and abundance of focal species present; avian community composition

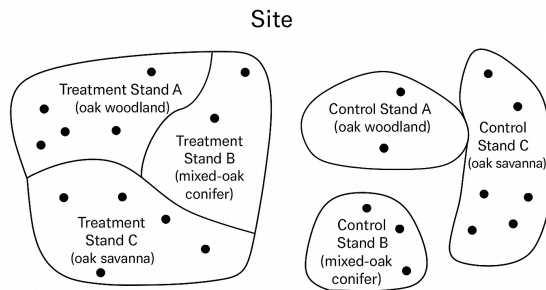
Approach Summary: Use standardized point-count surveys in a Before-After-Control-Impact (BACI) design. Pair treatment and control stands and monitor changes in bird community composition.

Scale and Frequency: Stand and project scales; pre-treatment and multiple post-treatment intervals (years 1–2, 5–6, 10–11).

Note: We will assess the condition of breeding birds using the presence of focal bird species associated with a given oak habitat as an indicator. By using a suite of focal bird species associated with desired structural and compositional traits of target oak habitats, we can measure success of restoration treatments in their ability to provide habitat features that sustain wildlife.

Sampling Design: Because bird populations fluctuate annually, and many are experiencing range wide declines, a study design that can differentiate treatment effects within that expected variation is needed. For this reason, the breeding birds KEA will apply a Before-After-Control-Impact (BACI) study design to monitor changes in the bird community in response to oak restoration. We will apply a hierarchical sampling design where points are individual survey locations, stands are relatively homogeneous plant communities with a similar structure, and sites are spatially independent (generally >1 km apart); the stand is the sampling unit (Figure 1). We will pair each restoration stand with a nearby control stand (generally within 500–1,000 m) that is the same oak habitat type and has similar canopy and understory cover. Point count and vegetation survey points will be established as subsamples within each stand (Figure 1). We will generate random points located at least 150 m apart and >50 m from the edge within each stand in ArcGIS using the Create Random Points tool. Within a project area, if possible, we survey ~150 treatment and control survey points within 25 treatment stands and 25 associated control stands. Bird communities will be assessed on plots that do not conform to the size of vegetation plots but are spatially aligned, where the stand is the sampling unit. Bird surveys will be completed prior to treatments, and resampled, preferably for two years following treatments and again incrementally into the future (e.g., years 5-6 post treatment and again 10-11 years post treatment).

Figure 1. The Breeding Bird KEA will apply a hierarchical sampling design where points are individual survey locations, stands are relatively homogeneous plant communities with a similar structure, and sites are spatially independent (generally >1 km apart); the stand is the sampling unit.



Prairie Focal Species: Savannah Sparrow, Western Meadowlark, Grasshopper Sparrow, Lark Sparrow, Vesper Sparrow

Note: Savannah Sparrow is the only focal species identified for prairie habitat in the conservation planning documents listed above. Additional species are pulled from Figure 2 of *The Land Manager's Guide to Bird Habitat and Populations in Oak Ecosystems of the Pacific Northwest* (Altman and Stephens 2012) which identifies them as the highest density in prairie habitat type compared to other oak and prairie targets.

Oak Savanna Focal Species: Ash-throated Flycatcher, Chipping Sparrow, California Scrub-Jay, Western Bluebird, Western Kingbird, Western Meadowlark

Notes: Includes Oak Savanna focal species identified by Altman and Stephens (2012), except for Lazuli Bunting, House Wren, and Spotted Towhee, which are species that are not specifically associated with desired oak savanna conditions in the UOP geography and thus not ideal indicators. For example, Lazuli Bunting can occur in conifer forests as well as oak savannas and House Wren and Spotted Towhee can occur in areas with greater tree and shrub cover. Additional species identified as indicators of oak savanna vegetation conditions in KBO and LRP (2020) are included: Western Kingbird and Western Meadowlark. Ash-throated Flycatcher is also included; while not an Oak Savanna focal species in Altman and Stephens (2012), that publication suggests that they respond positively to removal of Douglas Fir in oak savannas.

