2-3-2 Cohesive Strategy Partnership Multiparty Monitoring Plan

for the Rio Chama Collaborative Forest Landscape Restoration Program

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RIO CHAMA
Collaborative Forest Landscape Restoration Project

Forest Stewards Guild

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[1] This institution is an equal opportunity provider. Tables in this publication will be made available in accessible formats upon request.

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Glossary and Acronyms

2-3-2 Partnership: Two watersheds-Three rivers-Two states Cohesive Strategy Partnership. See *2-3-2 Cohesive Strategy Partnership* section of document.

ACS: American Community Survey. An ongoing survey that provides yearly information about the United States and its people (U.S. Census Bureau, 2022).

Adaptive Management: A planning process that uses monitoring as collective learning opportunities about the effects of on the ground management activities and adjusts decisions based on what is learned (CFLRP Common Monitoring Strategy, 2020).

BLM: Bureau of Land Management.

BOR: Bureau of Reclamation.

Burn severity: See *Fire severity*.

CANF: Carson National Forest.

Carbon sequestration: The process of capturing and storing atmospheric carbon dioxide, the most commonly produced greenhouse gas (USGS, n.d.).

CFLRP: Collaborative Forest Landscape Restoration Program.

CO: Colorado.

CPW: Colorado Parks and Wildlife.

CWD: coarse woody debris.

CWPP: County Wildfire Protection Plan.

dbh: diameter (at) breast height. The diameter of the stem of a tree measured at breast height (4.5 ft or 1.37 m) from the ground (Helms, 1998).

Departure: The difference in landscape condition between its current state and natural, sustainable range of variation (as derived from models, dendrochronology, bog coring, etc). Departure can be expressed in terms of vegetation, where the abundances of seral stages by vegetation type are compared against their modeled natural (historic) abundances. It can also be expressed in terms of the difference between current and historic fire frequency and severity estimates (CFLRP Common Monitoring Strategy, 2020; DeMeo et al., 2018; Haugo et al., 2015; LANDFIRE, n.d.).

Desired conditions: In a planning context, these are the ultimate goals of management actions, reflecting both the ecological and socioeconomic wishes of society. They are not necessarily the same as ecologically sustainable or resilient conditions (CFLRP Common Monitoring Strategy, 2020).

eDNA: Environmental deoxyribonucleic acid (DNA). eDNA is organismal DNA that can be found in the environment. eDNA originates form cellular material shed by organisms (via skin, excrement, etc.) into aquatic or terrestrial environments that can be sampled and monitored using new molecular methods to detect species presence (USGS, 2018a).

Environmental justice: The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (EPA, 2022).

EPA: Environmental Protection Agency.

EPS: Economic Profile System. A free, continuously updated tool operated by Headwaters Economics that provides 17 socioeconomic reports based on credible public data sources such as the U.S. Bureau of Economic Analysis, U.S. Bureau of Labor Statistics, U.S. Census Bureau, U.S. Department of Interior, and U.S. Department of Agriculture (Headwaters Economics, 2023).

FACTS: The Forest Service Activity Tracking System. A USDA Forest Service database used to record planned and accomplished treatments (CFLRP Common Monitoring Strategy, 2020; USDA Forest Service, n.d.).

FIA: Forest Inventory and Analysis. The FIA program collects analyzes, and reports information on the status and trends of America's forests: how much forest exists, where it exists, who owns it, and how it is changing, as well as how the trees and other forest vegetation are growing and how much has died or has been removed in recent years (FIA, 2022).

Fire intensity: The energy released from the fire or characteristics of fire behavior such as flame length and rate of spread. It is closely related to the amount of fuel available (CFLRP Common Monitoring Strategy, 2020; Keeley, 2009).

Fire Regime: Description of the patterns of fire occurrence, frequency, size, severity, and effects in a given area or ecosystem based on fire histories at individual sites (National Wildfire Coordinating Group, n.d.)

Fire return interval: The average time between fires in a fire regime (CFLRP Common Monitoring Strategy, 2020).

Fire severity: The degree of loss of or change in organic matter aboveground and belowground from fire, such as percent tree mortality or topkill (Keeley, 2009).

Fireshed: A Fireshed is the delineation of how fires are likely to spread to communities and Fireshed maps show the source of exposure to fire (USDA Forest Service, 2019).

Fire transmission risk: The likelihood of fire spreading to a community or land ownership based on fuel loadings and topography (Ager et al., 2014; CFLRP Common Monitoring Strategy, 2020).

FRAGSTATS: A spatial pattern analysis program for quantifying the composition and configuration of landscapes (McGarigal and Marks, 1995; USGS, 2022).

GIS: Geographic Information System.

Guild: Forest Stewards Guild.

Habitat: The vegetation structure, function and composition needed to support the needs of species (CFLRP Common Monitoring Strategy, 2020).

IFTDSS: Interagency Fuels Treatment Decision Support System. A web-based application designed to make fuels treatment planning and analysis more efficient and effective (CFLRP Common Monitoring Strategy, 2020).

IMPLAN: Short for "impact analysis for planning." A software platform combining databases, economic factors, multipliers, and demographic statistics with customizable modeling. The modeling shows direct, indirect, and induced effects (CFLRP Common Monitoring Strategy, 2020; IMPLAN, 2022).

Invasive species: Sometimes referred to as nonnative invasive species or exotic species. Any plant or animal species that is alien to the ecosystem under consideration and whose introduction does or is

likely to cause economic or environmental harm or harm to human health. Invasive species infest both aquatic and terrestrial areas (Executive Order 13112 – Clinton, 1999).

LANDFIRE: Landscape Fire and Resource Management Planning Tools. LANDFIRE is a shared program between the wildland fire management programs of the U.S. Department of Agriculture Forest Service and U.S. Department of the Interior, providing landscape-scale geospatial products to support cross-boundary planning, management, and operations (LANDFIRE, n.d.).

Landscape: see *Scale of Monitoring* section of document.

Monitoring: Tracking the ecological, social, or economic aspects of the landscape over time. An integral part of adaptive management (CFLRP Common Monitoring Strategy, 2020).

MPM: Multiparty Monitoring. See *Multiparty Monitoring* section of document.

MSI: Mountain Studies Institute.

MTBS: Monitoring Trends in Burn Severity. An interagency program to consistently map burn severity on all lands of the United States. In the western United States, all fires over 1000 acres are mapped (MTBS, n.d.).

NAIP: National Agriculture Imagery Program. NAIP acquires 1-meter aerial imagery during peak growing seasons, "leaf on" conditions, for the conterminous United States (USGS, 2018b).

NEPA: National Environmental Policy Act.

NGO: Non-governmental organization.

NM: New Mexico.

NMDGF: New Mexico Department of Game and Fish.

NMFWRI: New Mexico Forest and Watershed Restoration Institute. One of the three Southwest Ecological Restoration Institutes and located in Las Vegas, NM.

R3 Analysis Framework: A system for the consistent assessment, monitoring, and management of landscapes for ecological integrity, climate adaptation, and the continued delivery of services to communities. The framework provides a streamlined and defensible approach to support Forest Management Plan revision and implementation, and is built upon a set of upland, riparian, aquatic, climate, and socioeconomic indicators. State-and-transition models assist in analysis and monitoring along with standard map products for landscape stratification mapping (Ecological Response Units or LANDFIRE Biophysical Settings) and existing vegetation mapping (INREV). By applying coefficients, the models can be augmented for some indicators including snag density, coarse woody debris, and carbon stocks. (J. Triepke, personal communications, January 26, 2023).

RATS: Restoration Activity Tracking Summary. The details of RATS are in development but will serve as a tool for tracking treatments across all-lands in the 2-3-2 Partnership footprint.

Resilience: The capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks (Walker et al., 2004). The concept applies to both ecological and socioeconomic systems (CFLRP Common Monitoring Strategy, 2020).

RGNF: Rio Grande National Forest.

SFNF: Santa Fe National Forest.

SJNF: San Juan National Forest.

Subsistence economy: An economy where harvesting natural resources is important for the psychological, sociocultural, and material needs of a community. A subsistence economy incorporates private (market), public (government), and subsistence sectors (Glass et al., 1990).

Sustainability: The capability to meet the needs of the present generation without compromising the ability of future generations to meet their needs (CFLRP Common Monitoring Strategy, 2020).

SWERI: Southwest Ecological Restoration Institutes. A consortium of three university-based research groups supporting CFLRP monitoring (CFLRP Common Monitoring Strategy, 2020).

TCA: Terrestrial Condition Assessment. TCA evaluates effects of uncharacteristic stressors and disturbance agents in land-type associations to identify restoration opportunities on national forest system lands (Cleland et al., 2017).

TIM: Timber Information Manager. Tim provides automated reporting mechanisms and tools for sales of forest products, including stewardship and other authorities. TIM data is used to analyze, track, and report data about forest product permits and sales, including the volume and value of forest products sold from national forests (USDA Forest Service, n.d.).

TPO: Timber Products Output. TPO is an industry survey conducted by the USDA Forest Service every 3-5 years to determine where wood is coming from, the products produced, and the species cut in each state (Northern Research Station, 2008).

Traditional Knowledge: The cumulative, collective understanding derived from individuals and communities about ecological processes, natural resources, and socio-cultural adaptive responses to the environment (Lake et al., 2017).

TREAT: Treatment for Restoration Economic Analysis Toolkit. TREAT was developed to provide CFLRP projects with a standard interface to estimate employment and labor income impacts from proposed or completed restoration activities. TREAT consists of a data-entry spreadsheet and an impact calculation spreadsheet (CFLRP Common Monitoring Strategy, 2020).

USDA: United States Department of Agriculture.

WCATT: Watershed Classification Assessment Tracking Tool. A USDA Forest Service system to collect, edit, and report watershed classification data and track on-the-ground restoration projects (USDA Forest Service, n.d.).

WCF: Watershed Condition Framework. A National Forest assessment of aquatic values using a six-step process and 12 indicators (CFLRP Common Monitoring Strategy, 2020; Potyondy and Geier, 2011).

Western Knowledge: The collective understanding and documentation of natural phenomena that results from observations, experimental manipulations, or modeling (Lake et al., 2017).

WFDSS: Wildland Fire Decision Support System. A data rich, map-centric application to track fires and streamline the decision-making process (Wildland Fire Decision Support System, 2019).

WIT: Watershed Improvement Tracking. A USDA Forest Service restoration activity tracking system intended to benefit watershed, wildlife, and aquatic ecosystems health and function (USDA Forest Service, n.d.).

WO: Washington Office.

WUI: Wildland-Urban Interface.

Executive Summary

This multiparty monitoring plan was developed for the Two Watersheds-Three Rivers-Two States Cohesive Strategy Partnership (2-3-2 Partnership) to track change across the 2-3-2 Partnership footprint. A significant portion of the 2-3-2 Partnership footprint is the focus of the Rio Chama Collaborative Forest Landscape Restoration Program (CFLRP) which was selected for 10 years of programmatic funding beginning in 2022. Multiparty monitoring is necessary to track and assess the ecological, social, and economic effects of the 2-3-2 Partnership, and the Rio Chama CFLRP treatments, at both the project- and landscape-scale.

This plan was compiled by members of the Forest Stewards Guild (Guild), with input from Mountain Studies Institute (MSI), and with guidance from the 2-3-2 Partnership Monitoring committee and the USDA Forest Service. This plan incorporates USDA Forest Service CFLRP Common Monitoring Strategy questions, as well as those identified by the 2-3-2 Partnership, to measure the implementation of the Rio Chama CFLRP and other management activities within the 2-3-2 Partnership footprint. The plan is designed to meet the following objectives:

- Inform adaptive management at the project- and landscape-scale;
- Provide transparency regarding project implementation;
- Provide opportunities for community engagement and project learning; and
- Maintain a connection to place by valuing individuals, collaboratives, and efforts already on the landscape.

RIO CHAMA
Collaborative Forest Landscape Restoration Project

Introduction

The Rio Chama Collaborative Forest Landscape Restoration Project (CFLRP) was developed to enhance the headwaters and communities tied to the Chama, Rio Grande, and San Juan watersheds. Numerous individuals and organizations are working to restore and sustain healthy forests, watersheds, and forest-adjacent communities by using prescribed fire, fuels treatments, managed wildfire, regeneration harvests, wetland restoration, a local workforce, and an established monitoring program.

The Rio Chama CFLRP boundary (Figure 1) contains the headwaters of the Chama and San Juan river and the source waters of the Rio Grande, critical drainages that supply the life blood of the arid Southwest. The project footprint spans over 3.81 million acres of public and private lands, of which over 55% (approx. 2.1 million acres) is managed by the San Juan, Rio Grande, Carson, and Santa Fe National Forests. Other lands within the project area are managed by the Jicarilla-Apache Nation, Southern Ute Indian Tribe, Santa Clara Pueblo, Ohkay Owingeh, the States of Colorado and New Mexico, the Bureau of Reclamation, the Bureau of Land Management, community land grants, and private land stewards. This landscape, and the communities that depend on it, has been impacted by wildfire, insects and disease, drought, and flooding. These disturbance agents traverse political and ownership boundaries and impact swaths of uninterrupted wildlife habitat, forest health, and city and rural water supplies. Treatments can increase forest resilience to disturbances, improve water quality and watershed function, improve range conditions and wildlife habitat and connectivity, support local rural economies, and create jobs by utilizing restoration by-products. If left untreated, landscape-scale disturbances in the Chama, Rio Grande, and San Juan watersheds would limit tribal, land grant, and acequia communities' ability to access water, as well as negatively impact the water supplies for population centers like Santa Fe, Albuquerque, and beyond to Texas and Mexico.

Taking a watershed-scale approach, the Rio Chama CFLRP footprint was determined by the four national forests and local partners over the course of multiple meetings. The CFLRP aims to work across socio-political boundaries to support the interdependence of local communities and resources. Local communities, non-governmental organizations (NGOs), industry, tribes, and state and federal land managers laid the groundwork for a landscape-scale approach through years of prioritizing cross-boundary restoration. For example, Rio Arriba County and the Fire Adapted New Mexico Learning Network have used grassroots organizing to reduce wildfire risk, the Rio Grande Water Fund is generating sustainable restoration funding, the San Juan-Chama Watershed Partnership brings together agencies and NGOs to support watershed health, the San Juan Headwaters Forest Health Partnership prioritizes cross-boundary planning and restoration efforts, the All Hands All Lands burn team supports prescribed fire implementation, and the Natural Resources Conservation Service committed $3.5 million

for private land restoration within the CFLRP footprint. Further efforts have been led by the USDA Forest Service and state agencies to prioritize collective stewardship in southern Colorado and northern New Mexico.

