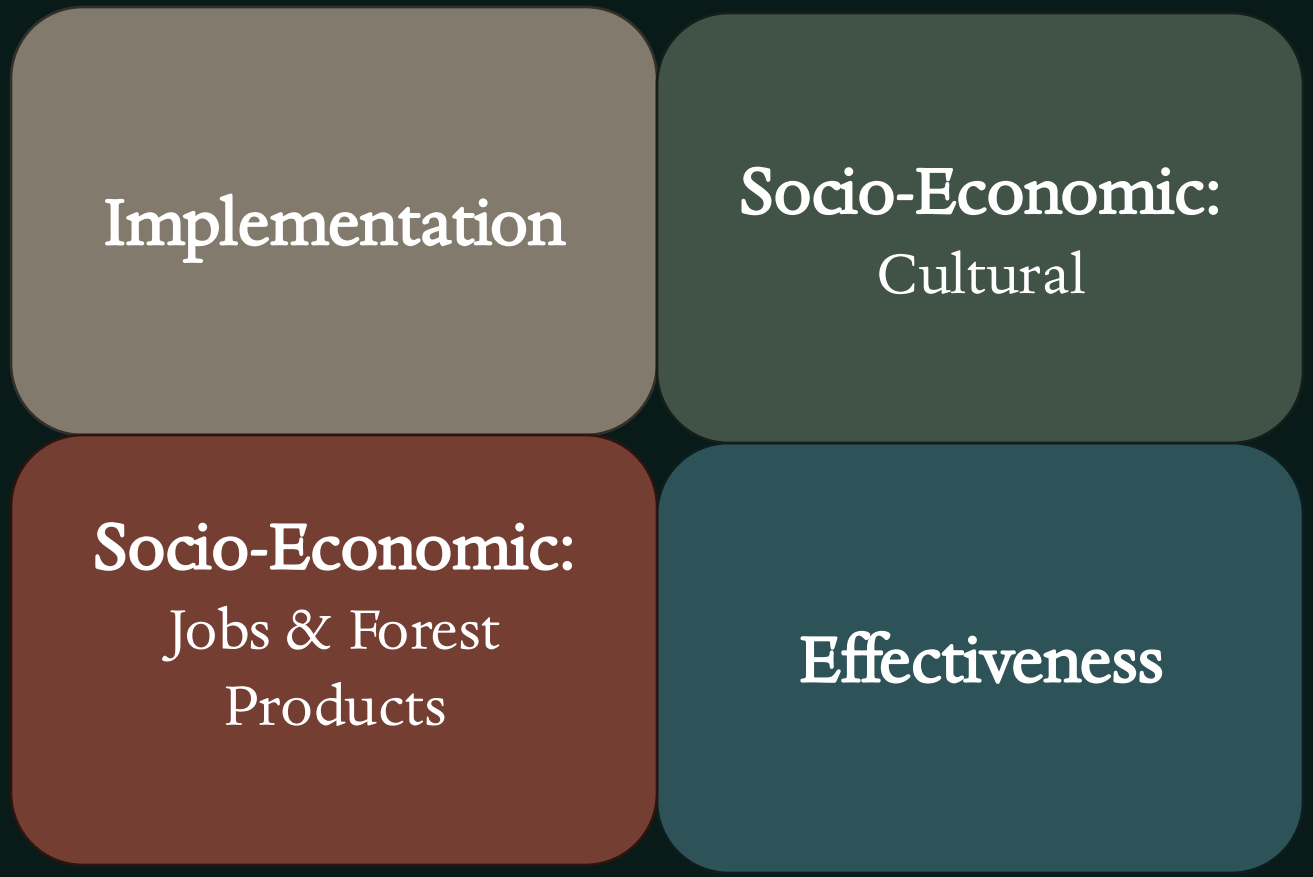
Mokelumne Amador Calaveras Forest Resilience Project (MAC) Monitoring Plan

ACCG General Meeting October 21st, 2026

BECKY ESTES, USDA FS

TY MCCARTHY, UMRWA

MEGAN LAYHEE, UMRWA



Presentation Overview

- Background & Goals of Presentation
- Monitoring Plan Development Process
- Monitoring Plan Questions Overview
- Deep Dive Into the Question Pathway
- Implementation & Field Monitoring Plan
- Funding Plan
- Key Dates & Next Steps
- Q&A

Background

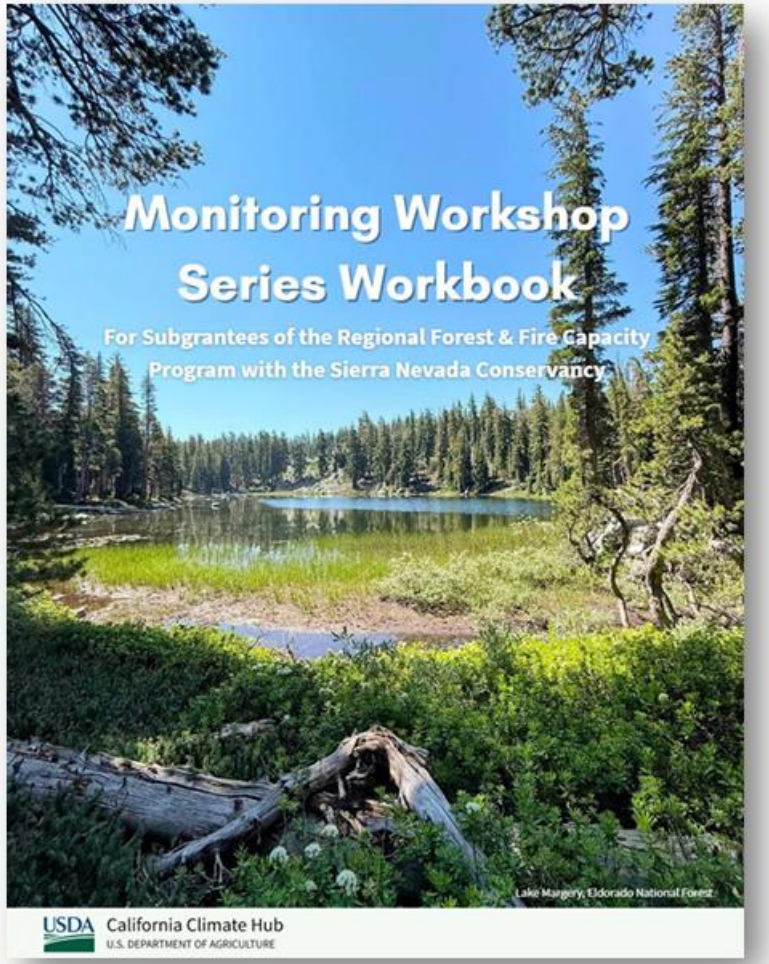
- UMRWA's SNC RFFCP grant deliverable- development of MAC Monitoring Strategy and Funding Plan (due December 2026).
- UMRWA & FS working closely with ACCG Monitoring WG.
- Monitoring questions, indicators and other descriptors under development.