Oak Woodland Focal Species: Chipping Sparrow, Lazuli Bunting, White-breasted Nuthatch, Acorn Woodpecker, Ash-throated Flycatcher, Western Wood-Pewee, Purple Finch, Bushtit

Note: Includes all Oak Woodland focal species listed in Altman and Stephens (2012), with the exception of House Wren, Spotted Towhee, and California Towhee. Spotted Towhee and House Wren are excluded because they are generalists that are not specifically associated with desired oak woodland conditions in the UOP geography. California Towhee is also not included; while not an Oak Woodland focal species in Altman and Stephens (2012), that publication suggests that they respond positively to oak woodland canopy thinning and Douglas fir removal; but this species is rare in the Umpqua river valley.

Mixed Oak-Conifer Forest: Focal Species: Black-headed Grosbeak, Black-throated Gray Warbler, Nashville Warbler, Western Tanager, Cassin's Vireo, Hutton's Vireo, Black-capped Chickadee, Bushtit, Downy Woodpecker

Note: Includes all Oak Conifer focal species listed in Altman and Stephens (2012). The *OakBirdPop*

supplement (Altman et al. 2017) predicts several of the listed species at higher densities in oak-fir vegetation as compared to closed oak woodland.

Lead: Klamath Bird Observatory

OBJECTIVE 2 METHODOLOGY

Monitoring

KEA 1: Acreage – Amount on landscape

We will monitor target habitat acreage using the most recent LEMMA and LANDFIRE datasets available. LANDFIRE datasets are updated annually. We will determine target habitat acreage using the same classification methods described in the Strategic Action Plan. Specifically, updated LEMMA GNN Species-Structure maps, available at a 30m pixel resolution, will be used to classify forested area within the geography by oak habitat target, and total area of each oak habitat target will be calculated using Spatial Analyst tools in ArcGIS Pro. LANDFIRE Existing Vegetation Cover (EVC) data is available to assess shrub cover in 10% intervals and is used alongside LEMMA GNN data to classify oak savanna and oak chaparral. We will use the most recent LANDFIRE data to classify shrub cover when classifying changes in oak habitat target area. Where possible, we will also assess oak habitat canopy cover change at the project scale using regional remote sensing derived datasets (e.g., Fall Foliage Index; LANDSAT). This metric will be measured at the project scale and landscape scale. Analysis will be repeated periodically, approximately every 6 years, to allow for updated datasets and landscape-level habitat change.

KEA 2: Condition – Plant community

On plots, understory plant communities will be monitored using a combination of the FIREMON Species Composition Sampling Method (Caratti 2006) and Intuitive Controlled surveys (Whiteaker et al. 1996). On each plot, each tree, shrub, and herbaceous species will be assigned the following: 1) status (live or dead), 2) size class (see FIREMON Species Composition protocol for classes), and 3) cover class (see FIREMON Species Composition protocol for classes). A single species may be assigned more than one size class, in which case each will be assigned its own cover class. Additionally, ground cover types (bare ground, rock, gravel, wood, cryptogams, thatch, litter) will be assigned a cover class.

During Intuitive Controlled surveys, when rare species or noxious weeds are encountered, the botanist will use a mobile GPS application to record the extent and abundance (cover and/or count, depending on the species) of each population. The botanist will note plant phenology (veg, flowering, in seed). The location and status info of noxious weed species (ODA 2022) will be shared with project partners to ensure appropriate actions can be taken prior to treatment; when appropriate, non-native plant populations will be controlled prior to ground disturbing activities or defer actions if necessary; monitoring crews will comply with the RRS National Forest Weed Management plan; populations of invasive non-native plants will be flagged prior to implementation (see RFP 2021 for detail). Effectiveness monitoring is necessarily limited to the stand scale for short-term treatment impacts but will be evaluated at the project scale as sufficient area within projects is treated.

Vegetation conditions will be measured on a series of plots randomly distributed throughout each treatment unit (i.e., the stand), as well as utilizing intuitive-controlled surveys of entire treatment units. All sampling will occur during May and June, unless the phenology of a species of interest requires alternate timing.