The forests and human communities within the Rio Chama CFLRP are spatially diverse and changing over time. Vegetation follows an elevational gradient from lower grasslands and piñon-juniper woodlands to ponderosa pine and mixed-conifer forests, upwards to aspen and spruce-fir forests. The characteristics of these vegetation types have changed over time in response to fire suppression, insect and disease outbreaks, and shifting grazing patterns. Similarly, human communities within the CFLRP span the rural landscape and possess rich cultural histories. Forests in the area support subsistence economies and ways of life centered around wood, water, forage, wild game, and traditional arts and culture.

Treatments across the Rio Chama CFLRP are intended to be adaptive, science-based, and collaborative in design. The project will align with the National Cohesive Wildland Fire Management Strategy's goal to restore and maintain landscape vegetation and fuels using prescribed fire, forest thinning, and managed wildfire for resource objectives. In turn, creating resilient landscapes that support fire adapted communities in which socioeconomic conditions improve over time within the CFLRP footprint. All treatments on federally managed lands will follow National Environmental Policy Act (NEPA) protocols. Project goals aim to sustain healthy forests and watersheds for future generations and monitoring will be essential to track, measure, and inform treatment outcomes. Although CFLRP treatment funds can only be applied to lands managed by the USDA Forest Service, the 2-3-2 Partnership will work to obtain funding for cross-boundary and priority work on non-USDA Forest Service managed lands within the 2-3-2 Partnership footprint.

National legislation mandates 15 years of Rio Chama CFLRP monitoring, however the 2-3-2 Partnership intends to continue MPM efforts for multiple decades to understand long-term landscape-scale change. These efforts will require participation from multiple stakeholders to be successful. This MPM plan was developed by members of the Forest Stewards Guild (Guild) and Mountain Studies Institute (MSI) with guidance from the Two Watersheds-Three Rivers-Two States Cohesive Partnership (2-3-2 Partnership), the 2-3-2 Partnership Monitoring Committee, and the USDA Forest Service. This plan incorporates USDA Forest Service Washington Office (WO) common monitoring questions (Appendix I), USDA Forest Service Region 2 and Region 3 interests, and questions identified by the 2-3-2 Partnership, that will help document project- and landscape-scale change over time.

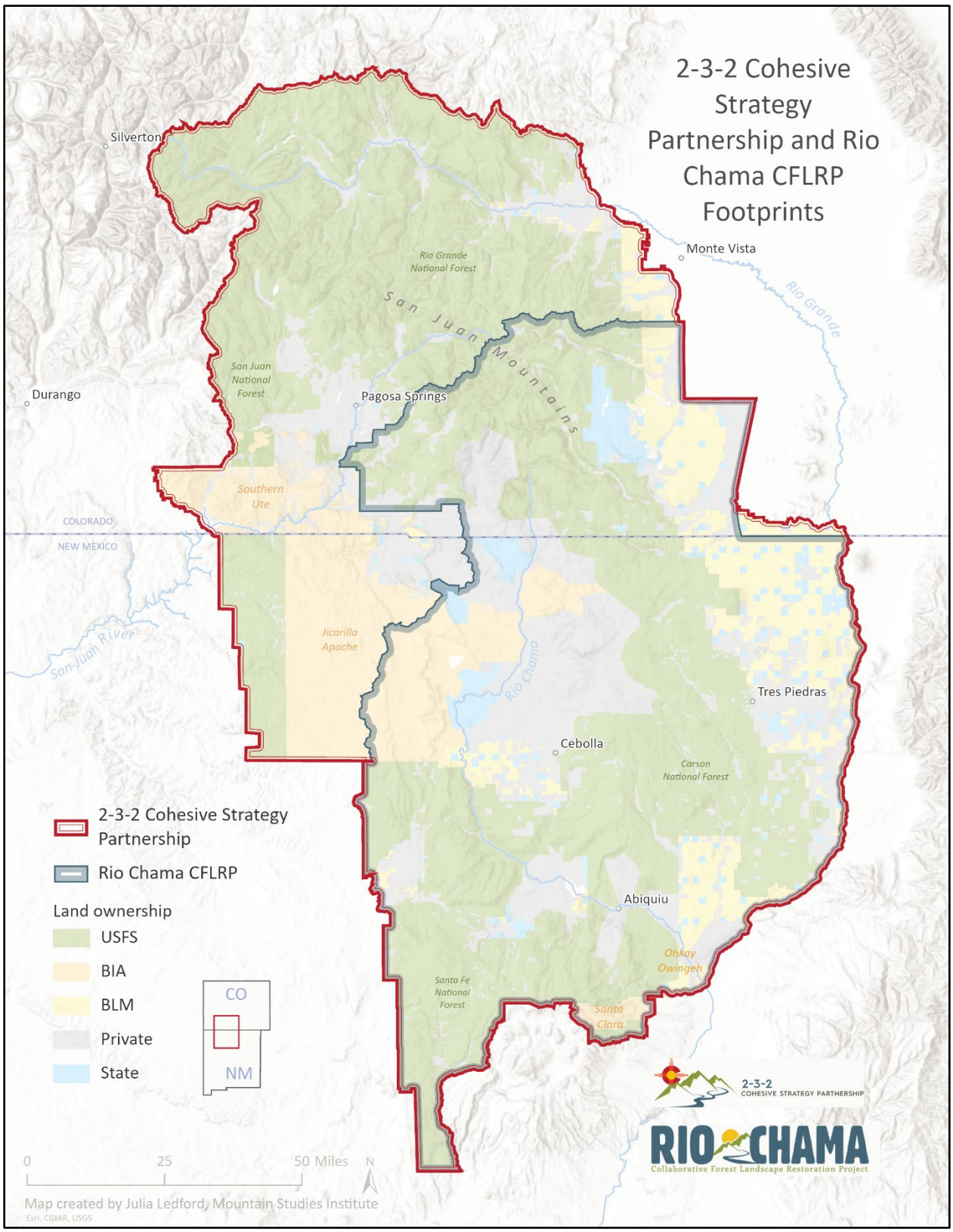


Figure 1. Map of 2-3-2 Cohesive Strategy Partnership and Rio Chama CFLRP footprints.

Purpose and Need

The purpose of the 2-3-2 Partnership multiparty monitoring (MPM) plan for the Rio Chama CFLRP is to guide a collaborative monitoring process that informs adaptive management. The 2-3-2 Partnership is committed to MPM because "without adequate monitoring, the ability to understand the impacts of restoration activities on ecosystem integrity and sustainability is severely limited" (Schultz et al., 2014). In addition, MPM requires diverse stakeholders to collectively buy-in, approve, and implement long-term measures. The purposes of this MPM plan are to:

- Outline the Rio Chama CFLRP monitoring program in line with USDA Forest Service expectations and 2-3-2 Partnership interests;
- Distill project goals into measurable and observable metrics;
- Develop protocols that measure changes at both the landscape- and project-scale, incorporate community science, and address USDA Forest Service Washington Office Common Monitoring Strategy, USFS Region 2 and Region 3 standard CFLRP guidance, and 2-3-2 Partnership questions;
- Utilize existing protocols, data, and remote sensing efforts to understand treatment effects within the context of dynamic landscape changes;
- Implement shared monitoring techniques to ensure data collection is cohesive and comparable across all landownerships within the 2-3-2 Partnership footprint;
- Determine an appropriate comprehensive data management plan;
- Create MPM plan timelines;
- Monitor CFLRP related treatments across all land jurisdictions to learn, and inform Adaptive Management;
- Analyze monitoring data and share findings with land managers, 2-3-2 Partnership participants, and beyond;
- Provide opportunities for MPM expansion if additional resources become available; and
- Serve as the 2-3-2 Partnership MPM plan within and beyond the Rio Chama CFLRP boundary and lifespan.

2-3-2 Cohesive Strategy Partnership

Covering two watersheds, three rivers, and two states, the 2-3-2 Partnership formed from community recognition of the need for a cohesive, multi-faceted strategy to address forest and watershed health concerns across 5.1+ million acres of southern Colorado and northern New Mexico (Figure 1). Launched in 2016, the 2-3-2 Partnership brings together a diverse "team of teams" and convenes collaborators across the landscape (https://232partnership.org/partners/) to build trust and identify shared goals. This relationship building led to a 2018 cross-boundary meeting with the USDA Forest Service Southwestern and Rocky Mountain Regions, and multiple stakeholders to discuss shared values and opportunities to advance resource-based economic development in the region. That conversation laid the foundation for the CFLRP proposal and continued collaborative development.

The 2-3-2 Partnership employs a consensus-based decision-making approach to leverage the diverse knowledge, interests, and expertise of participating partners. While the 2-3-2 Partnership reflects diverse interests, it is successful because members share common values, a collective vision, and a

commitment to making science-informed decisions. The 2-3-2 Partnership leads the Rio Chama CFLRP monitoring efforts and will coordinate with USDA Forest Service regional and forest staff, tribal leadership, private land stewards, Colorado and New Mexico state managers, and multiple NGO's to implement, adapt, and manage the monitoring plan as it is presented in this document.

Executive Committee

The Executive Committee is the decision-making body of the 2-3-2 Partnership. The committee consists of Active Members who engage at a higher level to support the basic functions and advancement of the 2-3-2 Partnership. This team works together to provide strategic direction for the partnership, establish and uphold foundational documents and partnership processes, determine support for funding initiatives and proposals, stand up implementation teams and committees, and support partnership administration.

Monitoring Committee

The Monitoring Committee is a sub-committee of the 2-3-2 Partnership and includes individuals with diverse local and regional expertise. The Monitoring Committee oversees plan development, and translates and communicates monitoring results to the full 2-3-2 Partnership and public entities.

About this Monitoring Plan

Monitoring is necessary to track and assess the ecological, social, and economic effects of project and landscape treatments across the 2-3-2 Partnership footprint. The Guild and MSI have, and will continue, to engage the 2-3-2 Partnership, including monitoring committee members and USDA Forest Service representatives, to develop an iterative MPM plan that covers the 2-3-2 Partnership footprint and fulfills the requirements associated with the Rio Chama CFLRP and Title IV of the Omnibus Public Land Management Act of 2009 (H.R. 146, 2009).

Monitoring consists of "repeated field-based empirical measurements [that] are collected continuously and then analyzed for at least 10 years" (Lidenmayer and Likens, 2010). Guided by this definition, the 2-3-2 Partnership MPM plan outlines the approach, protocols, and timeline to address the ecologic and socioeconomic questions related to the Rio Chama CFLRP and as-determined by the 2-3-2 Partnership. The Guild, MSI, and monitoring committee will seek feedback from technical experts to develop feasible and reliable monitoring protocols, and will bring together stakeholders with different backgrounds and perspectives to promote mutual learning, engender trust, and build relationships able to collectively address future challenges. This collective expertise and capacity will expand upon existing USDA Forest Service project monitoring to address "all-lands" and implement novel monitoring tools. Additionally, the MPM process provides opportunities to improve public understanding of and engagement in forest and wetland restoration, climate adaptation, and fire management. By witnessing firsthand the impacts and outcomes of restoration treatments, participating individuals will understand how restoration efforts can improve forest health within the 2-3-2 Partnership footprint, inform future management actions, and ensure that undesirable effects are mitigated to prevent repetition.

This plan will be implemented for at least 15 years (beginning federal Fiscal Year 2022) to inform adaptive management at the project- and landscape-scale; provide transparency regarding project implementation; provide opportunities for community engagement and project learning; and maintain a connection to place by valuing individuals, collaboratives, and efforts already on the landscape. The

MPM plan may be adjusted, with 2-3-2 Partnership feedback and monitoring committee approval, to account for technology improvements, additional resources, and landscape disturbances.

In an attempt to understand changes on the 3.81+ million-acre landscape, the MPM plan was developed by acknowledging USDA Forest Service requirements, incorporating an adaptive management strategy, considering monitoring scale, encouraging community science, consulting collaborative partners, prioritizing opportunities, and outlining program review.

CFLRP Common Monitoring Strategy

The 2-3-2 Partnership MPM plan for the Rio Chama CFLRP was created around the CFLRP Common Monitoring Strategy (2020; Appendix I). Upon review of 23 existing CFLRP projects, the USDA Forest Service Washington Office identified MPM as a "critical factor for project success and stakeholder trust" but noted the challenges of landscape-scale monitoring (CFLRP Common Monitoring Strategy, 2020). The new common monitoring strategy attempts to support landscape-scale monitoring and outlines mandatory questions and suggested indicators for each CFLRP to address alongside locally developed monitoring questions. This strategy will support national comparison of CFLRP projects and help inform the program into the future. Many of the CFLRP Common Monitoring Strategy questions closely aligned with 2-3-2 Partnership project goals and are outlined throughout this plan. For ease of recognition, all common monitoring strategy questions and associated indicators are marked as such. The 2-3-2 MPM plan will be adjusted over time to incorporate changes to the CFLRP Common Monitoring Strategy and to accommodate future 2-3-2 Partnership questions and needs.

Multiparty Monitoring

Multiparty monitoring (MPM) questions and approaches were determined by the monitoring committee to focus on project-specific interests and gaps in knowledge that the 2-3-2 Partnership felt were not adequately addressed by the CFLRP Common Monitoring Strategy or are of importance to local stakeholders. The 2-3-2 Partnership MPM relies on place-based knowledge to expand upon local energies and efforts, and capitalize on existing relationships -- to include NGOs, youth conservation corps, community scientists, academic researchers, and agency leads -- in monitoring-plan development and data collection. MPM will expand as additional partnerships, resources, capacity, and momentum build throughout the life of the CFLRP and beyond.

Adaptive Management Strategy

Adaptive management is a strategic approach to "manage natural resources in the face of uncertainty" (Rist et al., 2013) by treating management actions as scientific experiments and adjusting future actions based upon experimental results (Ralph and Poole, 2003). Adaptive management is a key priority of this MPM plan and Rio Chama CFLRP treatment implementation to ensure undesirable restoration effects can be mitigated to prevent repetition, and successful forest management can inform future actions within the project footprint and beyond.