TODAY'S GOAL

ACCG opportunity to engage, and provide input on MAC Monitoring and Funding Plan

Today's goal

- **Today: approve first iteration of the MAC Monitoring Plan.**
- Reminder: Plan is not static.
- Next steps:
  1. Finalize this first iteration of plan with Monitoring work group.
  2. **Submit plan to SNC as grant deliverable by Nov.-early Dec. 2026.**



Workbook Overview

Recipe book for developing your monitoring plan

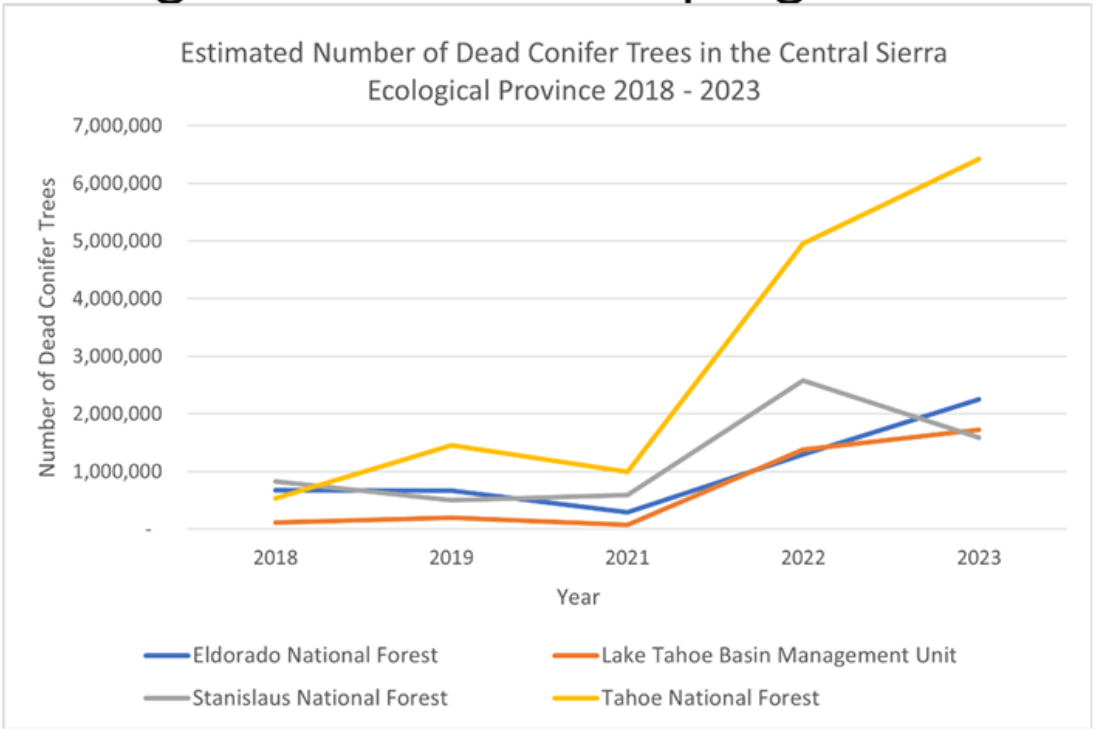
- Monitoring Plan Framework
- Component information
- Component exercises
- Example monitoring plan format
- Glossary
- Notes

USDA California Climate Hub
Monitoring Plan Framework
Workshop Series

Refresher - Monitoring

Systematically measuring the same element or process repeatedly over time to evaluate changes in condition or progress

- Tied to management goals
- Requires a clear question…
- To be understood through data collection…
- To inform resource management & to determine if changes are needed to management plans.



Monitoring Plans ≠ Monitoring Report

How you will monitor

- Indicators
- Data collection methods
- How data will inform management decisions

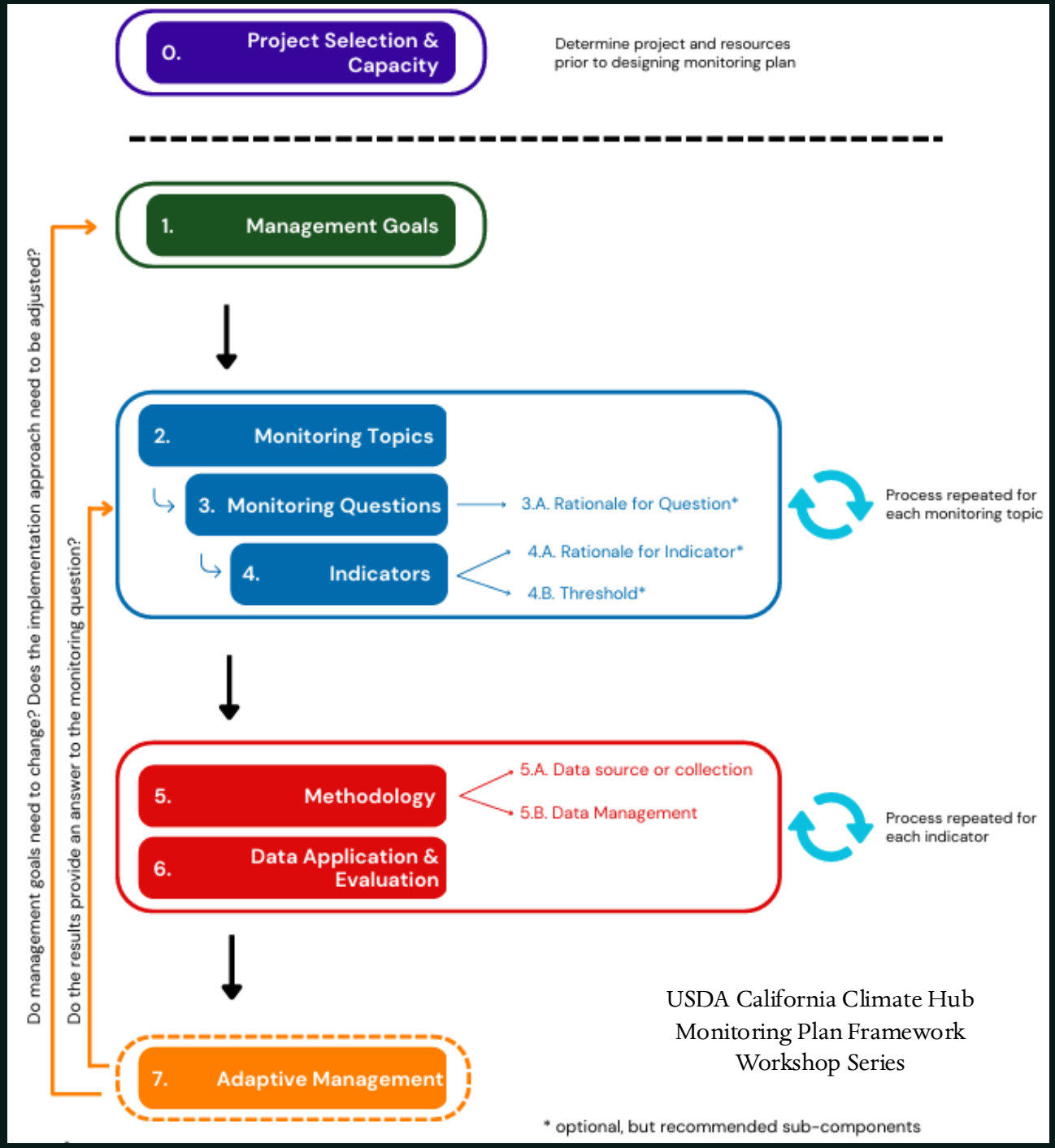
What you did monitor

- Compilation of monitoring results
- Conclusions and implications of management actions based on findings



A well-designed monitoring plan ensures that the evaluation of results in a monitoring report is effective and provides valuable insight.