Sampling design for the plot-based component of this KEA will follow the methods detailed in Rogue Forest Partners (2021). Plots will be circular and will cover 1/10 of an acre. Sample plots will be located using a spatially balanced random sample design. Random points will be assigned using the Generate Random Points tool, Data Management toolbox, ArcPro 3.0.3 with a minimum distance between plots

that allows for good dispersal and fit of plots within the unit. Plots falling on roads or landings will be moved to the interior of the vegetation type by 2x plot radius but plots falling in skips, openings, or other vegetation types within the unit perimeter will be measured. In non-commercial units, plots will sample 10 points for every 100 ac of project area, generally resulting in a 10% frequency sample. The sample frequency in areas with significant diversity in forest types or structures may be increased to 15 points for every 100 ac. For units < 100 ac, a minimum sample threshold of 5 points should be used. In commercial stands, monitoring plots will be located using a systematic sampling approach in accordance with USFS stand exam protocols. In these cases, the sampling density will be 1 plot for 5 acres, with at least 3 plots per unit for smaller units, generally resulting in a 20% frequency sample unless treatments are <100 acres and relatively uniform in nature (e.g., plantations) sample density will be reduced to (10%) one plot for every 10 acres. Plots will be sampled no more than one year prior to treatments, and resampled at least one year after treatments. During Intuitive Controlled surveys, a botanist will traverse treatment units sufficiently to see a cross section of all topographical, ecological, and hydrological conditions within the unit. The botanist will seek out portions of the unit where conditions are likely to host either rare species or noxious weeds.

KEA 3: Condition – Oak trees – Legacy trees

Legacy tree monitoring is a component of the Rogue Forest Partners' Vegetation and Fuels Field Protocols (RFP 2021). Species, azimuth, DBH, and competitive environment (encroached, overtopped, pierced) will be recorded for all legacy trees or shrubs (>150 years) within the 0.1 ac plot. Any tree bole falling within the plot will have data collected on its entire canopy. The relative size of competing non-legacy trees will be recorded.

- A legacy tree is encroached when there is >30% shrub and/or sub-dominate (relative to legacy tree crown) tree cover within approximately twice the crown radius.
- A legacy tree is overtopped when one or more adjacent non-legacy competitor trees is within the same or taller height strata compared to the legacy tree. This competitor tree(s) is generally within twice the crown radius, or is further away but blocking significant sunlight.
- A legacy tree is pierced when one or more non-legacy competitor trees is intersecting the crown of the legacy tree.

Legacy Tree Identification

Relatively large size is a common feature of legacy trees for a given species on a given site, but actual diameter and size dimensions vary and represent a data gap for the Umpqua region). Legacy structures often developed under more open stand conditions and with more frequent fire than younger forest trees. As such, they may have forms or features not found in younger neighbors. Legacy structures may be encroached or overtopped by more recent in-fill of the same, or a more shade tolerant or less fire-adapted species. Hardwood and shrub legacies are typically characterized by a relatively large trunk diameter (or root crown diameter for re-sprouted/ring-form individuals), relatively broad canopy with large and low-branching limbs, deeply furrowed and complex bark patterns, fire scars, and large dead limbs or cavities. Legacy conifers have similar characteristics but are more reliably identified by relative diameter or height rather than canopy form. To assist in identifying legacy trees, a dataset of cored trees from 59 plots in the Ashland watershed and an additional 100 plots distributed through the Rogue Basin was used to develop regression equations predicting the diameter of trees at 150 years old (Table 3). Ring-form resprouting hardwoods are indicative of greater longevity and smaller stem diameters are indicative of legacy status if the root crown of the resprouting rings is >3 feet in diameter.

Sampling Design (scale, temporal, spatial)

Effectiveness monitoring is necessarily limited to the stand scale for short-term treatment impacts but will be evaluated at the project scale as sufficient area within projects is treated.

Sampling design for this KEA will follow the methods in Rogue Forest Partners (2021). Plots will be circular and will cover 1/10 of an acre. Sample plots will be located using a spatially balanced random sample design. Random points will be assigned using the Generate Random Points tool, Data Management toolbox, ArcPro 3.0.3 with a minimum distance between plots that allows for good dispersal and fit of plots within the unit. Plots falling on roads or landings will be moved to the interior of the vegetation type by 2x plot radius but plots falling in skips, openings, or other vegetation types within the

unit perimeter will be measured. In noncommercial units, plots will sample 10 points for every 100 ac of project area, generally resulting in a 10% frequency sample. The sample frequency in areas with significant diversity in forest types or structures may be increased to 15 points for every 100 ac. For units < 100 ac, a minimum sample threshold of 5 points should be used. In commercial stands, monitoring plots will be located using a systematic sampling approach in accordance with USFS stand exam protocols. In these cases, the sampling density will be 1 plot for 5 acres, with at least 3 plots per unit for smaller units, generally resulting in a 20% frequency sample unless treatments are <100 acres and relatively uniform in nature (e.g., plantations) sample density will be reduced to (10%) one plot for every 10 acres. Plots will be sampled no more than one year prior to treatments, and resampled at least one year after treatments.