In a fluctuating system with dynamic ecologic, social, and political components, it is essential to define a successful adaptive management strategy. Success can be defined as 1) a strict adherence to the cyclical adaptive management process or 2) by measuring an adaptive management strategy's ability to reduce uncertainty (Rist et al., 2013). The 2-3-2 Partnership recognizes the variable environmental and governance factors within the project footprint and is therefore focused on the latter definition of adaptive management success. The 2-3-2 Partnership is focused on reducing treatment uncertainty and

our collective understanding of the dynamic project area supports a “broader management framework” (Rist et al., 2013) approach to adaptive management.

The 2-3-2 Partnership Adaptive Management Strategy is designed to track treatment effects and outline a collaborative review process to guide future treatments. The 2-3-2 Partnership aims to develop monitoring and management plans that work together (Ralph and Poole, 2003) by engaging stakeholders and management agencies in the design, implementation, and review of a monitoring program (Schultz et al., 2014) and associated adaptive management strategy. Although “trigger points” are often used in adaptive management to prompt treatment changes (Schultz et al., 2014), ongoing stakeholder and agency discussions highlight the challenge of developing trigger points for the 2-3-2 Partnership landscape. First, defining trigger points in a 15-year monitoring plan will inherently miscalculate stochastic environmental and social changes -- such as insect and disease outbreaks, climate change impacts, flooding, and wildfires -- that will interact with forest treatments. Second, the Rio Chama CFLRP encompasses lands and waters managed by diverse agencies, Native nations, and private citizens who have differing abilities to implement and adjust treatment activities. Third, a collaborative project of this size and scale relies on multiple individuals whose roles and duties will change throughout the life of the project, and therefore the social support of pre-defined triggers may wane. Fourth, scientific research will continue to advance and trigger-appropriateness may change. Fifth, forest and human community succession make it difficult to respond to trigger points since they occur along a temporal timeline. Lastly, defining spatially-relevant triggers is challenging as treatment effects may differ at the project and landscape levels. For these reasons, the 2-3-2 Partnership Adaptive Management Strategy foregoes defining triggers and instead relies on adaptive management “watch-outs” and a science review network to connect monitoring data and treatment implementation.

Adaptive management watch-outs were outlined by the 2-3-2 Partnership and approved by the monitoring committee (see tables 1 and 11). The watch-outs are designed to fit into the bounds of what can and will be measured (Ralph and Poole, 2003) and focus on data trends in treatment areas and at the landscape-scale. The monitoring committee will review annual data trends and assess which adaptive management watch-outs are met. The monitoring committee will coordinate with the full 2-3-2 Partnership to determine what monitoring and treatment changes should be made, and over what time frame, in order to stop, reverse, or further understand data trends associated with adaptive management watch-outs.

This collaborative approach incorporates ecosystem and social dynamics into an adaptive management framework which creates a “planning process that uses monitoring as collective learning on the effects of ground activities and adjusts decisions based on what is learned” (CFLRP Common Monitoring Strategy, 2020). In order to collect data in an “experimental” fashion, treated and untreated (equivalent to experimental “controls”) will be incorporated and ecosystem variables will be measured before and after restoration treatments. In socioeconomic systems, baseline data will be collected at the beginning of CFLRP implementation and recollected at various intervals to measure project impacts over time.

Science and Local Knowledge

The 2-3-2 Partnership brings together individuals who are focused on watershed and forest resilience, are interested in landscape treatments in the region, and are informed by diverse backgrounds and knowledge systems. To do so, the 2-3-2 Partnership actively tracks relevant and timely scientific information across the Rio Chama CFLRP and adjacent landscapes to incorporate up-to-date, region-specific science in monitoring and analysis. In addition, local and traditional knowledge broaden collaborative efforts toward informed decision making.

Scale of Monitoring

Restoration treatment effects will be measured at the project- and landscape-scale, as well as across all landownerships within the 2-3-2 Partnership footprint. As Schultz et al. (2014) note, landscape restoration is a process and all steps in that process should be evaluated. Put another way, it is essential to track local results and the synergistic interaction of multiple projects at a larger scale (Ralph and Poole, 2003), because the cumulative landscape response to forest and watershed treatments is amplified in a non-linear fashion (SW Jemez CFLRP Report, 2021). In addition, the 2-3-2 Partnership values the diverse land stewardship in the region and is dedicated to tracking treatment effects with an "all-lands" approach. This MPM plan is designed to address each monitoring question in a way that measures both project and landscape effects across all land management areas.

Defining Landscape

Given the desire of the 2-3-2 Partnership and CFLRP Common Monitoring Strategy to monitor landscape-scale change (CFLRP Common Monitoring Strategy, 2020; Esch and Waltz, 2019), there is a need to outline a MPM plan definition of "landscape". The 2-3-2 Partnership footprint includes 5.1+ million acres and extends north of the 3.81+ million acre Rio Chama CFLRP, covering portions of southern Colorado and northern New Mexico. Given these socio-political boundaries, the monitoring landscape could be defined as the 2-3-2 Partnership or the Rio Chama CFLRP footprint. However, collective treatment effects on ecological and socioeconomic conditions do not stop at project borders, and a "landscape" viewed by economic reach is different than one viewed by migratory animals or ecosystem function (McGarigal and Marks, 1995).

Guidance from the CFLRP Common Monitoring Strategy (2020) indicates landscape extents should be large enough "to support fire regimes" and "encompass the disturbance processes of the area involved." With this understanding, the 2-3-2 Partnership MPM plan accepts the Urban et al. (1987) landscape definition of "a mosaic of heterogenous landforms, vegetation types, and land uses", as well as acknowledges that a series of social and economic landscapes exist within and around program boundaries.

In an effort to track landscape change over time, ecological monitoring data will be summarized across the entire Rio Chama CFLRP boundary as well as at the subwatershed level (Hydrologic Unit Code 12 (HUC12)), as defined by the U.S. Geological Survey Watershed Boundary Dataset (USGS and NRCS, 2013). Using HUC12 boundaries to track landscape change across the Rio Chama CFLRP highlights the program and 2-3-2 Partnership's focus on promoting watershed health within the headwaters and tributaries of the San Juan, Rio Chama, and Rio Grande rivers. In addition, HUC12s provide a consistent "landscape" delineation across all-lands within the Rio Chama CFLRP and will provide for on-going comparison and correlation between monitoring questions. There are 204 HUC12s encompassed within the Rio Chama CFLRP and each one is typically 10,000-60,000 acres. The use of HUC12 delineations can expand beyond the Rio Chama CFLRP for application in other portions of the 2-3-2 Partnership footprint.

Defining Local

Local contractors and organizations were defined as those with business addresses in the 19-county area of interest that surrounds the Rio Chama CFLRP -- Taos, Rio Arriba, Santa Fe, Sandoval, Los Alamos, San Miguel, Bernalillo, Mora, and San Juan Counties in New Mexico and Conejos, Archuleta, La Plata, Rio

Grande, Costilla, Alamosa, Montezuma, Dolores, Montrose, and Saguache Counties in Colorado. This delineation was chosen based on local knowledge of these county's economic dependance on national forestland within the Rio Chama CFLRP boundary. Residents of the listed counties depend on forested lands in many ways, including but not limited to meeting wood gathering and processing needs, biomass utilization at wood processing facilities, and employment related to forest product activities. This list of counties reflects the areas where the workforce for the Rio Chama CFLRP lives and where they will likely spend their wages.

Leakage of benefits out of the local area will be quantified based on three tiers: leakage to businesses in adjacent counties, leakage to businesses in other parts of New Mexico or Colorado, and leakage to businesses in other states (McIver, 2016).

Collaborative Monitoring

Collaborative monitoring is an ideal way for project stakeholders to directly participate in treatment implementation (Shultz et al., 2014) and partnerships are essential for the success of this MPM plan. Collaborative monitoring builds relationships and trust among stakeholders, even when there is a history of conflict (Walpole et al., 2017), and is an opportunity to incorporate human perspectives into natural resource management to improve social-ecological systems (Taracón et al., 2020). The 2-3-2 Partnership MPM plan recognizes the diverse social and cultural histories within the area and the need to incorporate both traditional and western knowledge in holistic landscape restoration (Lake et al., 2017). These different but complementary ways of knowing combine to generate co-produced knowledge that improves restoration and social-ecological outcomes (Lake et al., 2017; Long and Lake, 2018; Tarancón et al., 2020).

Building collaborative partnerships, and the relationships that maintain them, takes time. Establishing trust and creating a space for information sharing requires variable communication patterns and respect for nation sovereignty (Lake et al., 2017). In addition, community perspectives vary across the landscape (Brunswig et al., 2010) and efforts must be made to continually expand the reach of collaborative partners. As the collaborative process continues to grow, this MPM plan encourages monitoring question expansion and novel, multi-disciplinary approaches as resources allow. 2-3-2 Partnership members will continue to explore opportunities for additional monitoring funding and research partnerships.

Community Science

Community science (previously referred to as "crowdsourced science", "participatory science", and "citizen science") provides the opportunity for everyone, regardless of their background, to contribute meaningful data to further our collective understanding of treatment effects. Involving members of the greater community in collecting and analyzing monitoring data serves the concurrent purposes of generating additional data and involving interested or concerned individuals in shared learning with restoration scientists and resource managers. No matter where a volunteer was born, where they live, or where they call home, their observations and records of environmental data are valuable. Engaging the community is a key step to building trust and long-term project success (Olsen and Sharp, 2013) and members of the public will be invited to participate in community science monitoring as methods allow.

Prioritization

Given the size of the 2-3-2 Partnership footprint, limited monitoring resources, and diverse member interests, not all proposed approaches and questions were included in the MPM plan. There are inherent monitoring constraints including cost, linkage to CFLRP objectives, sensitivity to resources, and adaptive management potential. The monitoring committee explored various approaches to address proposed monitoring questions. The committee favored monitoring approaches that could be used to answer multiple monitoring questions, could be applied cohesively across “all-lands” within the 2-3-2 Partnership footprint, informed adaptive management, fulfilled knowledge gaps, were cost-effective, could be replicated over multiple years, provided opportunities for community participation, and had buy-in from multiple collaborative partners.

In addition, the monitoring committee recognized the need to pair monitoring prioritization with treatment prioritization. Multiple participants in previous CFLRPs identified challenges with allocating monitoring resources in-line with planned treatments and noted inefficiency where monitoring focal areas were never treated. The 2-3-2 Partnership will make concerted efforts to coordinate MPM in conjunction with all-lands treatments to ensure baseline and treatment-control data are collected at spatial and temporal scales to document treatment effects.

Program Review

An explicit program review process helps ensure that the 2-3-2 Partnership MPM plan increases shared learning and informs management actions. Analyzed monitoring data will be shared with USDA Forest Service personnel, the 2-3-2 Partnership, and other interested stakeholders on field trips, at annual review meetings, and in written summaries. These forums provide opportunities for participants to learn about and provide feedback on resource conditions and project implementation, outputs, and outcomes. More details about program review are included in the Results and Reporting section of this plan.

Monitoring Plan Workflow

While there is ongoing debate regarding the line between research and monitoring (Schultz et al., 2014), this MPM plan is meant to inform adaptive management processes, and to do so, must include thinking about monitoring as applied science (Ralph and Poole, 2003). Specifically, the plan must establish “good questions” based on a strong understanding of how ecosystems work, coordination amongst scientists and managers, and critical treatment evaluation (Lindenmayer and Likens, 2010). Good questions can inform adaptive management when they are led by a distinct set of desired conditions (Schultz et al., 2014), designed before treatment decisions are made (Ralph and Poole, 2003), and result in "quantifiable objectives" or “benchmarks” to clearly measure restoration progress (Lindenmayer and Likens, 2010; Ralph and Pool, 2003). The Guild, MSI, and monitoring committee developed a monitoring plan workflow (Figure 2) to guide monitoring development and ensure the monitoring approach is accountable to the project goals, desired conditions, and monitoring questions.

Project goals were defined by the Rio Chama CFLRP proposal (Collaborative Forest Restoration in the Rio Chama Landscape, 2020) and updated in 2022. The Rio Chama CFLRP brings together four National Forests and place-based collaboratives within the 2-3-2 Partnership to work at a landscape-scale to

implement Community Wildfire Protection Plans and Forest Land Management Plans. The goals of this work are to:

- Manage fuel loads to reduce the risk of uncharacteristically severe fire in target areas;
- Strive to restore natural fire regimes using prescribed and managed fire for multiple resource benefit;
- Restore or maintain desired forest diversity, structure, and/or old growth characteristics consistent with Forest Plans;
- Maintain or improve fish and wildlife habitat quality and connectivity for native and desired non-native fish and wildlife species;
- Conserve or restore important habitat to help recover threatened and endangered species;
- Improve or maintain water quality and watershed function;
- Implement climate change adaptation strategies;
- Maintain or increase the number of people from underserved and distressed communities who are directly or indirectly employed in forest and watershed restoration in the project vicinity;
- Maintain or increase the public acceptance of forest and watershed restoration activities including frequent, low-intensity wildfire or prescribed fire;
- Encourage market availability and product utilization to provide a long-term economic relationship between forest restoration products/by-products and local markets;
- Maintain or increase the availability and/or access to medicinal, food, heating, or building materials and pursue opportunities to integrate outcomes that may also facilitate public access; and
- Maintain or increase the number of acres treated to reduce fire hazard, expand wildfire response decision space, improve wildfire outcomes, and increase protection of homes and infrastructure.

Project goals determine the focus of the landscape treatments and MPM plan, and serve as guards to keep the plan focused. There is inherently ecologic and socioeconomic overlap between project goals, the specifics of which will be discussed in annual reports.

Desired conditions describe specific ecologic, economic, and/or social characteristics of an area toward which land management should be directed. It is difficult to concisely summarize desired conditions across the landscape, and therefore, desired conditions are frequently broad, subjective statements. In review of past CFLRP efforts, Schultz et al. (2014) note the need for measurable and "clear desired conditions to drive a more robust and effective monitoring approach." The monitoring committee collected the desired conditions listed in all four National Forest forest-wide land management planning documents (Cress, 2021; Dallas, 2020; Duran, 2021; Jiron, 2021; see Appendix E) related to each project goal. However, this produced a substantial list of desired conditions and the monitoring committee, with 2-3-2 Partnership input, created MPM desired conditions that tier from these forest plans and are applicable to all-lands within the 2-3-2 Partnership footprint.

Monitoring questions shape the indicators, metrics, and analyses used in the monitoring program and should "critically evaluate study manipulations" (Lindenmayer and Likens, 2010). The CFLRP Common Monitoring Strategy (2020) noted the importance of simple questions that were developed by stakeholders. Following the same core strategy document, the majority of monitoring questions included in this MPM plan were determined by the common monitoring strategy with additional

questions selected by USFS Region 2 and Region 3 leadership. Where resources, time, and interest allowed, additional monitoring questions were developed by the monitoring committee based on input from the 2-3-2 Partnership (Tables 1 and 11).