Monitoring Plan Framework



MAC Monitoring Strategy Development

MAC PURPOSE & NEED (MANAGEMENT GOALS)

1.1 Reduce Safety Hazards Across Public Lands

1.2 Restore Ecosystem Health and Resilience

1.3 Promote a Fire-Resilient Landscape

1.4 Maintain and Support Local Communities

MAC MONITORING PLAN

Monitoring questions developed to address MAC Project Purpose & Need.

MAC Monitoring Questions Types, Topics & Sub-topics

Implementation

- Wildfire risk reduction
- Safe Ingress/Egress Routes
- Habitat & Biodiversity
- Watershed Integrity
- Fire Process Reestablishment

Socio-Economic: Cultural, TEK

Socio-Economic: Jobs & Forest Products

Effectiveness

- Forest Resilience/Resistance
- Wildfire risk reduction
- Safe Ingress/Egress Routes
- Habitat & Biodiversity
- Invasive Species
- **Watershed Integrity**

MAC Monitoring Questions – 20 Questions

Topic, sub-topic	P&N	# of Questions
Implementation: • Wildfire risk reduction • Safe Ingress/Egress Routes • Habitat & Biodiversity • Watershed Integrity • Fire Process Reestablishment	1.1, 1.2, 1.3	5
Socio-economic: Jobs & Forest Products	1.4	2
Effectiveness: • Forest Resilience/Resistance • Wildfire risk reduction • Safe Ingress/Egress Routes • Habitat & Biodiversity • Invasive Species • Watershed Integrity	1.1, 1.2, 1.3	13
Socio-economic: Cultural/ TEK	1.1, 1.2, 1.3, 1.4	TBD

Topic: Implementation			
#	Sub-topic	MAC Purpose & Need	Question
1	**Wildfire Risk Reduction**	Reduce risk of wildfire to communities and their assets.	What percentage of the WUI surrounding at-risk communities have received wildfire mitigation treatments?
2	**Safe Ingress/ Egress Routes**	Reduce risk of wildfire to communities and their assets.	How many miles of vegetation along ingress and egress routes have been maintained to provide safe escape routes?
3	**Habitat & Biodiversity**	Improve and protect plant and wildlife habitat.	Are project design features and mitigations implemented correctly to protect target wildlife species and plant communities?
4	**Watershed Integrity**	Improve and protect watershed integrity.	Are project Best Management Practices (BMPs) designed to protect beneficial uses of water being implemented as planned? Are implemented BMPs effective in protecting beneficial uses of water?
5	**Fire Process Reestablishment**	Reestablish fire processes.	What acreage has been treated with prescribed fire or wildfire managed for resource benefit?

Topic: Socio-Economic			
#	Sub-topic	MAC Purpose & Need	Question
6	Jobs and Forest Products	Provide jobs and forest products.	How many local (Amador, Calaveras, Alpine, Tuolumne, El Dorado Counties) jobs (including contracts) have been created or maintained through restoration and management activities?
7	Jobs and Forest Products	Provide jobs and forest products.	What volume of forest products (e.g., timber, biomass) has been sustainably harvested from restoration areas