KEA 4: Condition – Oak trees – Young trees

In addition to recording cover classes by oak species for each size class, oak seedlings (<1" DBH, or <4.5' tall) will be counted in a circular subplot located at the center point of each vegetation plot using the protocol recommended in the FIREMON Tree Data Sampling Method (Lutes 2006). The subplot size will be determined by the density of tree seedlings, and will range from 0.0025 acre to 0.01 acre (see Lutes 2006 for subplot sizing). Within each subplot, seedlings will be tallied by species and assigned a status (healthy, unhealthy, sick, or dead). Each seedling will also be assigned a size class according to their height (0.2, 1, 2, 3, or 4 feet).

KEA 5: Condition – Oak trees – Acorn crops

This component of the monitoring plan follows KSON monitoring plan (Stephens 2024). This methodology identifies individual trees for measurement, tagging, and monitoring over multiple years. Observers visit individual trees, conduct a phenotypic assessment, and count acorns just before dropping by randomly subsampling parts of the tree with binoculars and counting all acorns within 15 second windows and noting acorn developmental phenology.

KEA 6: Condition – Fuel loads

Fuel load monitoring is a component of the Rogue Forest Partners' Vegetation and Fuels Field Protocols (RFP 2021). We will assess KEAs for fuel loading using surface fire behavior models, measured by fuel model (Scott and Burgan 2005) and base height of continuous canopy fuels (canopy base height) using a local photo series to improve fuel model assignment consistency (Perchemlides 2020). Within plots, basic unit conditions of slope, aspect, and canopy closure are recorded. Fuel model and canopy base height are recorded pre/post burn as indicators of fuel reduction and for fire modeling. To visually document the unit and fire effects, a representative photograph of stand conditions is taken pre-treatment and pre-burn, along with a second-low angle photograph of representative surface fuels. The percent live cover of understory trees and shrubs, and herbaceous cover (optional) are each recorded pre/post burn. For tree mortality, the percentage of recently dead trees (needles or fine twigs still present) in each relevant size class is recorded pre-burn and used to correctly assign mortality from fire post-burn. Litter and duff depths can be recorded pre-burn if needed for smoke modeling (optional). During pre-burn monitoring, the unit-scale condition of legacy trees and large down wood or snags are noted (RFP 2021 Fire Effects Monitoring Method). At a minimum, fire behavior metrics of flame length (average and maximum) and rate of spread (average) quantify representative fire behavior. Observations are updated when fire behavior, weather conditions, or ignitions change rather than at a standard time interval. Peak fire events such as torching, crowning, spotting, or escape, and other descriptive metrics including bole char height, fire type, or flame zone depth are recorded when relevant. The timing, location, and outcome of the test burn are always recorded.

KEA 7: Condition – fire regime

To broadly measure progress toward restoring fire regimes, as described by Barrett et. al (2010, Table 2-1) within oak targets, we will model expected fire behavior (surface, passive, or crown fire) as a surrogate for fire severity, grouped by oak targets by subbasin as an indicator. Assessing the post-treatment landscape expected fire severity and disturbance frequency, relative to historic fire regimes will measure treatment success and inform future prescriptions. Proportion of landscape [e.g., subbasin (HUC6)] oak targets within natural Fire Regime [LANDFIRE (Barrett et al. 2010) disturbance frequency interval and severity (actual and predicted), relative to desired KEA fire regime condition for

oak targets.