Indicators are specific approaches for addressing monitoring questions. The indicators break monitoring questions into measurable components that are sensitive to change over time (Derr et al., 2005). Some indicators were suggested by the CFLRP Common Monitoring Strategy (2020) and others were developed based upon monitoring committee feedback and interests.

Metrics identify the specific measures to be monitored and used to address a given indicator. Metrics identify what changes will be tracked.

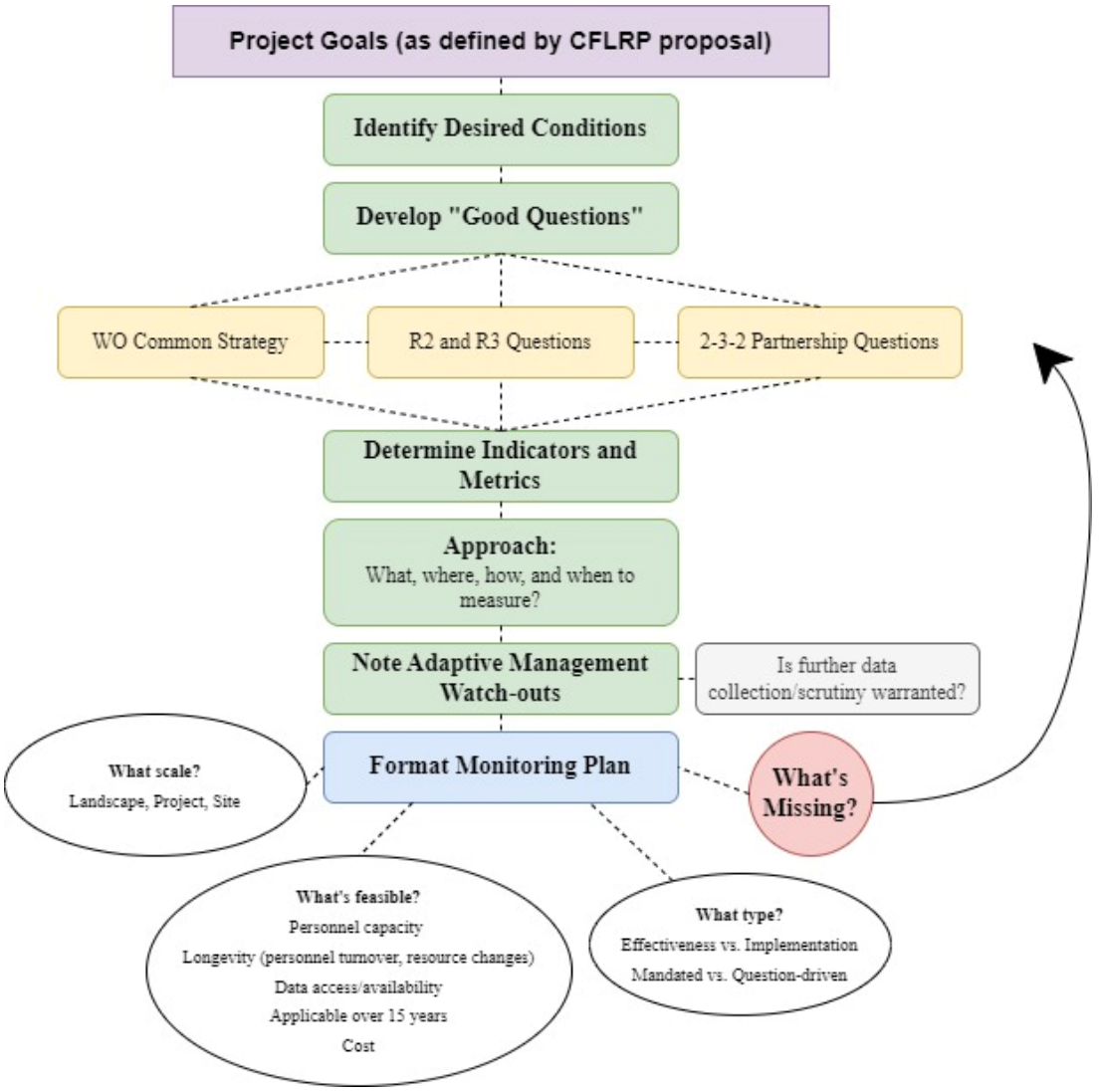
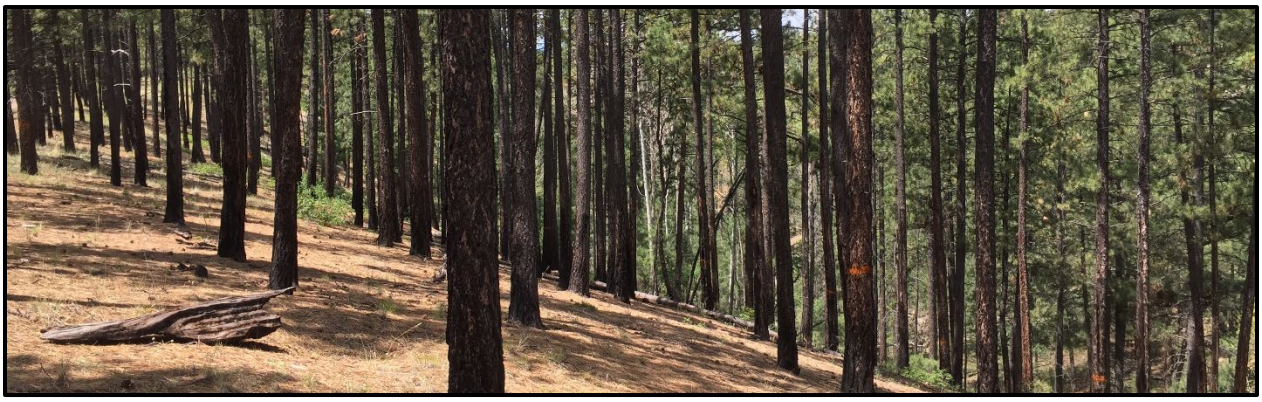


Figure 2. Monitoring plan workflow.

Monitoring approach refers to the determined information source and course of action to collect data and analyze the results for each monitoring metric. The approach outlines the specific database, tool, program, and/or framework to be used, who is responsible for data collection and analysis, and implementation frequency.

Adaptive management watch-outs are built in "checks" to determine if treatments are moving toward the desired and/or resilient conditions. These watch-outs were designed to identify departures from desired conditions, or potential undesirable treatment effects, and to "flag" areas where additional data and scrutiny are needed to inform adaptive management. Given the necessary crossover between a monitoring program and treatment implementation, the 2-3-2 Partnership sought significant input from the USDA Forest Service to define an adaptive management strategy that can be applied to all-land and cross-boundary projects. Adaptive management watch-outs should be worked into treatment plans and reviewed if met (see Adaptive Management Strategy section).



Ecological Monitoring

Ecological monitoring is used to determine if the current state of a biophysical system is moving toward a desired condition (Noon, 2003). This MPM plan began with the CFLRP Common Monitoring Strategy (2020) questions and suggested indicators and expanded outward to incorporate USDA Forest Service regional interests and 2-3-2 Partnership questions, as resources allowed. The reach and extent of ecological monitoring will grow throughout the lifespan of this plan and will be documented in Figure 3 (to be updated yearly).

In order to address both the CFLRP Common Monitoring Strategy (2020) questions and those determined by the 2-3-2 Partnership, as well as monitoring across all lands within the CFLRP boundary and at both the project- and landscape-scales, this MPM plan incorporates a mix of field surveys and model analyses to track treatment effects over time. Field surveys and model runs will be carried out by both the USDA Forest Service and the 2-3-2 Partnership to obtain project-specific data to inform landscape modeling. Forest plot data will address multiple monitoring questions and provide input for numerous models. There are a range of model options available to address the suite of indicators and questions outlined in this plan. Where possible, models will be selected to address multiple monitoring questions. Because there is not a single "golden" model, multiple models will be required. The following MPM approaches have been identified as priorities to address project goals and associated monitoring questions.

Table 1. Ecological monitoring goals, questions, and methodology.
*Overview of the ecological monitoring questions and methodology to be implemented in the 2-3-2 Cohesive Strategy Partnership's Rio Chama Collaborative Forest Landscape Program Multiparty Monitoring Plan. Project goals were determined by the 2-3-2 Cohesive Strategy Partnership. *Indicates methodology will be used to address multiple questions.*

	Project Goal	Monitoring Question	Question Source	Methodology	
Fire Regimes	Manage fuel loads to reduce the risk of uncharacteristically severe fire in target areas	What is the reduction in fuel hazard based on our treatments?	WO Common Strategy Q1	a. IFTDSS* b. FEMO Observations c. Forest Plots* d. FragStats e. MTBS	See Table 2.
	Strive to restore natural fire regimes using prescribed fire and managed fire for multiple resource benefit	What is the effect of the treatments on moving the forest landscape toward a more sustainable (or resilient) condition?	WO Common Strategy Q2	a. R3 Analysis Framework* b. Spatial analysis c. TCA d. Traditional Knowledge	See Table 3.
Forest Characteristics	Restore or maintain desired forest diversity, structure, and/or old growth characteristics consistent with Forest Plans	What is the trend in invasive species within the CFLRP project area?	WO Common Strategy Q5	a. FIA Analysis* b. Forest Plots* c. Project summaries*	See Table 4.
		How do treatments alter the density and distribution of large trees, snags, and coarse woody debris?	2-3-2 Partnership	a. Community Site Visits b. FIA Analysis* c. Forest Plots* d. R3 Analysis Framework* e. Repeat Photo Points*	See Table 5.
		What is the effect of treatments on the presence of forest pests and disease?	2-3-2 Partnership	a. Aerial surveys b. FIA Analysis* c. Forest Plots*	See Table 6.
		How do CFLRP activities affect carbon carrying capacity over time?	USFS Region 3	a. R3 Analysis Framework*	See Table 7.
Wildlife	Conserve or restore important habitat to help recover threatened and endangered species Maintain or improve fish and wildlife habitat quality and connectivity for native and desired non-native fish and wildlife species	What are the specific effects of restoration treatments on the habitat of at-risk species and/or the habitat of species of collaborative concern across the CFLR project area?	WO Common Strategy Q3	a. eDNA Sampling b. Forest Plots* c. Project summaries* d. Specialist Panel e. R3 Analysis Framework* f. Repeat Photo Points*	See Table 8.
		What are the specific effects of restoration treatments on populations of species of collaborative concern across the CFLRP project area?	2-3-2 Partnership	a. Forest Plots* (Pollinator surveys) b. Presence/absence (Beaver = visual survey; Cutthroat trout = eDNA)	See Table 9.
Water	Improve or maintain water quality and watershed function	What is the status and trend of watershed conditions in the CFLR area, with a focus on the physical and biological conditions that support key soil, hydrologic and aquatic ecosystem processes?	WO Common Strategy Q4	a. HOBO Sensors b. Project summaries* c. Repeat photo points* d. State water data e. WCF	See Table 10.

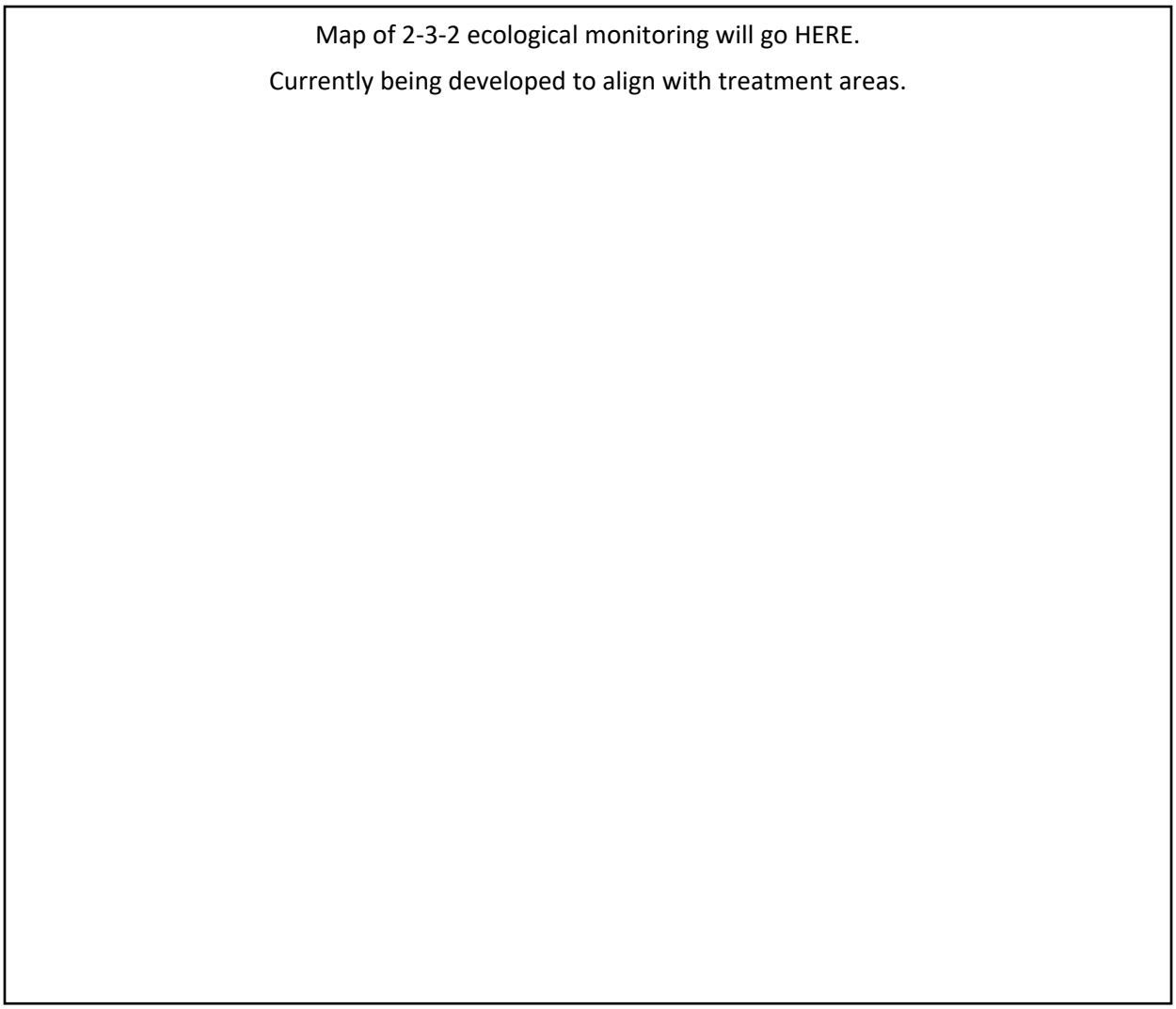


Figure 3. Map of 2-3-2 Cohesive Strategy Partnership ecological monitoring.