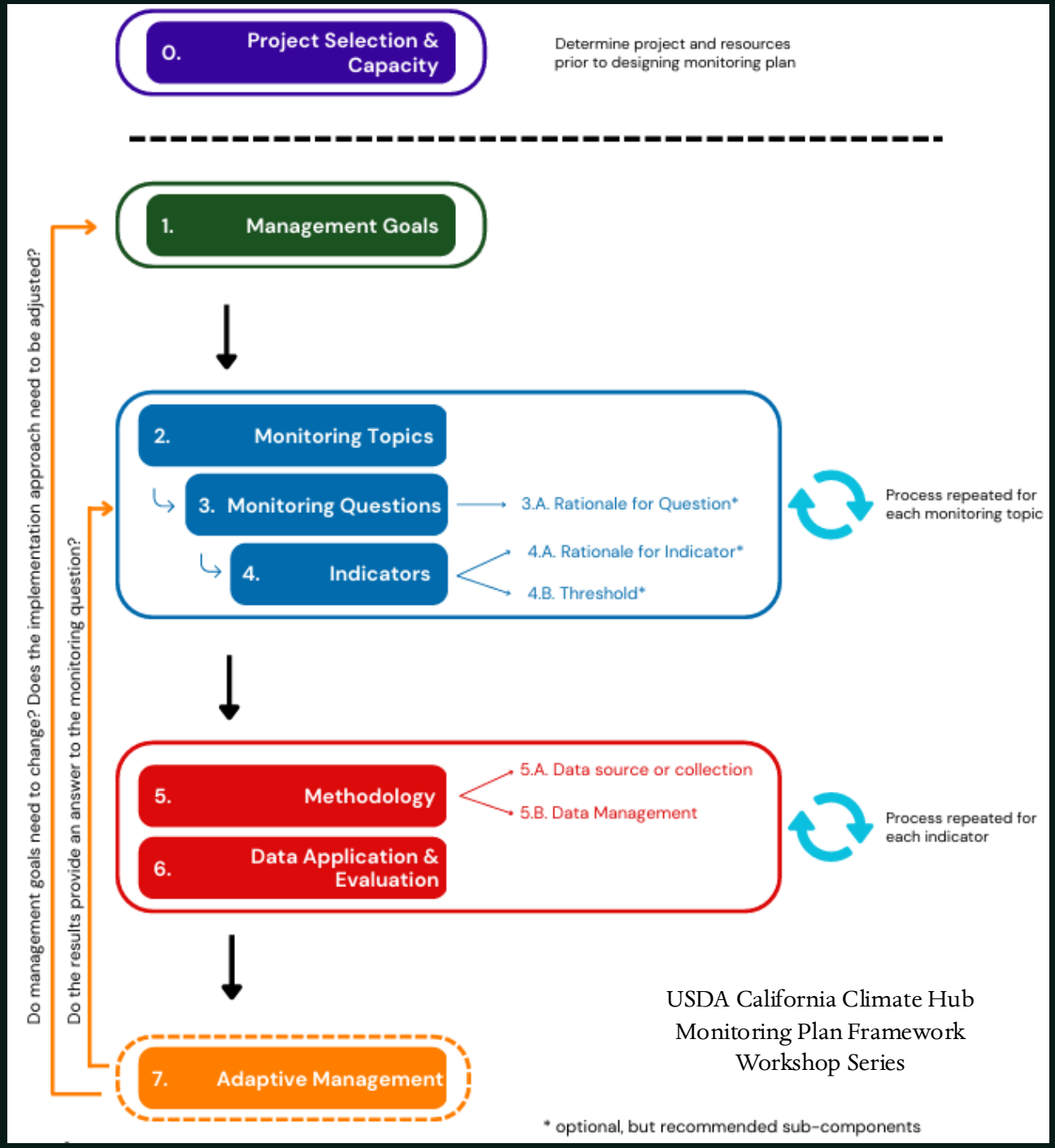
Topic: Effectiveness

#	Sub-topic	MAC Purpose & Need	Question
8	Forest Resilience / Resistance	Increase forest resilience to natural disturbances and stressors.	Are shaded fuelbreaks being created and properly maintained to meet fire management objectives?[
9	Wildfire Risk Reduction	Reduce risk of wildfire to communities and their assets.	Has there been a measurable reduction in the risks of wildfire to at-risk communities (WUI) following treatments?
10	Wildfire Risk Reduction Forest Resilience / Resistance	Increase forest resilience to natural disturbances and stressors. Reestablish fire processes.	Has there been a measurable reduction in the risks of wildfire to vegetation community types in the general forest?
11	Forest Resilience / Resistance	Increase forest resilience to natural disturbances and stressors. Reestablish fire processes.	Have treated areas seen a measurable reduction in fuel loading (e.g., tons per acre, tree density) that has facilitated the use of prescribed fire?
12	Forest Resilience / Resistance	Increase forest resilience to natural disturbances and stressors. Reestablish fire processes.	Has the density, composition and structure of forest vegetation been maintained or improved to increase resilience to human and natural disturbances (e.g., wildfire, drought)?
13	Forest Resilience / Resistance Wildfire Risk Reduction	Increase forest resilience to natural disturbances and stressors. Reestablish fire processes.	Have treated areas experienced fewer large-scale disturbances (e.g., wildfire, insect outbreaks) compared to untreated areas over the project implementation period?

Topic: Effectiveness

#	Sub-topic	MAC Purpose & Need	Question
14	Habitat & Biodiversity	Improve and protect plant and wildlife habitat and biodiversity.	How do treatments affect terrestrial and aquatic wildlife species populations?
15	Habitat & Biodiversity	Improve and protect plant and wildlife habitat and biodiversity.	How do treatments affect the habitat quality for terrestrial and aquatic wildlife species in treated areas?
16	Habitat & Biodiversity	Improve and protect plant and wildlife habitat and biodiversity.	How did treatments affect the occurrence of Threatened and Endangered, Rare or other identified Forest Service Sensitive plants?
17	Habitat & Biodiversity	Improve and protect plant and wildlife habitat and biodiversity.	How did treatments affect the occurrence of special terrestrial plant communities?
18	Invasive Species	Improve and protect plant and wildlife habitat and biodiversity	Are project activities introducing and/or spreading invasive plants?
19	Invasive Species	Improve and protect plant and wildlife habitat and biodiversity	Are we meeting treatment objectives for targeted invasive species infestations (i.e. eradication vs. control)?
20	Invasive Species	Improve and protect plant and wildlife habitat and biodiversity	Are we making progress removing priority invasive infestations over the long term?

Monitoring Plan Framework



Management Goal (MAC Purpose & Need):

Reduce risk of wildfire to communities and their assets.

Monitoring Topic:

Implementation

Monitoring Question 1:

What percentage of the WUI surrounding at-risk communities have received wildfire mitigation treatments?

Rationale for Question:

This question is designed to track the success of completing wildfire mitigation treatments around at-risk communities. Communities can benefit from direct treatments to WUI which would reduce wildfire risk and from indirect creation and maintenance of fuel breaks that would assist in fire management activities.

Indicators:

1.1 Acres by treatment type in the WUI (initial or maintenance)

Rationale for Indicator:

This indicator is intended to track any changes in treatment in WUI.

Threshold:

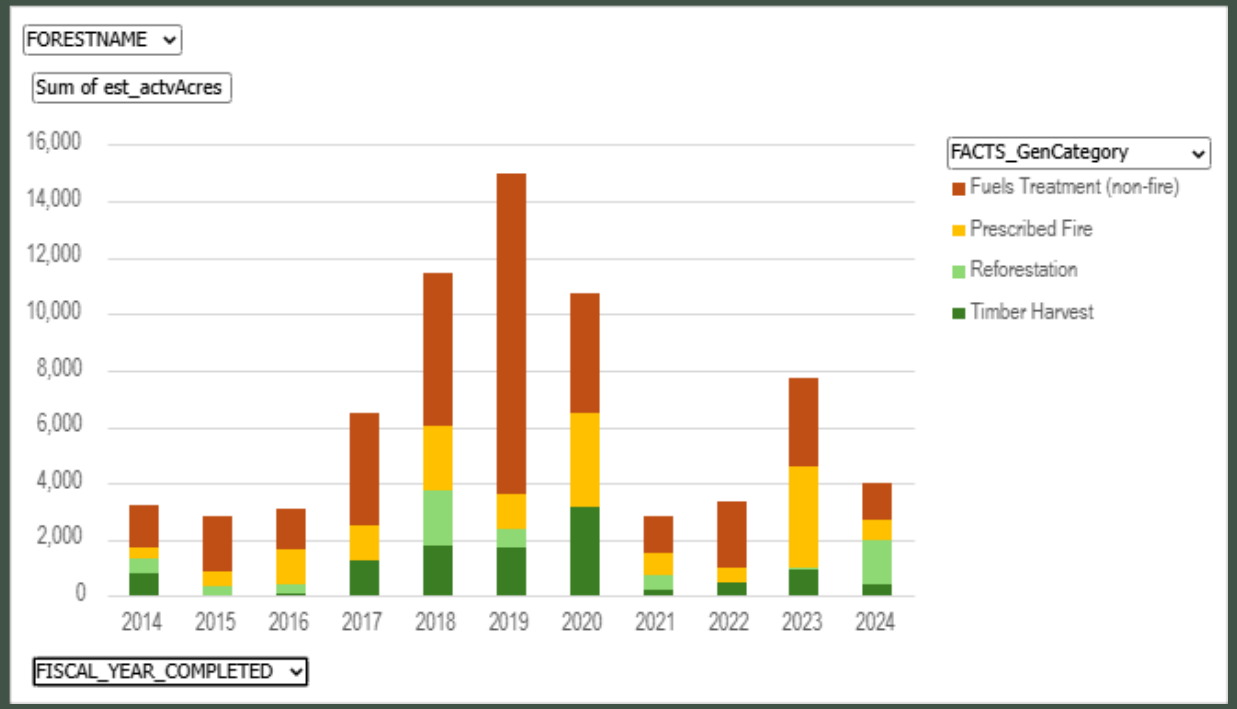
Success would be measured as an increase in acres treated or maintained in WUI. A decrease in acres of treatment in WUI might indicate a threshold but it would be necessary to evaluate the contributing factors. For example, if all areas in WUI have already been treated then the reported acreage might lower in subsequent years until maintenance needs to occur.