KEA 8: Condition – Breeding birds

Within this plot network, breeding season (mid May-June) point counts will be conducted to characterize bird communities and determine the presence and abundance of focal species (See Appendix 2). Observers will follow a standardized point count protocol (Stephens et al. 2010). Point count surveys begin within 15 minutes of sunrise and are completed within 4 hours. All birds detected by sight or sound during a 5-minute period are identified to species and recorded by the minute, along with the initial detection cue, and horizontal distance to each bird, estimated to the nearest meter. Estimating distance to the meter minimizes common biases with methods that place individuals in distance bins; e.g., the tendency to include birds that are close to the distance cut-offs as within the bin. This method gathers information on relative abundance and density of individual bird species, as well as species richness and community composition.

Data Quality Assurance / Quality Control

KEAs 1-7

All spatial data will maintain a consistent attribute naming convention across years to ensure data can be quickly and easily summarized using available analysis tools in ArcGIS. Ground truthing and/or comparing oak habitat maps with other data sources (e.g., aerial images or other remote sensing datasets) will be performed as needed to assess local conditions for project planning.

Quality assurance and quality control of monitoring data takes place before, during and after data collection. Before data collection quality control and assurance is provided by the monitoring working group. This ensures appropriate data are collected and the workflow for data management are sound. During data collection assurance is provided at the data collection and data curation stages. Statistical software will be used to identify outlier values in an iterative data assurance process, enabled by Dashboards linked to Survey123 in the ESRI environment. Quality control standards are under constant development and these updates will be integrated into future versions of this monitoring plan.

KEA 8: Condition – Breeding birds

Breeding bird point count data will be entered in the Avian Knowledge Network (see below), and undergoes a series of QA/QC queries, first during data entry to prevent common entry errors. When entered, data is first proofed by the biologist, and then checked by the project manager, who runs a series of queries designed to identify outliers and other data anomalies. When data has been checked, the project manager updates the data sharing levels to indicate that the data is clean and available for analysis.

Data Management and Storage

KEA 1: Acreage – Amount on landscape

As new LEMMA rasters become available, they will be downloaded from the project site (<https://lemma.forestry.oregonstate.edu/data>). The most recent LANDFIRE EVC datasets will be downloaded from the project site (<https://www.landfire.gov/evc.php>). Rasters will then be classified in ArcGIS Pro based on pixel attributes to create a map of oak targets according to the rule set developed the SAP to generate a classified raster of oak targets, which will then be uploaded to an online data repository (e.g., an ArcGIS online hub) for use in mapping tools and project planning.

KEA 2: Condition – Plant community

Plot-based plant community sampling will result in a matrix of species abundances by size class and plot. Similarly, plot-based environmental data will be stored in a separate matrix. Intuitive Controlled surveys will result in GIS layers containing points and polygons that represent the spatial distribution of rare

species and noxious weeds. Data related to population counts or cover will be contained in the layers' attribute tables.

Community and environmental matrices will be stored as spreadsheets uploaded to a shared drive until integration with a larger database is appropriate/necessary. GIS layers will be stored as ESRI shapefiles and uploaded to a shared drive. These may also be integrated into a larger database as the framework is developed.

KEAs 3,6,7

Data will be managed and stored within a relational geodatabase on ArcGIS Online (AGOL). These data will be accessible to all partners through shared groups on AGOL.

KEA 4: Condition – Oak trees – Young trees

Oak seedling counts according to status and height class will be stored within the same spreadsheet as the environmental variable's matrix described for the Plant Community KEA. Data will be stored in a spreadsheet that will be uploaded to a shared folder until integration into a larger database is possible and necessary.

KEA 5: Condition – Oak trees – Acorn crops

Klamath Bird Observatory has developed an access database for storage and quality control of Acorn crop data. Acorn crop data will be stored in a similar Microsoft Access database with functionality for reporting and quality assurance.

KEA 8: Condition – Breeding birds

Avian data are entered and stored in Avian Knowledge Northwest, a regional node of the Avian Knowledge Network and a part of the Point Blue Science Cloud, a fedramp certified warehouse of avian data that supports the entry, storage, and analysis of data collected through diverse bird monitoring protocols.

Data Analysis

KEA 1: Acreage – Amount on landscape

Total area of oak target habitat will be assessed at project and landscape level scales by comparing total area of target habitat before work began as assessed in the UOP Strategic Action Plan, which used LEMMA raster GNN Species-Structure data based on imagery from 2012 and LANDFIRE EVC data from 2014. When LEMMA analysis is available for post-restoration years, we will apply the same rule set developed for classifying pre-restoration landscape scale oak habitat target amounts to the new data within focused geographies [i.e., at the HUC 8 (subbasin) watershed level] to assess the change in oak habitat target amount at the project and landscape scales.