Fire Regimes

Fire regimes are the patterns of fire occurrence, frequency, size, severity, and effects in a given area or ecosystem (National Wildfire Coordinating Group, n.d.). Rio Chama CFLRP treatments intend to alter current fire regimes using a combination of thinning and prescribed burning to increase fire frequency and reduce fuel loading. Landscape-scale changes to fuel loads are expected to reduce fire severity and improve future fire management options (Evans et al., 2019; Korb et al., 2012; Lyderson et al., 2017; Prichard and Kennedy, 2013; Prichard et al., 2010).

Fire regime monitoring addresses two project goals and is divided into two questions related to fuel loads, and fire severity and frequency:

Project Goal: Manage fuel loads to reduce the risk of uncharacteristically severe fire in target areas.

Desired Condition: *Forest treatments decrease fuel loads in targeted areas and reduce predicted wildfire characteristics at the project- and landscape-scale.*

Q What is the reduction in fuel hazard based on our treatments? (Table 2)

Project Goal: Strive to restore natural fire regimes using prescribed fire and managed fire for multiple resource benefits.

Desired Condition: *Wildland fires burn within the desired range of severity and frequency for the affected vegetation communities and move ecosystems toward desired landscape conditions. Fire functions in its natural ecological role across administrative boundaries and under conditions where safety and values-at-risk can be protected.*

Q What is the effect of treatments on moving the forest landscape toward a more sustainable (or resilient) condition? (Table 3)

To understand if fuel treatments are promoting forest resilience, MPM will use established and vetted fire behavior models and forest plots to track changes over time. Fireline intensity and crown fire probability will be modeled using the Interagency Fuel Treatment Decision Support System (IFTDSS). Forest plots will follow MPM protocols (Appendix B) to establish baseline data, capture treatment-control change over time, and inform IFTDSS. Acres burned are tracked using USDA Forest Service and partner databases, and vegetation departure is modeled using the R3 Analysis Framework. Traditional Knowledge will inform the state of ecological conditions and the Terrestrial Condition Assessment (TCA) will be run at the national level to assess ecological integrity across all CFLRPs.

Table 2. What is the reduction in fuel hazard based on our treatments? (CFLRP Common Monitoring Q1)[2]

Baseline: Pre-treatment IFTDSS analysis and CWD loads.					
Indicator	**Metric**	**Data Collection**	**Analysis Tool**	**Frequency**	**AM Watch-out**
Fireline Intensity[WO]	Δ in predicted flame lengths	FACTS[F] Forest Plots[C] (canopy cover, stand height, canopy base height)	IFTDSS[C,F]	Baseline and Annually[L,P]	Flame lengths increase by more than double baseline estimates.
	Observed fireline intensity	Fire behavior[C]	FEMO Report[C]	As able[P]	
Crown Fire Prob.[WO]	Δ in crown fire prob. class	FACTS[F] Forest Plots[C] (canopy cover, stand height, canopy base height)	IFTDSS[C,F] FragStats[C]	Baseline and Annually[L,P]	# of acres with crown fire activity increases.
Fuel Loads	Δ in CWD fuel loads and sapling density	Forest Plots[C] (CWD, sapling counts)	Excel, R[C]	Baseline, post-treat, and every 3 years after[P]	Significant change in fuel loads and sapling density.
Burn Severity	Ratio of burn severity classes between treated and untreated stands	Occurs on 1000+ acre fires[F]	MTBS[C,F]	Following wildfire[L,P]	Treated stands have greater % of high severity fire than adjacent untreated stands.

[2] For tables 2 through 10 and 12 through 25: [WO] indicates monitoring indicator was determined by CFLRP Common Monitoring Strategy (2020). [C] indicates collaborative partners are responsible for data collection and/or analysis. [F] indicates USFS are responsible for data collection and/or analysis. [L] indicates monitoring evaluates landscape-scale change. [P] indicates monitoring evaluates project-scale change.

Table 3. What is the effect of treatments on moving the forest landscape toward a more sustainable (or resilient) condition? (CFLRP Common Monitoring Q2)[2]

Baseline: Pre-treatment vegetation mapping and analysis.					
Indicator	**Metric**	**Data Collection**	**Analysis Tool**	**Frequency**	**AM Watch-out**
Veg. Departure [WO]	Δ in acreage by seral state and fire regime	Landscape Stratification Mapping[F,C] (LANDFIRE, Oregon State Univ. Institute of Natural Resources)	R3 Analysis Framework[F]	Baseline and every 5 years[L]	Methodology not accounting for climate change.
					A notable stochastic event occurs within the CFLR footprint.
Acres Burned[WO]	Δ in acres burned by fire regime # of prescribed and managed fires for multiple resource benefits	Vegetation Mapping[F,C] (INRev maps, LANDFIRE, FIA) Landscape Updates[F,C] (NAIP, Tx shapefiles, FVS, fire severity maps, NMFWRI Opportunity Map, FACTS, WFDSS)	Spatial Analysis[F,C]	Annually[L]	Type of burning siloing (i.e., all federal or all NWCG). Decreasing number of federal and/or non-federal burns.
	Departure from NRV: # acres burned compared to natural regime	Data collection occurs at national level[F]	TCA[F]	Every 5 years[L]	A notable stochastic event occurs within the CFLR footprint. Forests are not moving toward desired conditions.
Eco Conditions	Δ from past and/or desired conditions	Engaged Listening[C]	Traditional Knowledge[C]	Continuous[L,P]	Untreated forest stands resemble desired conditions more than treated stands.

Forest Characteristics

Forest compositional and structural characteristics influence forest function and multiple ecologic interactions. For example, homogenous even-aged stands reduce variability and associated vegetative and wildlife diversity (Evans et al., 2019). The Rio Chama CFLRP proposal document (Collaborative Forest Restoration in the Rio Chama Landscape, 2020) notes the importance of using treatments to increase the presence of uneven-aged forests where the combination of forest openings reduces the risk of insect, disease, and stand-replacing wildfires, and large tree retention provides valuable wildlife habitat and carbon sequestration. Forest composition and structure will be monitored by a variety of means and will focus on specific forest characteristics.

This section addresses two project goals and asks four monitoring questions:

Project Goal: Restore or maintain desired forest diversity, structure, and/or old growth characteristics[3] consistent with Forest Plans.[4]

Desired Condition: *Terrestrial and aquatic ecosystems have a diverse composition of self-perpetuating, desired plant and animal species. Invasive species are decreasing in abundance and extent within project areas and at the landscape-scale.*

Q What is the trend in invasive species within the CFLRP project area? (Table 4)

Desired Condition: *Promote forest conditions that are broadly resilient to disturbances of varying frequency, extent, severity, and type. Promote current and future old forest characteristics by increasing desired multistory forest structure including large trees, old trees, snags, heterogeneous coarse woody debris, and diverse understories in forest and woodland vegetation communities.*

Q How do treatments alter the density and distribution of large trees, snags, and coarse woody debris? (Table 5)

Q What is the effect of treatments on the presence of forest pests and disease? (Table 6)

Project Goal: Implement climate change adaptation strategies.

[3] This MPM plan adheres to the old growth characteristics defined in the Forest Management Plan of the four forests contained within the 2-3-2 Partnership landscape (Cress, 2021; Dallas, 2020; Duran, 2021; Jiron, 2021) and will incorporate old growth and mature tree guidance resulting from The White House's Executive Order on Strengthening the Nations Forests, Communities, and Local Economies (Biden, 2022).

[4] Forest Plans refers to the most recent Forest Management Plan of each forest within the 2-3-2 Partnership landscape, as well as the desired conditions determined by the 2-3-2 Partnership for all-lands across the landscape.

Desired Condition: *Forested ecosystems maintain optimal carbon stocks that balance fire risk and long-term carbon storage.*

Q How do CFLRP activities affect carbon carrying capacity over time? (Table 7)

Data will be collected on invasive species presence through the project tracking systems, and forest plot data will be compared with Forest Inventory and Analysis (FIA) plots to see how invasive species trends in treatment areas compare to trends across the landscape. Treatment effects on large tree and snag densities, and coarse woody debris loading will be modeled using the R3 Analysis Framework. Field data will be collected using forest plots, established FIA plots, and repeat photo points. In addition, large tree retention monitoring will include qualitative feedback from collaborative site visits. Forest pest and disease trends will be captured through USDA Forest Service and the States of Colorado and New Mexico aerial surveys and FIA data. Treatment effects will be measured using forest plots and compared to landscape-wide trends. Finally, to track changes in carbon storage over time, the R3 Analysis Framework will model carbon stock by forest type.

Table 4. What is the trend in invasive species within the CFLRP project area? (CFLRP Common Monitoring Q5)[2]

Baseline: FIA plot extrapolation and pre-treatment forest plots.					
Indicator	**Metric**	**Data Collection**	**Analysis Tool**	**Frequency**	**AM Watch-out**
Acres Treated[WO]	# acres treated, # individuals found, # acres inventoried	FACTS[F] RATS[C]	Project Summary[F,C]	Baseline and Annually[L,P]	# of individuals per acre inventoried increases or does not change Treated acres are double counted in agency database. Planned treatments are completed for a given area but follow-up treatments are needed to reach desired conditions.
Plot Extrap.	Δ in % cover of invasives of top concern; Δ in % cover of veg. Functional groups	FIA Plots[F] (~635)	FIA Analysis[F]	2019 and every 5 years[L]	Ground cover of invasive species in treatment areas increases at a greater rate than across FIA and control plots in similar ecosystem types.
		Forest Plots[C] (invasive cover, veg. func. group estimates)	Excel, R[C]	Pre-treat, Post-treat, and every 3 years[P]	
	Visual Change	Repeat Photo Points[C]	Visual Comparison[F,C]	Pre-treat, post-treat, and every 3 years after[P]	

Table 5. How do treatments alter the density and distribution of large trees, snags, and coarse woody debris? (2-3-2 Partnership Interest)[2]

Baseline: Field visits to proposed treatment areas. Plot extrapolation from forest plots and FIA data.					
Indicator	**Metric**	**Data Collection**	**Analysis Tool**	**Frequency**	**AM Watch-out**
Forest Conditions	Δ in community and practitioner evaluation of forest health	Community Site Visits[F,C] (Field Trips)	Discussion tracking/review [C]	Yearly[P]	Treatment areas are straying from desired or anticipated conditions.
Plot Extrap.	Δ in tpa by species, size class, and live/dead, BA, # dead top trees, # snags, CWD, vegetation	FIA Plots[F] (~635)	FIA Analysis[F]	2019 and every 5 years[L]	Structural stage distributions move away from desired conditions. Conclusions oversimplify or generalize diverse landscape.
		Forest Plots[C] (tree counts, CWD estimates, veg. func. group estimates)	Excel, R[C]	Pre-treat, post-treat, and every 3 years[P]	
	Visual Change	Repeat Photo Points[C] (ground and drone imagery)	Visual Comparison[C,F]	Pre-treat, post-treat, and every 3 years after[P]	Observable trend in stand composition and structure moving away from desired conditions.
Frag. Metric	Δ in patch size and density of large trees and snags	Landscape Stratification Mapping[F,C] (LANDFIRE, Oregon State Univ. Institute of Natural Resources) Vegetation Mapping[F,C] (INRev maps, LANDFIRE, FIA) Landscape Updates[F,C] (NAIP, Tx shapefiles, FVS, fire severity maps, NMFWRI Opportunity Map, FACTS, WFDSS)	R3 Analysis Framework[F]	Baseline and every 5 years[L]	Trends in landscape fragmentation moving away from desired conditions.

Table 6. What is the effect of treatments on the presence of forest pests and disease? (2-3-2 Partnership Interest)[2]

Baseline: FIA plot extrapolation and landscape aerial surveys. Pre-treatment Forest Plots.					
Indicator	**Metric**	**Data Collection**	**Analysis Tool**	**Frequency**	**AM Watch-out**
Plot Extrap.	Δ # dead trees, # trees with signs of infestation	FIA Plots[F] (~635)	FIA Analysis[F]	2019 and every 5 Years[L]	Forest plots indicate higher presence of pest/disease impacted trees than FIA data
		Forest Plots[C] (tree counts)	Excel, R[C]	Pre-treat, post-treat, and every 3 years[P]	
Aerial Surveys	# of acres tree mortality by insect/disease agent	Forest and State Aerial Detection Surveys[F]	Document Review[C]	Annually[L]	Aerial survey results not ground truthed.

Table 7. How do CFLRP activities affect carbon carrying capacity over time? (R3 Common Monitoring)[2]

Baseline: Pre-treatment vegetation mapping and analysis.					
Indicator	**Metric**	**Data Collection**	**Analysis Tool**	**Frequency**	**AM Watch-out**
Stored Carbon	Δ in total carbon stock by forest type	Landscape Stratification Mapping[F,C] (LANDFIRE, Oregon State Univ. Institute of Natural Resources) Vegetation Mapping[F,C] (INRev maps, LANDFIRE, FIA) Landscape Updates[F,C] (NAIP, Tx shapefiles, FVS, fire severity maps, NMFWRI Opportunity Map, FACTS, WFDSS)	R3 Analysis Framework[F]	Baseline and every 5 Years[L]	Modeled carbon storage trends do not align with desired conditions for a given forest type. Model not accounting for below ground carbon.

Wildlife

Wildlife monitoring is designed to address at-risk species (selected by USDA Forest Service led panel) and species of collaborative interest (determined by the monitoring committee based on input from multiple stakeholders across the landscape). CFLRP thinning, burning, and riparian restoration treatments are expected to improve over 145,000 acres of terrestrial wildlife habitat. Potential habitat improvements include reduction of invasive species and maintenance of large and/or old tree habitat components.

This section addresses two project goals and asks two monitoring questions:

Project Goal: Conserve or restore important habitat to help recover threatened and endangered species.