Methodology:

FACTS and AGOL Implementation Interface. See Implementation monitoring description in Appendix A.

Data Application & Evaluation:

FACTS and AGOL Implementation Interface. See Implementation monitoring description in Appendix A.



Management Goal (MAC Purpose & Need):

Reduce risk of wildfire to communities and their assets.

Monitoring Topic:

Social and Economic

Monitoring Question 6:

How many local (Amador, Calaveras, Alpine, Tuolumne, El Dorado Counties) jobs (including contracts) have been created or maintained through restoration and management activities?

Rationale for Question:

Human communities in the vicinity of the MAC project are a critical part of land management. Social and economic conditions in the broader landscape can influence the sustainability of resources and ecosystems within the MAC project. Data on social and economic conditions can provide insight into the resilience of local communities and their sensitivity to changes in forest management and resource conditions.

Indicators:

6.1 Number of forest-related local jobs or contracts

Rationale for Indicator:

The total number of jobs and contracts related to work in the MAC project area could provide key information on economic benefit to the local communities.

Threshold:

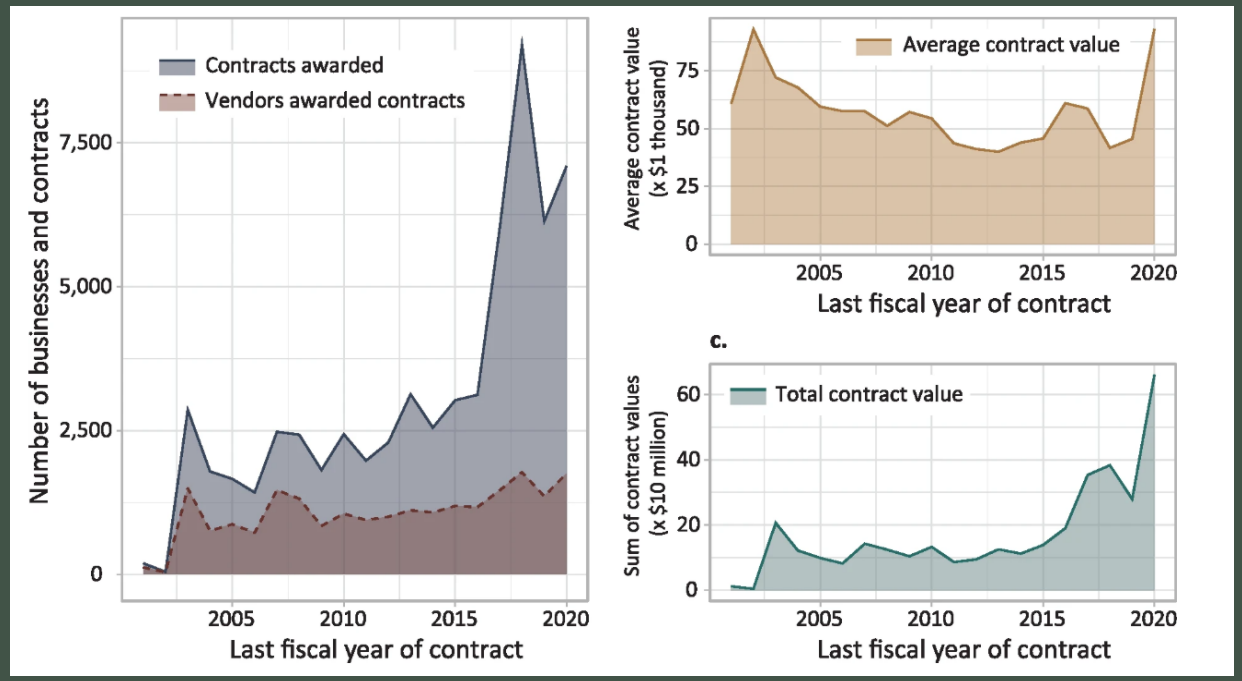
Increase local job opportunities. A decrease in job opportunities doesn't imply that there is a negative benefit and other contributing factors must be considered.

Methodology:

TREAT model and implementation reporting.

Data Application & Evaluation:

Summary of forest-related local jobs and contracts.



Management Goal (MAC Purpose & Need):

Increase forest resilience to natural disturbances and stressors.

Reestablish fire processes.

Monitoring Topic:

Effectiveness - Forest

Monitoring Question 13:

Have treated areas experienced fewer large-scale disturbances (e.g., wildfire, insect outbreaks) compared to untreated areas over the project implementation period?

Rationale for Question:

Fire is an important ecological process in Sierra Nevada forests. Prior to the twentieth century, fires were a common occurrence in the Sierra Nevada and foothills. Much of the forests burned at regular intervals on a 15- to 30-year cycle due to natural causes like lightning or intentional ignitions and vegetation management by Indigenous people. This historical, regular pattern of fire, known as a fire regime, created a mosaic of vegetation patterns including varying degrees of canopy cover and forest openings. After nearly a century-long over-emphasis on fire suppression, Sierra Nevada forests are now uncharacteristically dense, with understory ladder fuels often coupled with suppressed to codominant sized trees and a thick layer of dead and down woody material, litter, and duff. Now, when fires ignite, forests erupt into infernos that generate their own weather, burning large expanses of forested lands at much higher intensities and severity than historical levels, consuming or killing most of the live vegetation and leaving, in some areas, sterilized soils and long-lasting fire scars on huge expanses of our public lands.

Indicators:

13.1 Mean condition class (mean fire return interval departure condition class)

Rationale for Indicator:

This indicator uses the mean percent FRID to measure the extent to which contemporary fires (i.e., since 1908) are burning at frequencies like the frequencies that occurred prior to Euro-American settlement summarized across known literature, with the mean reference FRI binned into another basis for comparison. Mean PFRID is a metric of fire return interval departure (FRID) and measures the departure of current FRI from reference mean FRI in percent.