KEA 2: Condition – Plant community

Multivariate analyses such as PERMANOVA or community analyses such as metric and nonmetric analyses of community difference statistics such as Bray-Curtis and Sorenson indices will be used to determine whether community composition significantly changes following treatments. Plant species will be classified as either native, exotic, or noxious, and the relative cover of each of these classifications will be assessed for all size classes. Differences in the abundance of individual species and/or functional groups before and after treatments will be tested using ANOVA. Non-metric multidimensional scaling (NMDS) will be used to visualize patterns in plant community composition among treatment units before and after treatment. NMDS will be conducted using the VEGAN package for R. Correlations between plot NMDS scores and environmental variables (canopy cover, relative dominance of tree species, shrub cover, ground cover types, etc.) will be tested using the Envfit function in VEGAN. Spatial data related to rare species and noxious weeds will be summarized and used for adaptive management, but may not be analyzed.

KEA 3: Condition – Oak trees – Legacy trees

Legacy trees data will be summarized descriptively. Changes in the competitive environment will be summarized at the individual tree and species levels.

KEA 4: Condition – Oak trees – Young trees

Differences in seedling and sapling counts and cover estimates will be tested before and after treatments using ANOVA in R.

KEA 5: Condition – Oak trees – Acorn crops

To be determined

KEA 6: Condition – Fuel loads

We will summarize predicted fire behavior metrics in all treated areas and observed fire behavior from prescribed burns. In addition, changes in predicted fire behavior metrics and canopy base height following restoration treatments will be analyzed with ANOVA in the program R.

KEA 7: Condition – Fire regime

We will assess fire regime condition by measuring time since disturbance (mechanical or fire), the severity of actual past disturbances, and proportions of predicted severity classes in the most recent 30-year timeframe and compare to natural fire regime disturbance frequency and severity. We will also include some measure of magnitude of departure from fire regime disturbance return intervals. The fire regime condition will be assessed by reviewing time since fire surrogate disturbance and/or disturbance [mechanical or wildland fire (prescribed or wild)], and associated severity of past disturbance. We will summarize stand-scale changes at the landscape in focal geographies using fire modeling software (IFTDSS, Flammap, etc.) to assess proportions relative to KEA desired conditions (Table 1). We will also generate predictive fire regime modeling (predicted severity classes) at the focal geography landscape and derive additional fire behavior metrics (rate of spread and flame length) around fire hazard.

KEA 8: Condition – Breeding birds

The KEA for breeding bird condition will be assessed using the percentage of focal bird species present, with greater than 75 percent of species present on at least 50 percent of the landscape indicating a “good” condition. Treatment effectiveness will be evaluated by measuring changes in focal species presence and/or bird community composition. Data will include metrics pre and post restoration on treatment and control sites and early reporting (pre-restoration) will summarize results at the stand scale, such as a list of species detected and anticipated response of select focal species to treatment at the stand-scale. At the culmination of a project-scale study (~5-7 years) data will be analyzed to identify whether songbird community composition differed before and after treatments or differed on treated and untreated stands. We will use a community matrix of abundance or density estimates for focal species and test for an interaction between time (before or after) and treatment (treatment vs. control) using a PerMANOVA in R. PerMANOVA tests provide a pseudo F-ratio and p value similar to a multivariate analysis of variance and are thus useful in a BACI design to test the interaction between control and treatment groups before and after treatment. To interpret the results, it is often followed by additional analysis such as nonmetric multidimensional scaling and indicator species analysis to explore the potential causes of differences among groups; metrics collected for the other KEAs will be incorporated as potential explanatory variables.

OBJECTIVE 3: MEASURE LANDSCAPE SCALE ECOLOGICAL OUTCOME

Indicators described in Table 1 will be used to provide a landscape scale measure of UOP’s progress towards the SAP’s core implementation strategy outcomes for each KEA specific to a given target habitat.