Desired Condition: *Federally listed, proposed, and candidate species are conserved by maintaining or improving ecological conditions necessary for species persistence and recovery.*

Project Goal: Maintain or improve fish and wildlife habitat quality and connectivity for native and desired non-native fish and wildlife species.

Desired Condition: *Promote habitat configuration and availability to support fish and wildlife forage, shelter, genetic flow, and species' ability to adjust movements in response to major disturbance.*

Retain sufficient habitat characteristics, specific to at-risk species[5] and species of collaborative concern, to maintain species presence and/or movement between treated and adjacent untreated stands. Species and their associated desired habitat conditions are:

- *Abert's squirrel (Sciurus aberti) – Retain basal area diversity and mature conifer patches that provide interconnected structure and produce abundant foraging (cone crops and above/below-ground fungi) and reproductive habitat.*
- *American beaver (Castor canadensis) – Increase acreage of wetland and riparian habitat.*
- *Colorado River (Oncorhynchus clarkii pleuriticus) and Rio Grande cutthroat trout (Oncorhynchus clarki virginalis) – Natural and human-made barriers to upstream fish migration protect stream reaches large enough to support long-term population viability, and the distribution of cutthroat trout is increased where ecologically, sociologically, and economically feasible.*

[5] At-risk species refers to species listed as threatened or endangered under the Endangered Species Act and/or species of conservation concern as outlined in Forest Management Plans.

- *Lewis' woodpecker (Melanerpes lewis) – Increase forest age class diversity while retaining large trees, snags, and mature, acorn-producing oak. Retain and recruit mature cottonwoods in riparian habitats.*
- *Wild bees – Abundant and diverse understory vegetation is available throughout the growing season, with minimal presence of exotic plants. Downed woody debris is present for bee nesting and shelter.*

Q What are the specific effects of restoration treatments on the habitat of at-risk species and/or the habitat of species of collaborative concern across the CFLR project area? (Table 8)

Q What are the specific effects of restoration treatments on populations of species of collaborative concern across the CFLRP project area? (Table 9)

The CFLRP Common Monitoring Strategy (2020) focuses on changes to habitat characteristics which will be monitored using the R3 Analysis Framework and forest plots. In an effort to validate some of the selected habitat characteristics as well as broaden the MPM wildlife focus, presence/absence surveys will occur for cutthroat trout via eDNA sampling and for beavers via visual assessment, and population monitoring will occur for wild bees.

Table 8. What are the specific effects of restoration treatments on the habitat of at-risk species and/or the habitat of species of collaborative concern across the CFLR project area? (CFLRP Common Monitoring Q3)[2]

Baseline: NEPA decision documents. Pre-treatment forest plots, stream sensors, and vegetation mapping and analysis.					
Indicator	**Metric**	**Data Collection**	**Analysis Tool**	**Frequency**	**AM Watch-out**
Active Restoration Sum.[WO]	# fish passage barriers removed, # fish passage barriers strategically built, miles road closed, miles road improved, # acres treated, # stream miles improved, # streams removed from 303D list, acres wetland/riparian habitat restored	FACTS[F] WIT[F] RATS[C]	Project Summary[F,C] Spatial analysis of completed treatments and monitoring[F,C]	Annually[L]	Less than 75% of planned projects achieved each year. Treatments do not appear to be benefitting selected species. Monitoring methodologies are misaligned with treatment types.
			Specialist Panel[F]	Every 2-5 years[L,P]	
Plot Extrap.	Δ in TPA by species and size class, BA, # dead top trees, downed woody fuel loads, # snags, % canopy cover	Forest Plots[C] (tree counts, CWD, canopy cover)	Excel, R[C]	Pre-treat, post-treat, and every 3 years[P]	Structural stage distributions move away from desired conditions. Conclusions oversimplify or generalize diverse landscape.

Frag. Metric	Δ in patch size and density of large trees and snags	Landscape Statification Mapping[F,C] (LANDFIRE, Oregon State Univ. Institute of Natural Resources) Vegetation Mapping[F,C] (INRev maps, LANDFIRE, FIA) Landscape Updates[F,C] (NAIP, Tx shapefiles, FVS, fire severity maps, NMFWRI Opportunity Map, FACTS, WFDSS)	R3 Analysis Framework[F]	Baseline and every 5 years[L]	Trends in landscape fragmentation moving away from desired conditions.
Habitat metrics	Δ in seral state acreage				New Threatened & Endangered species listing within Rio Chama CFLR footprint.
	Δ in stream temp. and intermittency	Temperature sensors[C]	Excel, R[C]	Annually[P]	Trend in stream temps. misaligns with state water data. Increase in max. seasonal temperatures. Earlier peak temperature. Increased days of intermittency.
Visual Change	Δ in riparian and geomorph. veg.	Repeat Photo Points[C] (ground and drone imagery)	Visual Comparison[C,F]	Pre-treat, post-treat, and every 3 years[P]	Significant change in geomorphology. Comparative photos taken at different points of hydrograph. Presence of woody invasive species. Absence of beaver activity. Presence of livestock activity.

Table 9. What are the specific effects of restoration treatments on populations of species of collaborative concern across the CFLRP project area? (2-3-2 Partnership Interest)[2]

Baseline: State and forest wildlife monitoring. Pre-treatment forest plots and eDNA sampling.					
Indicator	**Metric**	**Data Collection**	**Analysis Tool**	**Frequency**	**AM Watch-out**
Pop. Trends	Δ in bee species diversity and abundance	Forest Plots[C] (veg. func. groups, pantraps)	Excel, R[C]	Annually[L,P]	Species presence responds differently than expected to habitat modifications.
Species Presence	Miles of stream occupied by cutthroat trout	eDNA samples[C] CPW Reports[C]	Excel[C] Spatial Analysis[C]	Baseline and every 5 years[L,P]	Detection of competing and/or predatory invasive species. Presence in areas outside of suitable habitat and/or defined range.
	% of focal subwatersheds with active beaver	Presence/Absence Surveys[C]			

Water Resources

Treatments aimed at improving watershed health include road and trail maintenance, hillslope stabilization, and riparian and aquatic restoration. These efforts aim to reduce travel and recreation impacts on water resources, reduce erosion, improve water quality, and increase aquatic habitat diversity. In addition, improving riparian and wetland functionality can retain more water in the system which benefits aquatic organisms, livestock, recreation, agriculture, and drinking water during droughts (Vose et al., 2019).

This section addresses one project goal and asks one monitoring question:

Project Goal: Improve or maintain water quality and watershed function.

Desired Condition: *Increase floodplain connectivity within subwatersheds, water quality at or above state standards, and connected hydrologic processes (including decreased stream channelization).*

Q What is the status and trend of watershed conditions in the CFLRP area, with a focus on the physical and biological conditions that support key soil, hydrologic, and aquatic ecosystem processes? (Table 10)

Watershed monitoring is designed around USDA Forest Service and 2-3-2 Partnership defined priority[6] and focal[7] subwatersheds within the Rio Chama CFLRP footprint (Figure 4). Priority and focal subwatershed characteristics will be tracked on USDA Forest Service lands using the Watershed Condition Framework (WCF) and established project tracking databases. On non-USDA Forest Service managed lands, review of existing state and local water quality data will occur. In addition, repeat photo points as well as temperature and intermittency monitoring will occur within select focal subwatersheds.

[6] Priority subwatersheds are associated with the USDA Forest Service Watershed Condition Framework and defined before implementation of the Rio Chama CFLRP.

[7] Focal subwatersheds supplement priority subwatersheds. Initial focal subwatersheds were proposed by USDA Forest Service leads based upon where current projects are underway and/or where future projects are planned. The 2-3-2 Partnership will incorporate a collaborative approach to highlight additional focal subwatersheds that contain non-USDA Forest Service managed lands and are important to regional water health and/or other partner values.

Table 10. What is the status and trend of watershed conditions in the CFLRP area, with a focus on the physical and biological conditions that support key soil, hydrologic, and aquatic ecosystem processes? (CFLRP Common Monitoring Q4)[2]

Baseline: Pre-treatment watershed summaries, ground and aerial imagery, and stream temperature sensors.					
Indicator	**Metric**	**Data Collection**	**Analysis Tool**	**Frequency**	**AM Watch-out**
Trend of WCF[WO]	Δ in total watershed condition score (priority HUC12s)	FACTS[F] WIT[F]	WCATT[F]	Baseline and every 5 years[L]	Decrease in stream reach rating from one measurement to the next.
	Δ in indicator condition scores (priority HUC12s)				
	Δ in # streams meeting state standards	NM/CO stream data[C]	Document Review[C]	As reported[L]	
	Δ in proper functioning condition assessment	BLM reporting[C]	Document Review[C]	As reported[L] (every 5 years)	
Active Restoration Sum.[WO]	# fish passage barriers corrected, miles road closed, miles road improved, # stream miles treated	FACTS[F] RATS[C]	Project Summary[F]	Annually[L,P]	Increase in # of defunct barriers.
Subwater-shed treat. prog.[WO]	# of essential projects implemented (per subwatershed WRAP)	FACTS[F]	Project Summary[F]	Baseline and Annually[L,P]	Grazing allotments re-opened within riparian areas.
Visual Change	Δ in riparian geomorph. and veg.	Repeat Photo Points[C] (ground and drone imagery)	Visual Comparison[C]	Pre-treat, post-treat, and every 3 years[P]	Increase in extent of invasive plants. Decrease in vegetation diversity. Stagnation or decrease in flood plain connectivity. Stagnation or decrease in large wood recruitment. Reduced bank stability. Algae present.
Site Extrap.	Δ in stream temp. and intermittency	Temperature sensors[C,F]	Excel, R[C]	Annually[P]	Trend in stream temps. misaligns with state water data. Increase in max. seasonal temperatures. Earlier peak temperature. Increased days of intermittency.

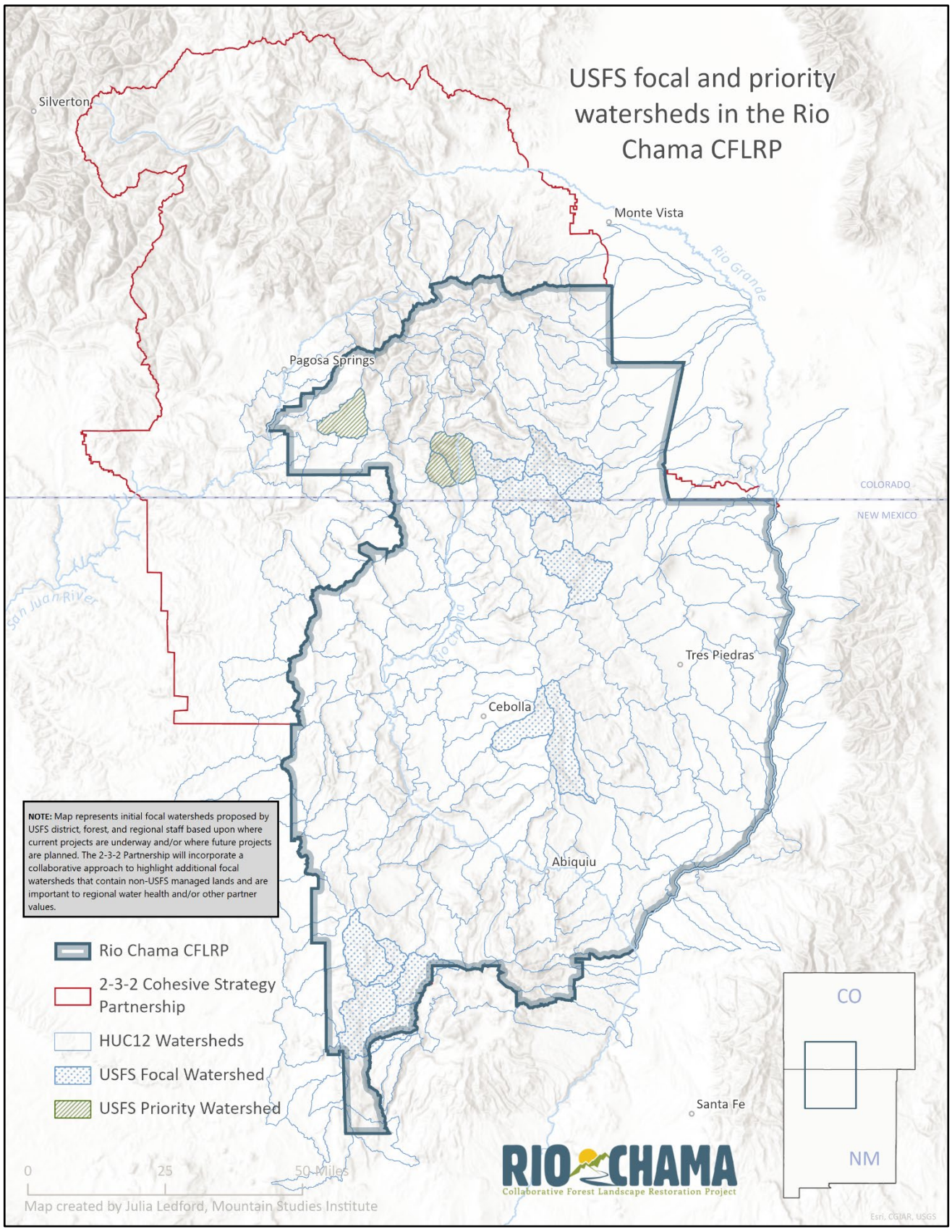


Figure 4. Map of Priority and Focal Watersheds within the Rio Chama CFLRP.

Socioeconomic Monitoring

Socioeconomic monitoring helps the USDA Forest Service and 2-3-2 Partnership understand the effects of restoration activities on workers, communities, and economies. This MPM plan began with the CFLRP Common Monitoring Strategy (2020) questions and suggested indicators and expanded outward to incorporate USDA Forest Service regional interests and 2-3-2 Partnership questions, as resources allowed. The extent of socioeconomic monitoring will grow throughout the lifespan of this plan as new data sources and methodologies are identified. Socioeconomic monitoring will focus on changes over time in the 19-county area surrounding the Rio Chama CFLRP (Figure 5; see *Scale of Monitoring* section of this document for more information about how these counties were selected).

Monitoring trends in the social and economic conditions surrounding the 2-3-2 Partnership landscape and Rio Chama CFLRP is essential for managers to contextualize project decisions. Trends in county-level data can be used to understand the correlation between project actions and broader social and economic changes – not to determine causality of project actions on the social and economic conditions of counties proximal to the project area. Socioeconomic data provides insight into the relative importance of the forestry and restoration sector in the economies of surrounding counties.