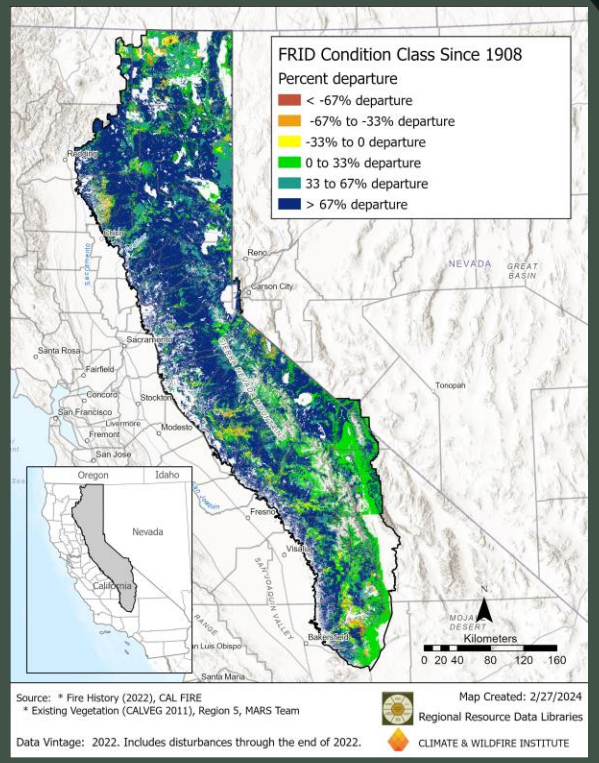
Threshold:

The Fire Return Interval (FRI) is moving towards natural variability with more acres moving towards desired CC 1; less (and eventually no) acres in CC 3.

From the MAC EIS: A fire return interval departure (FRID) analysis quantifies the difference between current and pre-settlement fire frequencies and provides a basis to identify areas for targeted management (Safford and Van de Water 2014). Based on FRID analysis of the MAC Project area, approximately 56 percent is highly departed, 27 percent is moderately departed, and 4 percent is within the historical range of variability.

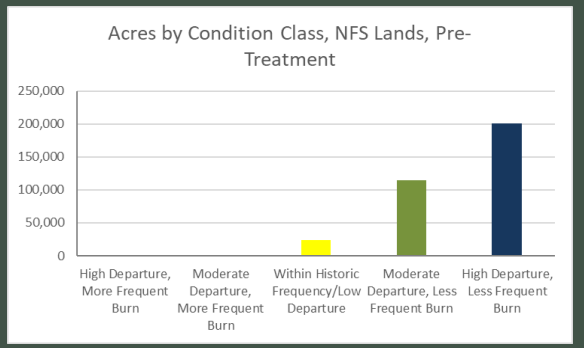
Methodology:

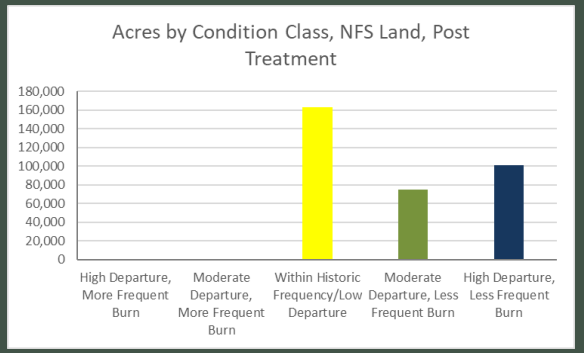
The Fire Return Interval Departure Analysis (FRID) is a remote sensed product generated by the Forest Service in Region 5. The FRID is updated every year to reflect changes in fire perimeters that are provided from the Cal Fire Fire and Resource Assessment Program (FRAP).



Data Application & Evaluation:

Use Fire Return Interval Departure Analysis (FRID) - Condition Class (CC) departure - Low (CC1), Moderate (CC2), or High (CC3) departure.





Cultural, Traditional Ecological Knowledge (TEK) objectives

- Objectives, questions to be developed in collaboration with a Tribal Monitoring Advisory Committee (UMRWA's Tribal Engagement Plan).
- Explore pathways for Tribes and tribal entities to participate or lead implementation of monitoring.
- Example cultural, TEK questions:
  - How many management activities have incorporated TEK in the planning or implementation in the past year?
  - How many CA Native American Tribes participated in the treated acres?
  - How many acres of prescribed fire was listed as including cultural objectives directly proposed by Tribes, or was informed prior by Tribes?