Acre-based stress reduction outputs, given adequate abundance and strategic placement, will scale up to landscape level conservation outcomes. To broadly measure success in maintaining or increasing target habitats ("Acreage -- Amount on Landscape" KEA; Table 1, Appendix 1), we will determine the amount of a given target habitat on a landscape using the total area by region as an indicator. The goal for most target habitats given current threats is to maintain current acreage by preventing further conversions.

Successful conservation actions will lead to the desired short-, medium-, and/or long-term ecological outcomes:

- Reduce conversion of oak habitat to intensive agriculture or commercial timber
- Reduce oak habitat encroachment
- Reduce fire exclusion
- Reduce non-native and invasive species
- Reduce effects of rural residential and urban development

GLOSSARY

Adaptive management is the intentional practice of adjusting strategies through a cycle of assessing, planning, implementing, monitoring, and evaluation.

A **biophysical factor** is a biological and physical stress that results from a direct threat and influences the health of a conservation target.

A **contributing factor** is a human-induced action or event that underlies or leads to one or more direct threats; contributing factors include indirect threats and opportunities.

An **indicator** is a measurable entity related to the status of a target, change in a threat, or progress towards an objective and that indicates the condition of the target, stress, threat, or progress.

A **key ecological attribute (KEA)** represents a target's biology or ecology that if present, defines a healthy target and if missing or altered, would lead to the outright loss or extreme degradation of that target over time.

Outcomes are short, medium, and long-term ecological results.

Outputs are intermediate, measurable, on-the-ground results from implementing an action.

Project scale as an area typically >10,000 acres which is an aggregation of untreated and treated areas united under an analysis for a particular project

A **results chain** shows the expected outcomes from the implementation of a strategy, a sequence of linked factors in a diagram.

A **strategy** is a broad course of action designed to restore natural systems, reduce threats, and/or develop capacity.

Stand scale - 10's of acres with relatively homogenous vegetation

A **target** is a suite of species, communities, and ecological systems that are chosen to represent and encompass the full array of biodiversity found in a project area. They are the basis for setting goals, carrying out conservation actions, and measuring conservation effectiveness. The conservation of the focal targets will ensure the conservation of all native biodiversity within functional landscapes.

A **threat** is a proximate agent or factor that directly degrades one or more conservation targets.

A **viability assessment** helps identify what a target's "healthy state" might look like, identify how the target is doing today, and determine how to measure a target's "health" over time. A viability assessment results in an overview of the status of each conservation target, a description of the desired conditions that help define short- and long-term conservation outcomes, and measures for monitoring the effectiveness of conservation actions over time.

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APPENDICES

APPENDIX I. VIABILITY ASSESSMENT - CURRENT AND FUTURE CONDITIONS

Appendix I. Viability Assessment - Current and Future Conditions presents the results of the viability assessment, which evaluates the current and desired conditions of each KEA across major oak habitat types in the Umpqua Basin. The color-coded rankings (Poor, Fair, Good) illustrate habitat conditions relative to desired ecological states and tie directly to long-term conservation objectives.