To evaluate the progress toward project goals, socioeconomic monitoring requires efforts at the local and national level to collect and model various data sources. For example, socioeconomic monitoring includes the Treatments for Restoration Analysis Toolkit (TREAT), a standardized method developed by the USDA Forest Service for comparison of economic "ripple effects" across all CFLRP projects, observed data generated from existing datasets (e.g. census data, etc.), and partner surveys[8].

[8] There are three partner surveys: the restoration and monitoring contractor survey, the wood processing and utilization survey, and the collaboration assessment survey. The first two surveys were developed by the Forest Stewards Guild and successfully implemented on landscape-adjacent CFLRPs, and the third survey was developed by the Southwestern Forest Restoration Institutes and standardized across all CFLRPs.

Table 11. Socioeconomic monitoring goals, questions, and methodology.
*Overview of the socioeconomic monitoring questions and methodology to be implemented in the 2-3-2 Cohesive Strategy Partnership's Rio Chama Collaborative Forest Landscape Program Multiparty Monitoring Plan. Project goals were determined by the 2-3-2 Cohesive Strategy Partnership. *Indicates methodology will be used to address multiple questions.*

	Project Goal	Monitoring Question	Question Source	Methodology	
Economic Sustainability	Encourage market availability and product utilization to provide a long-term economic relationship between forest restoration products/by-products and local markets	Did CFLRP maintain or increase the number and/or diversity of wood products that can be processed locally?	WO Common Strategy Q9	a. TPO* b. Partner surveys* c. Project summaries*	See Table 12.
		Did CFLRP increase economic utilization of restoration by-products?	WO Common Strategy Q10	a. Partner surveys* b. Project summaries* c. TPO*	See Table 13.
		How did CFLRP support fuel wood programs in the project landscape?	2-3-2 Partnership	a. Document review b. Project summaries*	See Table 14.
	Maintain or increase the number of people from underserved and distressed communities who are directly or indirectly employed in forest and watershed restoration in the project vicinity	How have CFLRP activities supported local jobs and labor income?	WO Common Strategy Q7	a. Partner surveys* b. TREAT*	See Table 15.
		How are CFLRP activities supporting jobs and labor income for youth, minority group representatives, or people from low-income communities?	2-3-2 Partnership	a. Partner survey*	See Table 16.
		How are the benefits of restoration activities distributed amongst communities adjacent to the project boundary?	2-3-2 Partnership	a. Headwaters Economics data review b. IFTDSS* c. Project summaries* d. Spatial analysis	See Table 17.
		How do sales, contracts, and agreements associated with the CFLRP affect local communities?	WO Common Strategy Q8	a. Document review b. Partner surveys* c. TREAT*	See Table 18.
		How has the social and economic context changed, if at all, from the beginning of CFLRP to the end?	WO Common Strategy Q6	a. Headwaters Economics data review b. Spatial analysis	See Table 19.
Forest Co-Management	Maintain or increase the public acceptance of forest and watershed restoration activities including frequent, low-intensity wildfire or prescribed fire	If and to what extent has CFLRP investments attracted partner investments across the landscape?	WO Common Strategy Q13	a. Document review b. Partner Surveys* c. Project summaries*	See Table 20.
		How has the CFLRP affected acceptance for forest treatments, including prescribed fire amongst partners?	2-3-2 Partnership	a. Collaborative governance surveys*	See Table 21.
	Maintain or increase the number of acres treated to reduce fire hazard, expand wildfire response decision space, improve wildfire outcomes, and increase protection of homes and infrastructure	Have project treatments changed the net risk of fire to communities and water resources over time?	2-3-2 Partnership	a. IFTDSS* b. Project summaries*	See Table 22.
Collaboration	Maintain or increase the availability and/or access to medicinal, food, heating, or building materials and pursue opportunities to integrate outcomes that may also facilitate public access	How does the identification process of focal watersheds guide treatment locations and implementation processes that account for and support traditional use of fire (e.g. prescribed fire) and traditional forest use, including access to medicinal, food, heating, building materials, and/or archeological and extant cultural sites?	2-3-2 partnership	a. Document review	See Table 23.
	NOTE: There is no project goal specific to the collaborate process, but it is inherent to the success of this plan.	Who is involved in the collaborative and if/how does that change over time?	WO Common Strategy Q11	a. Document review b. Partner surveys*	See Table 24.
		How well is CFLRP encouraging an effective and meaningful collaborative approach?	WO Common Strategy Q12	a. Partner surveys*	See Table 25

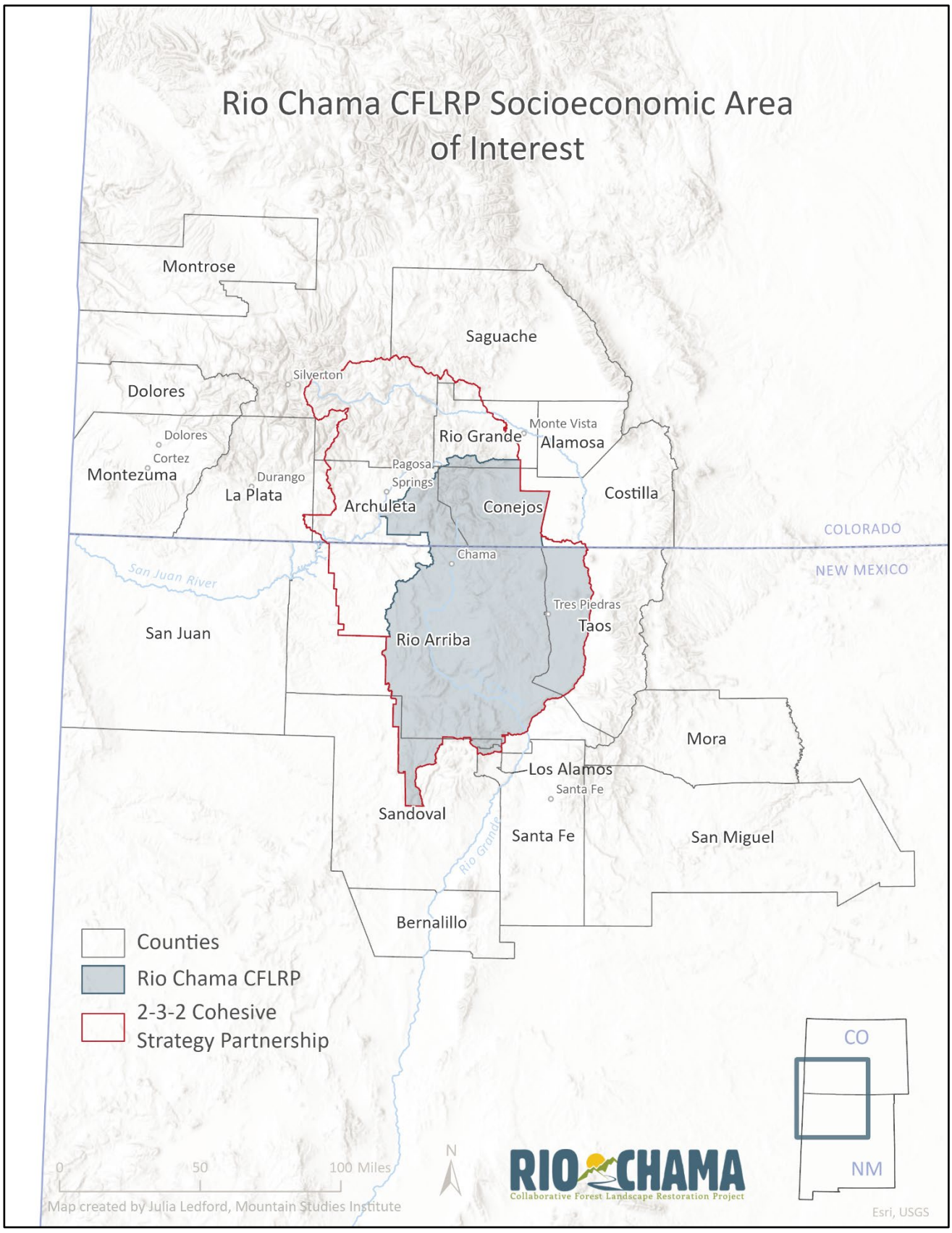


Figure 5. Map of 2-3-2 Cohesive Strategy Partnership socioeconomic monitoring.

Economic Sustainability

MPM of economic sustainability is designed around project goals and includes measures of wood product and by-product use, and employment trends.

Maintaining or enhancing local wood products infrastructure and markets will support employment and cost-savings within the 2-3-2 Partnership area. To evaluate treatment effects on local wood processing infrastructure and markets, we monitor the volume of wood delivered to local processors, the volume of products created and sold, and the number and type of wood processors operating in the project landscape.

Maintaining or enhancing utilization of restoration by-products may offset treatment costs and provide value to the restoration treatments of the 2-3-2 Partnership. Increasing utilization of restoration by-products can generate employment opportunities, offset the cost of forest treatments, and provide fuelwood to local communities living within and adjacent to the project boundary. To evaluate the utilization of restoration by-products, we monitor the volume of wood delivered to local processors, the volume of products created and sold, the number of development and training opportunities offered for biomass utilization, and the amount of fuelwood generated from treatments within the project landscape.

Monitoring changes to employment and wages allows managers to evaluate whether project actions are maintaining or increasing the number and quality of restoration-related employment opportunities in the project landscape. We capture quantitative data, in terms of number of employees and full-time equivalent positions, as well as qualitative data, in terms of the proximity of employment, safety of employment, employee retention, and career development opportunities offered.

This section addresses two project goals and asks eight monitoring questions:

Project Goal: Encourage market availability and product utilization to provide a long-term economic relationship between forest restoration products/by-products and local markets.

Desired Conditions: *Increases to the volume of wood product generated and used by local processors, use of restoration by-products, and value per acre of forest treatment.*

- Q Did CFLRP maintain or increase the number and/or diversity of wood products that can be processed locally? (Table 12)
- Q Did CFLRP increase economic utilization of restoration by-products? (Table 13)
- Q How did CFRLP support fuel wood programs in the project landscape? (Table 14)

Project Goal: Maintain or increase the number of people from underserved and distressed communities who are directly or indirectly employed in forest and watershed restoration in the project vicinity.

Desired Conditions: *Maintain or increase employment in terms of full-time employment and number of people employed. Increased wages paid within the project landscape. Increased local capture of restoration contracts.*

- Q How have CFLRP activities supported local jobs and labor income? (Table 15)
- Q How are CFLRP activities supporting jobs and labor income for youth, minority group representatives, or people from low-income communities? (Table 16)
- Q How are the benefits of restoration activities distributed amongst communities adjacent to the project boundary? (Table 17)
- Q How do sales, contracts, and agreements associated with the CFLRP affect local communities? (Table 18)

Desired Conditions: *Population-level economic conditions are maintained or improved within and adjacent to the project boundary. Project managers account for immigration and emigration of minority populations from within and adjacent to project landscape.*

- Q How has the social and economic context changed, if at all, from the beginning of the CFLRP to the end? (Table 19)

To evaluate the extent in which restoration contracts are awarded to businesses within the project landscape, we will monitor trends in the percentage of contracts, agreements, or tools, additional outreach, and capacity building opportunities awarded to local businesses. This data will be used to increase local contract capture, which is an important factor in developing local capacity for forest restoration and the long-term sustainability of project goals in the 2-3-2 Partnership and Rio Chama CFLRP landscapes.

Table 12. Did CFLRP maintain or increase the number and/or diversity of wood products that can be processed locally? (CFLRP Common Monitoring Q9) [2]

Baseline: Pre-implementation TPO and survey data.					
Indicator	**Metric**	**Data Collection**	**Analysis Tool**	**Frequency**	**AM Watch-out**
Number, Size, and Type of Sawmills in and around the CFLRP area[WO]	Δ in # observed Δ in size of mills observed Δ in # of types of mills observed	TPO[F]	TPO[F]	Baseline and every 3-5 years[L]	Decrease in # of mills. Decrease in variety of mills. Decrease in variety of wood products.

[2] For tables 2 through 10 and 12 through 25: [WO] indicates monitoring indicator was determined by CFLRP Common Monitoring Strategy (2020). [C] indicates collaborative partners are responsible for data collection and/or analysis. [F] indicates USFS are responsible for data collection and/or analysis. [L] indicates monitoring evaluates landscape-scale change. [P] indicates monitoring evaluates project-scale change.

Volume and type of wood products generated in mills in and around CFLRP area[WO]	Δ in volume of product generated	Contractor surveys[C] BIO NRG Agency performance measure[F]	Excel[C]	Baseline and Annually[L]	
	Δ in # of types of product generated				
Volume of biomass utilized	Δ in volume of wood to various sawmills within project landscape				

Table 13. Did CFLRP increase economic utilization of restoration by-products? (CFLRP Common Monitoring Q10)[2]

Baseline: Pre-implementation TPO, TIM, and survey data.					
Indicator	**Metric**	**Data Collection**	**Analysis Tool**	**Frequency**	**AM Watch-out**
Volume and type of wood products generated in mills in and around CFLRP area[WO]	Δ in volume of product generated	Contractor surveys[C] TPO[F] (UM BBER) TIM[F]	Excel[C]	Baseline and Annually[L]	Decrease in volume of wood products generated. Decrease in variety of wood products.
	Δ in # of types of product generated				
Volume of biomass utilized	Δ in volume of wood to various sawmills within project landscape	Contractor surveys[C] TPO[F] BIO NRG Agency performance measure[F]	Excel[C]	Baseline and Annually[L]	Decrease in volume of wood to mills.
# and type of trainings or biomass utilization devs. opportuns.	Δ in # of trainings or development events offered	Partner surveys[C]	Excel[C]	Baseline and Annually[L]	Trainings and development of biomass utilization are not offered.

Table 14. How did CFRLP support fuel wood programs in the project landscape? (2-3-2 Partnership Interest)[2]

Baseline: Pre-implementation amount of fuelwood permits and volume of fuelwood to fuelwood program contractors.					
Indicator	**Metric**	**Data Collection**	**Analysis Tool**	**Frequency**	**AM Watch-out**
Amount of fuelwood generated from the project landscape	Δ in # of fuel wood permits to local collectors, leñeros, etc.	TIM[F] Forest-level document review[C]	Excel[C]	Annually[L]	Decrease in the number of fuelwood permits.
	Δ in volume of fuelwood sold to fuelwood programs (e.g. wood for life)				Fuelwood programs are discontinued.