Four Integrated Geospatial Tools

ArcGIS Field Maps

Survey123

Implementation & Field Monitoring Plan

Custom HTML Dashboard

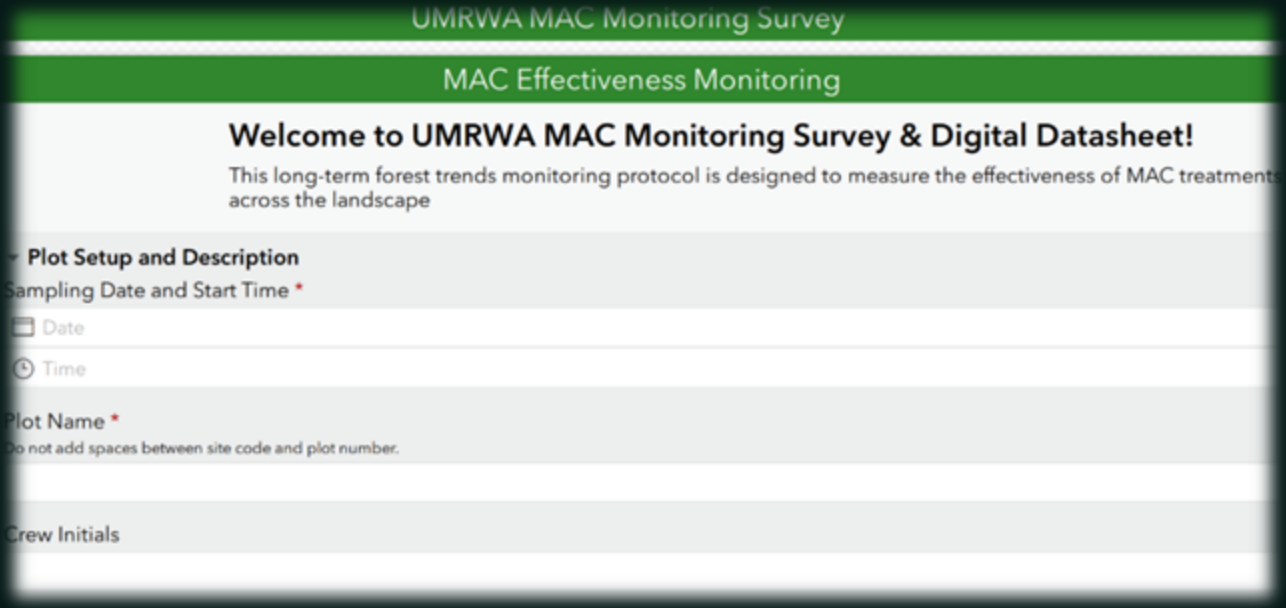
MAC Monitoring Plot Selection Tool

Implementation & Field Monitoring Plan



FIELD-BASED GEOSPATIAL TECHNOLOGY

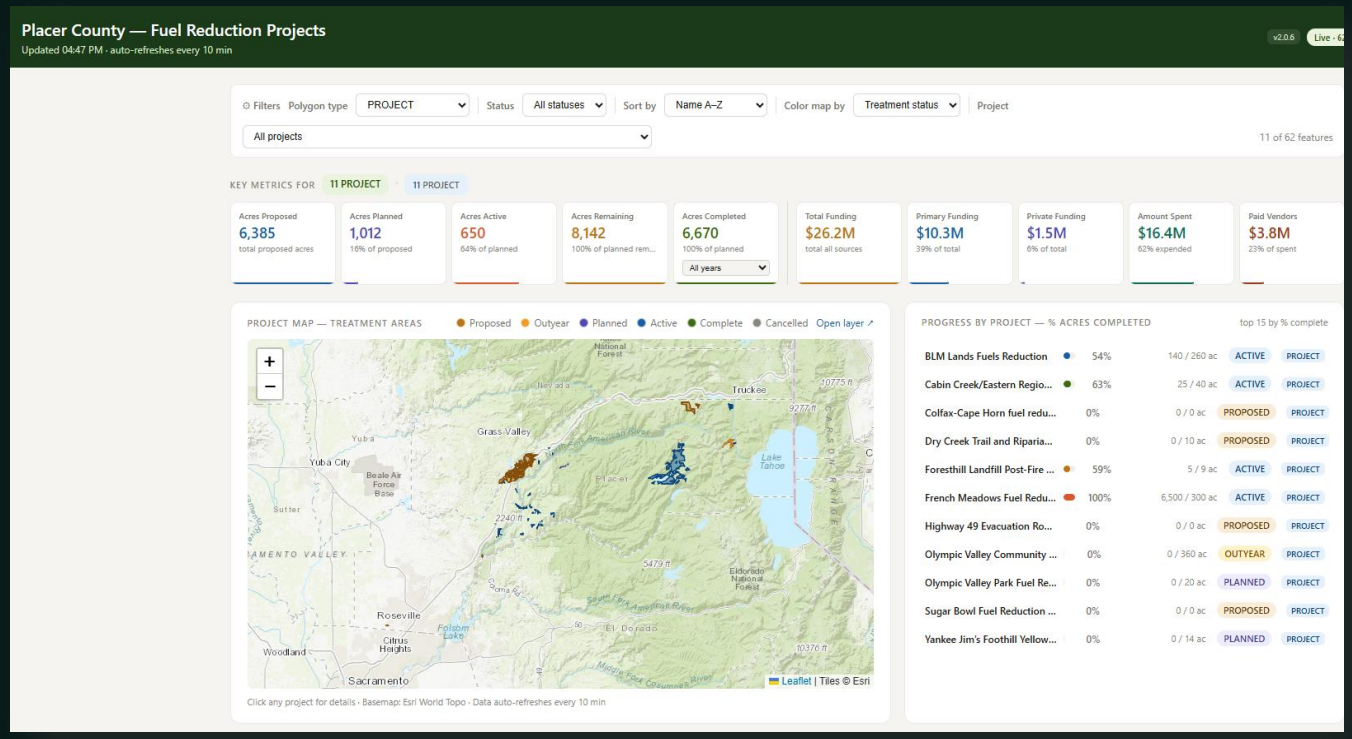
- ArcGIS Field Maps – map-centric data collection for capturing treatment polygons, plot locations, and field observations with GPS precision.
- Survey123 - form-centric data collection for structured monitoring protocols, BMP inspections, and reports with photo attachments and branching logic.



Implementation & Field Monitoring Plan

OTHER WEB-BASED TOOLS

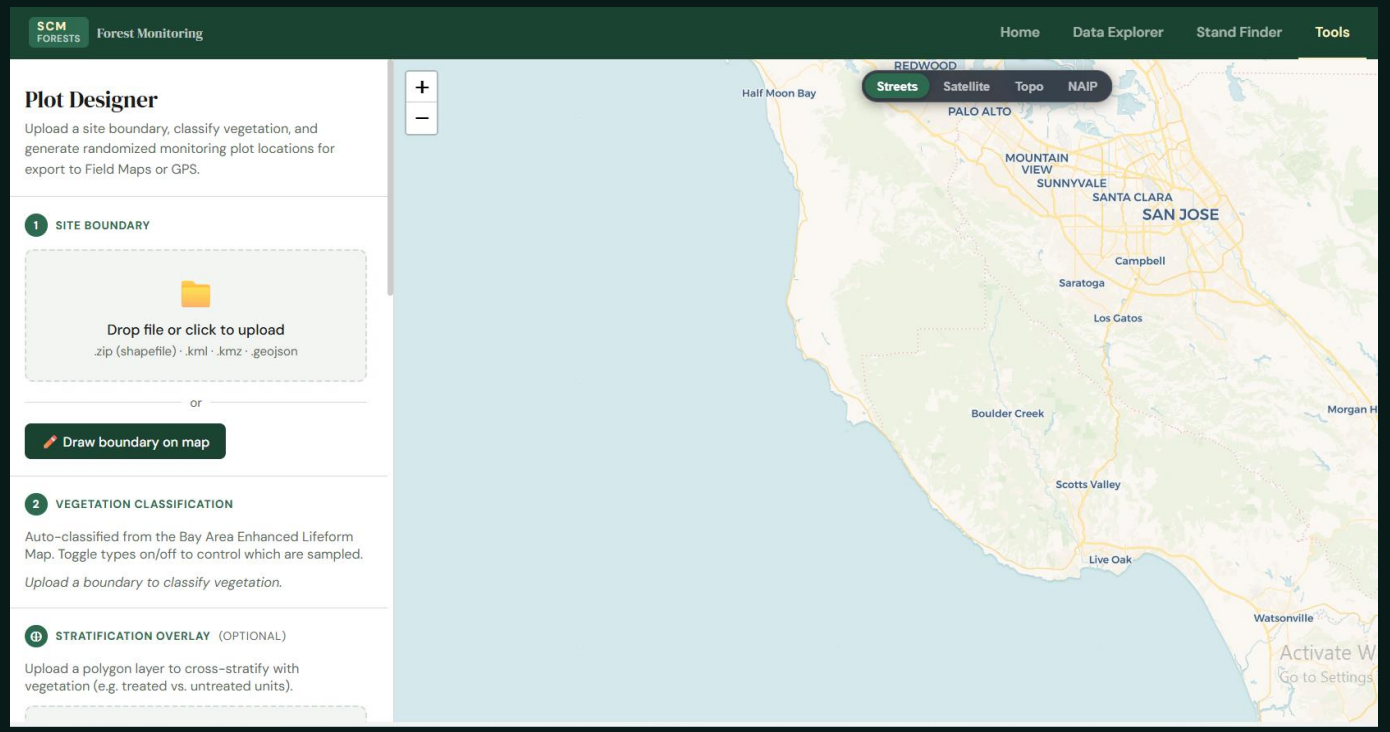
- Custom HTML Dashboard - a publicly accessible web application modeled after the Placer County Fuels Reduction Projects dashboard (https://rfh-dashboard-v2-0-6.netlify.app/),displaying real-time implementation and monitoring data without requiring an Esri account.