KEA	Indicator	Prairie		Oak Savanna		Oak Woodland		Oak Conifer		25-Year Objective
		Current	Desired	Current	Desired	Current	Desired	Current	Desired	
Amount on Landscape	Total area by subbasin	Poor	Fair	Fair	Fair	Fair	Fair	Fair	Good	Increase the amount of oak conifer by 4,350 acres (7%); increase the amount of prairie; and maintain the current amount of oak savanna and oak woodlands.
		Unknown acres	Increase	20,962 acres	20,962 acres	34,171 acres	34,171 acres	62,141 acres	66,491 acres	
Plant Community	>25% native understory cover with high structural and compositional diversity, adequate structural conditions for the persistence of rare species, and minimal cover of state or federally-listed noxious weeds	Poor	Fair	Poor	Fair	Poor	Fair			Maintain or improve the condition of oak savanna and woodlands so that at least 5,240 acres of oak savanna and 8,543 acres of oak woodlands support >25% cover of high-diversity native understory
		<25% landscape	>25% landscape	<25% landscape	>25% landscape	<25% landscape	>25% landscape			
Oak Trees	Abundance of younger age class oaks					Fair	Good	Fair	Good	Maintain or improve the condition of oak woodland and oak conifer habitat, so that at least 17,086 acres of oak woodland and 31,071 acres of oak-conifer habitat support abundant younger age-class oaks, retain at least 90% of legacy oaks, and ensure accessible, high-quality acorn crops.
						>25% landscape	>50% landscape	>25% landscape	>50% landscape	
Oak Trees	Non-encroachment of 90% of existing and potential legacy oaks (encroaching species)					Fair	Good	Fair	Good	
						>25% landscape	>50% landscape	>25% landscape	>50% landscape	
Oak Trees	Abundant and high-quality acorn crops					Fair	Good	Fair	Good	
						>25% landscape	>50% landscape	>25% landscape	>50% landscape	
Fuel Load	Low load surface fire behavior model (based on flame length, radial spread, suppression difficulty)					Fair	Good	Fair	Good	
						>25% landscape	>50% landscape	>25% landscape	>50% landscape	
Fire Regime	Proportion of landscape (e.g., subbasin (HUC6)) oak targets within fire frequency interval (existing) and severity (actual and predicted), relative to desired KEA fire regime condition for oak targets	Poor	Fair	Poor	Fair	Poor	Fair	Poor	Fair	Maintain or improve the condition of oak woodland and oak conifer habitat, so that at least 17,086 acres of oak woodland and 31,071 acres of oak conifer are characterized by a low load surface behavior model.
		<25% of landscape as Fire Regime 1	>25% of landscape as Fire Regime I	<25% of landscape as Fire Regime 1	>25% of landscape as Fire Regime I	<25% of landscape as Fire Regime 1	>25% of landscape as Fire Regime I	<25% of landscape as Fire Regime 1	>25% of landscape as Fire Regime I	
Breeding Birds	>75% of focal bird species present	Fair	Good	Fair	Good	Fair	Good	Fair	Good	Maintain or improve the condition of oak habitat so that more acres of prairie, 10,481 acres of oak savanna, 17,086 acres of oak woodland, and 31,071 acres of oak-conifer have >75% of focal bird species present.
		>25% of landscape	>50% of landscape	>25% of landscape	>50% of landscape	>25% of landscape	>50% of landscape	>25% of landscape	>50% of landscape	

APPENDIX II. MONITORING PROTOCOLS (EXTERNAL REFERENCES)

The Umpqua Oak Partnership Monitoring Plan relies on a set of standardized field and analytical protocols that provide detailed methods for sampling vegetation, fuels, fire effects, acorn crops, and focal bird species. To ensure version control, accessibility, and the ability to update methods as science evolves, these protocols are not embedded directly in this document. Instead, they are referenced throughout the plan and maintained in an online repository hosted by the Umpqua Oak Partnership.

The list below identifies each protocol, the Key Ecological Attributes (KEAs) it supports, and its citation.

Protocol / Citation	Applies to KEA(s)	Description / Use
Caratti (2006) – FIREMON: Fire effects monitoring and inventory system	KEA 2, KEA 4, KEA 6	Core vegetation and fuel sampling methods; species composition, size and cover classes, and FIREMON tree data protocols.
Lutes et al. (2006) FIREMON: Fire Effects Monitoring and Inventory System (Species Composition). Pp SC1-SC8	KEA 2, KEA 4	Detailed methods for species composition measurements, size classes, and cover classes.
Perchemlides et al. (2020) – The Ashland Forest all-lands restoration supplement to the 2005 Scott and Burgan standard fuel model photo guide	KEA 6	Photo guide used to calibrate fuel model assignment and improve fuels monitoring consistency.
Rogue Forest Partners (2021) – Multiparty Monitoring Plan 2021: Rogue Basin Cohesive Forest Restoration Strategy	KEA 2, KEA 3, KEA 6	Field protocols for vegetation, fuels, and legacy tree monitoring; sampling design and plot layout.
Stephens et al. (2010) – Klamath Network Landbird Monitoring Protocol	KEA 8	Standardized point-count monitoring methods for survey timing, detection, and distance estimation.
Whiteaker (1998) – Survey Protocols for Survey & Manage Strategy 2, Vascular Plants	KEA 2	Intuitive Controlled survey protocol for rare plant and noxious weed detection.
Stephens (2024) – Klamath Siskiyou Oak Network Acorn Monitoring Protocol	KEA 5	Standard method for selecting, tagging, and monitoring acorn-producing trees.