Table 15. How have CFLRP activities supported local jobs and labor income? (CFLRP Common Monitoring Q7)[2]

Baseline: Pre-implementation survey data.					
Indicator	**Metric**	**Data Collection**	**Analysis Tool**	**Frequency**	**AM Watch-out**
Number of full and part time jobs and number of employees	Δ in TREAT model outputs	Partner surveys[C] (avg. commute, worker safety, physical requirements, employee retention, enrollment in forestry programs at local accredited colleges and universities)	TREAT[C,F] Excel[C]	Baseline and Annually[L]	Number of FTE decreases. Proportion of full and part time jobs changes. Number of employees decreases.
	Δ in observed from partner surveys				
Quality of life	Δ in average commute time of employees				Average reported commute times increase.
Wages	Δ in % of wages paid				Wages paid decrease.
Turnover	Δ in ratio of people hired annually vs. employed				Increase in turnover. Turnover in CFLRP-specific positions.

Table 16. How are CFLRP activities supporting jobs and labor income for youth, minority group representatives, or people from low-income communities? (2-3-2 Partnership Interest)[2]

Baseline: Pre-implementation percentage of workforce representing youth, minority groups, and low-income communities.					
Indicator	**Metric**	**Data Collection**	**Analysis Tool**	**Frequency**	**AM Watch-out**
Employment demographics	Δ in % of firms located within low income and/or minority communities	Partner surveys[C] (demographic data)	Excel[C]	Baseline and Annually[L]	Decrease in employment from low-income and/or minority communities.

Table 17. How are the benefits of restoration activities distributed amongst communities adjacent to the project boundary? (2-3-2 Partnership Interest)[2]

Baseline: Pre-implementation trends in proximity of acres protected through defensible space, fuel treatments, and other fuel-reduction projects and EJ communities within and adjacent to the project boundaries.					
Indicator	**Metric**	**Data Collection**	**Analysis Tool**	**Frequency**	**AM Watch-out**
Proximity of CFLRP management activities to EJ communities	Δ in proximity of treatments to EJ communities	FACTS[F] RATS[C] Census data[C] Headwaters Economics EPS data[C]	IFTDSS[C] Spatial analysis[C]	Annually[L,P]	Decrease in % of treatments proximal to EJ communities.

Table 18. How do sales, contracts, and agreements associated with the CFLRP affect local communities? (CFLRP Common Monitoring Q8)[2]

Baseline: Pre-implementation surveys, TREAT analysis, and document review.					
Indicator	**Metric**	**Data Collection**	**Analysis Tool**	**Frequency**	**AM Watch-out**
Number of full and part time jobs and number of employees	Δ in TREAT model	Partner surveys[C]	TREAT[C,F] Excel[C]	Baseline and Annually[L]	Decrease in amount of full and part time jobs.
	Δ in observed from partner surveys				
	Δ in ratio of FTE to employees				Decrease in the number of employees.
Wages	Δ in % of wages paid	TREAT[F] Partner surveys[C]	Excel[C]	Baseline and Annually[L]	Decrease in wages paid.
Local contract capture[WO]	Δ in % of contracts awarded locally	Partner surveys[C] USAspending.gov reports[C]	Excel[C]	Baseline and Annually[L]	Decrease in proportion of contracts awarded locally.
	Δ in # of contracts awarded to HUB businesses through SBA program	Document review of SBA[C]	Excel[C]	Baseline and Annually[L]	Decrease in number of contracts awarded to HUB businesses through SBA program.
Type of work captured locally[WO]	Qualitative information about contracts awarded locally vs. outsourced	Partner surveys[C]	Excel[C]	Baseline and Annually[L]	Partners report greater outsourcing of work that has historically been completed locally.
Number and type of trainings offered locally	Δ in % in number of trainings; variety of type of trainings	Partner surveys[C]	Excel[C]	Baseline and every 2-3 years[L]	No trainings offered.

Table 19. How has the social and economic context changed, if at all, from the beginning of the CFLRP to the end? (CFLRP Common Monitoring Q6)[2]

Baseline: Pre-implementation trends, until 2020, in demographic and economic data from the American Community Survey (ACS) of the US Census and the census-tract level for socioeconomic counties of interest (Figure 5).					
Indicator	**Metric**	**Data Collection**	**Analysis Tool**	**Frequency**	**AM Watch-out**
Income, employment and poverty data [WO]	Δ in percentage of low-income, unemployed, and poverty communities annually	ACS census-tract data[C] Headwaters Economics EPS data[C]	Spatial analysis of census data[C]	Baseline and every 5 years[L]	Increase in the number of census-tract communities that exhibit poverty-level conditions.
Demographic data[WO]	Δ in minority populations within or adjacent to project landscape	ACS census-tract data[C] Headwaters Economics EPS data[C]	Spatial analysis of census data[C]	Baseline and every 5 years[L]	Significant change in the number of census-tract communities that qualify as having a disproportionate concentration of minorities when compared to state reference conditions.

Working Towards Forest Co-management

Forest co-management monitoring focuses on partner investments, partner acceptance of restoration activities, and fire risk to communities and the resources they rely on.

This section addresses two project goals and asks three monitoring questions:

Project Goal: Maintain or increase the public acceptance of forest and watershed restoration activities including frequent, low-intensity wildfire or prescribed fire.

Desired Conditions: *Maintain or increase the acceptance of frequent, low-intensity wildfire or prescribed fire amongst project partners. Maintain or increase partner contributions (in-kind time and funding) committed to shared project goals.*

- Q If and to what extent has CFLRP investments attracted partner investments across the landscape? (Table 20)
- Q How has the CFLRP affected acceptance of forest treatments, including prescribed fire amongst partners? (Table 21)

Project Goal: Maintain or increase the number of acres treated to reduce fire hazard, expand wildfire response decision space, improve wildfire outcomes, and increase protection of homes and infrastructure.

Desired Conditions: *Promote cross-boundary defensible space treatments to increase wildfire preparedness amongst individuals and communities within the project landscape.*

- Q Have project treatments changed the net risk of fire to communities and water resources over time? (Table 22)

We will capture data on perceptions of forest treatments, and leveraged funding within the project landscape. By monitoring perceptions of forest treatments, managers can evaluate the social willingness to use cost effective restoration tools like prescribed fire and managed wildland fire. Monitoring leveraged funding within the project landscape will help managers understand the effectiveness of the all-lands restoration approach and identify additional funding mechanisms.

Human communities within the Rio Chama CFLRP have deep ties to forest and water resources and fire risk modeling will inform how treatments are changing the net risk of fire to communities. We will run a resource exposure analysis in IFTDSS. This approach takes fire behavior outputs from the ecological monitoring portion of this plan and incorporates 2-3-2 Partnership defined assets of importance. Particular attention will be given to Traditional Knowledge and the range of assets of importance that are not necessarily contained within the WUI (Lake et al., 2017; Tarancón et al., 2020).

Table 20. If and to what extent has CFLRP investments attracted partner investments across the landscape? (CFLRP Common Monitoring Q13)[2]

Baseline: Pre-implementation surveys and document review.					
Indicator	**Metric**	**Data Collection**	**Analysis Tool**	**Frequency**	**AM Watch-out**
Amount and source of leveraged funding[WO]	Δ in amount of funding leveraged Δ in variety of leverage funding sources	Partner surveys[C]	Excel[C]	Baseline and Annually[L]	Leveraged funding decreases from baseline conditions.
Acres treated on non-federal lands	Δ in acres treated on non-federal lands in the project landscape	Partner surveys[C] Document review[C] (NRCS, CWDG, and other programs) RATS[C]	Excel[C]	Baseline and Annually[L]	Non-federal burns decreasing.
Amount and source of capital investment in partner businesses[WO]	Δ in the amount invested in partner businesses (e.g. training, equipment)	Partner surveys[C]	Excel[C]	Baseline and Annually[L]	No capital investment in partner businesses.

Table 21. How has the CFLRP affected acceptance of forest treatments, including prescribed fire amongst partners? (2-3-2 Partnership Interest)[2]

Baseline: CFLRP year 1 collaborative governance survey.					
Indicator	**Metric**	**Data Collection**	**Analysis**	**Frequency**	**AM Watch-out**
Perceptions of forest treatments	Δ in acceptance ratings of various treatment methods	Collaborative governance survey[C]	Excel[C]	Baseline and every 3 years	Partner acceptance decreases for all available forest treatment options. Significant political change within region or CFLR footprint.

Table 22. Have project treatments changed the net risk of fire to communities and water resources over time? (2-3-2 Partnership)[2]

Baseline: Pre-treatment IFTDSS analysis					
Indicator	**Metric**	**Data Collection**	**Analysis Tool**	**Frequency**	**AM Watch-out**
Active restoration sum.	Δ in acres treated to improve defensible space	FACTS[F] RATS[C]	Excel[C]	Annually[L]	Decreasing trend in acres treated to improve defensible space.
Exposure Analysis	Δ in burn prob., conditional flame length, and integrated hazard	ID locally important resources or assets[C,F] (Incorporate TK) Forest Plots[C] (fuel model, canopy cover, stand height, canopy base height)	IFTDSS[C]	Baseline and Annually[L,P]	Increase in % of locally important resources or assets exposed.

Collaboration

Monitoring participation in the 2-3-2 Partnership and Rio Chama CFLRP collaborative process helps managers evaluate whether they are creating adequate opportunities for engagement with project stakeholders. In addition, understanding partner perceptions of collaboration over time helps determine when changes are necessary to better capture and incorporate partner input, build trust and relationships, and develop social support for restoration treatments over time.

This section addresses one project goal, explores collaborative processes, and asks three monitoring questions:

Project Goal: Maintain or increase the availability and/or access to medicinal, food, heating, or building materials and pursue opportunities to integrate outcomes that may also facilitate public access.

Desired Conditions: *Forest resources important for cultural and traditional needs as well as for subsistence practices and economic support of rural historic communities are available and sustainable.*

Q How does the identification process of focal watersheds guide treatment locations and implementation processes that account for and support traditional use of fire (e.g. prescribed fire) and traditional forest use, including access to medicinal, food, heating, building materials, and/or archeological and extant cultural sites? (Table 23)

To understand how traditional uses are incorporated into treatment planning, we'll monitor the range of tribal and traditional communities represented in the identification process of focal watersheds.

Project Goal: There is no project goal specific to the collaborative process. However, collaboration is inherent to 2-3-2 Partnership success and will be monitored over time. The 2-3-2 Partnership outlined the following desired condition to address the two questions outlined by the CFLRP Common Strategy (2020):

Desired Conditions: *Increase representation within the 2-3-2 Partnership over time, particularly for tribes and traditional communities within the project landscape. Maintain or increase perceptions of collaborative effectiveness.*

Q Who is involved in the collaborative and if/how does that change over time? (Table 24)

Q How well is CFLRP encouraging an effective and meaningful collaborative approach? (Table 25)

Table 23. How does the identification process of focal watersheds guide treatment locations and implementation processes that account for and support traditional use of fire (e.g. prescribed fire) and traditional forest use, including access to medicinal, food, heating, building materials, and/or archeological and extant cultural sites? (2-3-2 Partnership Interest)[2]

Baseline: CFLRP year 1 meeting notes.					
Indicator	**Metric**	**Data Collection**	**Analysis Tool**	**Frequency**	**AM Watch-out**
Community involvement	Range of tribal nations and traditional communities involved	Meeting notes[C]	Excel[C]	Annually[L]	Decreased # of participants.

Table 24. Who is involved in the collaborative and if/how does that change over time? (CFLRP Common Monitoring Q11)[2]

Baseline: CFLRP year 1 surveys and document review.					
Indicator	**Metric**	**Data Collection**	**Analysis Tool**	**Frequency**	**AM Watch-out**
Individuals, organizations, and sectors represented in the collaborative over time[WO]	Δ in # of participants	Document review[C] (sign-in sheets, letters of support, etc.) Partner surveys[C]	Excel[C]	Baseline and Annually[L]	Continued lack of engagement from specific communities. Decreased # of participants active in sub. committees and monitoring efforts. Decreased authenticity in relationships. Stagnant or negative trend in representation and relationships. Partner representation is not geographically diverse. Stagnant or decreased # of community members participating.
	Δ in range of organizations, agencies, and stakeholder types				
	Δ in # of outreach/ engagement opportunities for Native nations and land grant communities	Document review[C] (sign-in sheets, letters of support, etc.)	Excel[C]	Baseline and Annually[L]	Decreasing # of outreach/engagement events. Partner representation is not geographically diverse.

Table 25. How well is CFLRP encouraging an effective and meaningful collaborative approach? (CFLRP Common Monitoring Q12)[2]

Baseline: CFLRP year 1 surveys.					
Indicator	**Metric**	**Data Collection**	**Analysis Tool**	**Frequency**	**AM Watch-out**
Partner perception[WO]	Δ in ratings of collaborative effectiveness	Partner surveys[C]	Excel[C]	Baseline and every 2 years[L]	Dissatisfaction with collaboration between 2-3-2 Partnership and USDA Forest Service. Partner satisfaction is increasing, but participation/representation is decreasing.

Results and Reporting

Comprehensive Data Management

Multiparty Monitoring data will be collected and managed following set protocols to ensure methods are replicable over time, data is accurate, data is secure, data sets can communicate using shared labels and formulas, and data can be shared widely. In addition, the 2-3-2 Partnership comprehensive data management plan (Appendix F) discusses quality control and data ownership. MPM results and findings will be reported annually to 2-3-2 Partners and through the USDA Forest Service CFLR program. When appropriate, monitoring data will be disseminated in peer-reviewed scientific journal articles.

The comprehensive data management plan will be overseen by Guild and MSI staff with input and analytical support from the monitoring committee and Regional USDA Forest Service leadership. Results will be shared on the 2-3-2 Partnership website.

Communication Products

Multiparty Monitoring results will be shared following the 2-3-2 Partnership communication strategy, including documentation on the 2-3-2 Partnership website (https://232partnership.org/) and presented at the annual 2-3-2 Partnership spring meeting.

Appendix A: Monitoring Timeline

Appendix B: Monitoring Protocols

Appendix C: Survey Materials

Appendix D: Other Monitoring Approaches Considered

Appendix E: USDA Forest Service Desired Conditions

Appendix F: Data Management Plan

Appendix G: Yearly Plan Evolution

Appendix H: Informing Adaptive Management

Appendix I: CFLRP Common Monitoring Strategy

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