Implementation & Field Monitoring Plan

OTHER WEB-BASED TOOLS

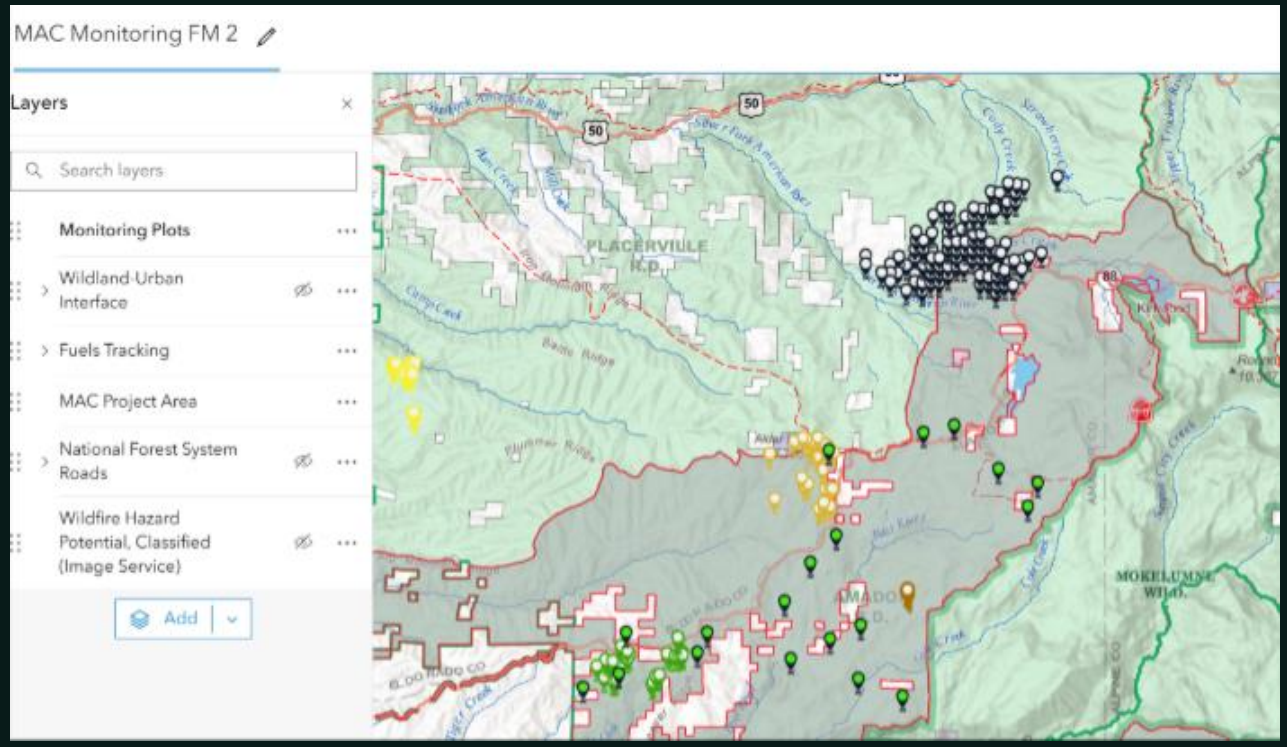
- MAC Monitoring Plot Selection Tool - a web-based interactive application, developed with Becky Estes (Central Sierra Province Ecologist, Eldorado NF), for spatially distributing and finalizing monitoring plots. Modeled after the Santa Cruz Mountains Forest Monitoring plot designer (https://scmforests.org/plot-designer.html).



Implementation Examples

FIELD MAPS – TREATMENT PROGRESS LAYER

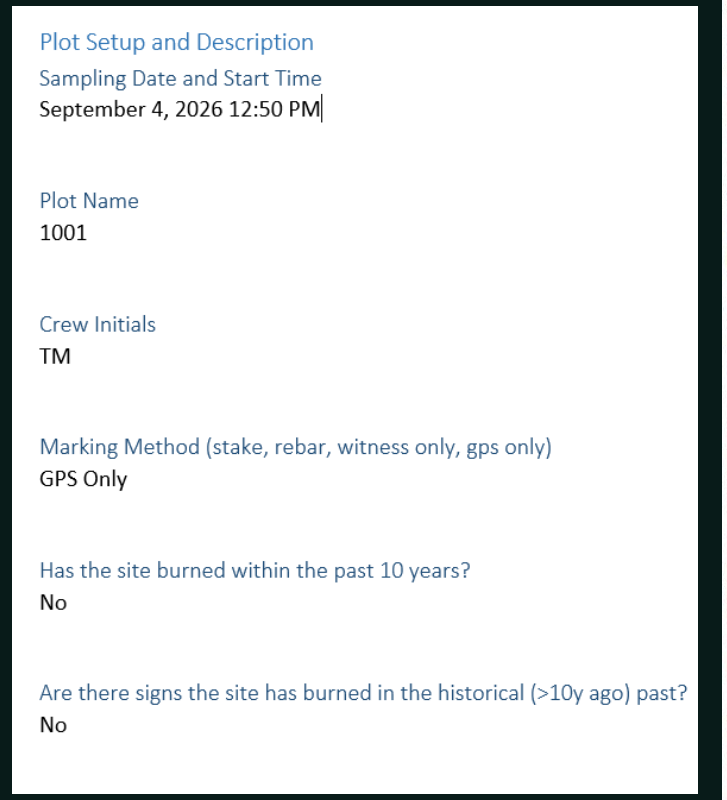
- UMRWA will use a Treatment Progress Layer, a polygon feature class in AGOL, to track treatment status in real time. As treatment is completed, the crew updates status (In Progress, Mechanically Complete, Cultural or Prescribed Fire Applied), records the date and contractor, and attaches geotagged photos. Project managers see updates immediately and it feeds into the HTML dashboard.



Implementation Examples

SURVEY123

- Long-Term Forest Trends Monitoring – Survey123 guides a two-to-three person crew through the monitoring protocol, modeled on the Santa Cruz Mountains Long Term Forest Stewardship Monitoring Program (SCMLTFSMP) protocol, capturing:
  - Plot ID and GPS Coordinates
  - Vegetation Type and seral stage
  - Tree-by-Tree tally: species, DBH size class, crown class, etc.
  - TPA and SDI
  - Canopy Cover and shrub cover by functional group along N-S and W-E transects
  - Down and dead surface fuels by class size
  - Directional photo points (N,S,E,W) for longitudinal comparison
  - Invasive Species presence, cover class, photos





How do we fund the monitoring plan?

- Problem: monitoring-specific funding sources infrequent, highly competitive
- Solution: ideally, 5-10% of MAC implementation grants $s go to monitoring
  - But even that won't fund the entire MAC monitoring plan!
  - Prioritize the monitoring plan, *Modules*:

    -Core modules: Remote-sensed data (~$160-175K annually)

    -Core + Additional modules: Remote- and field-based data (~$500K-$620K annually)

    -e.g., 5% of a $5M implementation grant is $63K for annual monitoring across a 4-year grant term.

    -Utilize modules to customize monitoring goals for individual implementation grants based on available funds and factors like treatment type, habitat, etc.

Target dates



Thank you!

Questions?







