

Cornerstone
Collaborative Forest Landscape Restoration Project
Monitoring Strategy



Compiled by ACCG Monitoring Workgroup
November 2016

Dedication

The monitoring strategy was developed by a dedicated team with diverse knowledge, technical resource skills, planning expertise, and perspectives on forest restoration and community conditions (Appendix A). Perhaps none more dedicated than *John Hofmann*.

This Monitoring Strategy is dedicated to *John Hofmann*,
for his vision and guidance;
for his quest to enhance planning, implementation and collaborative efficiencies;
for his dream of more resilient landscape and communities;
his generosity and wisdom will always be remembered.

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INTRODUCTION

Cornerstone Project Background

The Collaborative Forest Landscape Restoration (CFLR) program was established under Section 4003(a) of Title IV of the Omnibus Public Land Management Act of 2009, and reflected the premise that the best way to integrate restoration actions on National Forests was to integrate ecological, social, and economic needs. The Amador-Calaveras Consensus Group (ACCG), Cornerstone CFLR project was awarded in February 2012, with the core goal of moving landscapes towards sustainable conditions, reducing uncharacteristic wildfire, restoring a range

of ecological functions, and maintaining rural communities and livelihoods.

The 390,904 acre Cornerstone Project planning area is nested in a larger 840,316 acre ACCG all-lands planning area. The Cornerstone project has approximately 67,605 acres of restoration treatments planned (Figure 1). The all-lands area includes lands managed by the U.S. Forest Service (USFS), U.S. Bureau of Reclamation, Bureau of Land Management (BLM), State of California, industrial timberland owners, utility companies, and other private landowners. Lower elevation lands consist

largely of privately held rangelands and oak woodland, transitioning to yellow pine and mixed-conifer forest that includes sprawling residential development, small private timber holdings, and scattered BLM parcels. At mid-elevations, pine and mixed-conifer lands held by Sierra Pacific Industries dominate much of the landscape. The USFS manages a large portion of the mid and upper watersheds, including high-elevation designated wilderness (Mokelumne Wilderness).

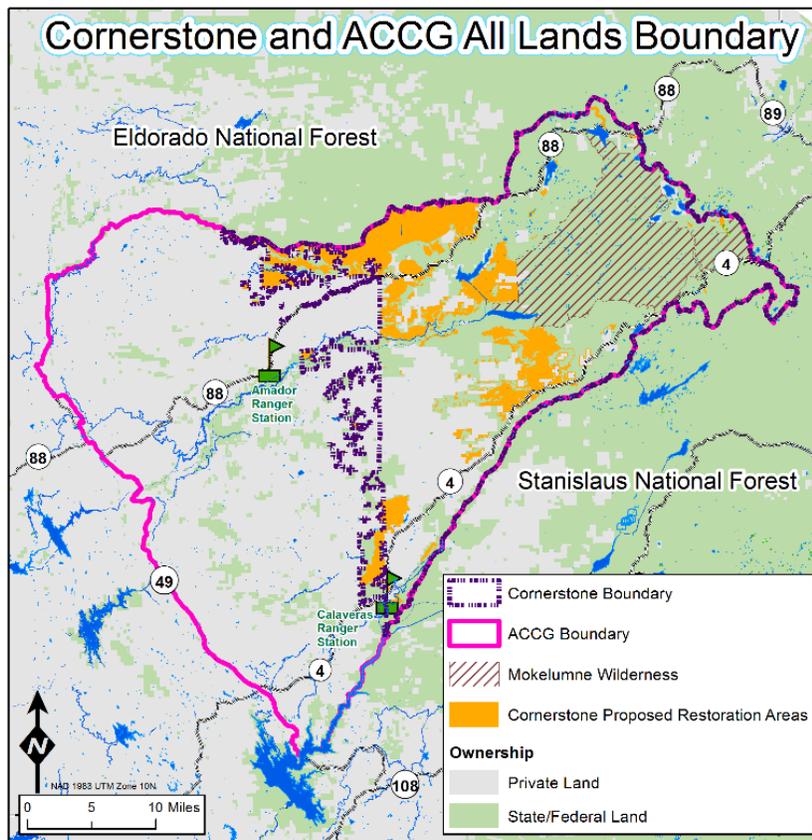


Figure 1. Cornerstone CFLR project area.

Amador, Eldorado, Calaveras, and Alpine counties in California are home to thousands of Wildland Urban Interface (WUI) residents, including Native Americans, descendants of early miners and ranchers, and families who once worked the

Amador Calaveras Consensus Group

- Amador County Veterans Organization
- Amador Firesafe Council
- Amador-Calaveras Cooperative Association for Biomass Utilization (ACCABU)
- Blue Mountain Community Renewal Council
- Blue Mountain GIS
- Buena Vista Biomass Power
- Bureau of Land Management
- CA Department of Fish and Wildlife
- CA Indian Manpower Consortium
- Calaveras Foothills Firesafe Council
- Calaveras Healthy Impact Product Solutions (CHIPS)
- Calaveras County District 2
- CalFauna
- CalFire
- Central Sierra Environmental Resource Center
- Central Sierra Resource Conservation and Development Council
- Ebbetts Pass Forest Watch
- Foothill Conservancy
- Forest Service (Eldorado & Stanislaus NF)
- Gwen Starrett
- Heissenbuttel Consulting
- John Hoffmann
- Mary Boblet
- Motherlode Job Training
- NRCS
- Pacific Gas and Electric Company
- Sierra Forest Legacy
- Sierra Nevada Conservancy
- Society of American Foresters
- Smith's Grinding
- Steve Wilensky
- The Nature Conservancy
- Vicini Brothers Green Material Recycling
- West Point Fire District

rich forest landscapes. ACCG intends to use its community-based partnerships to build social and economic capacity while restoring and maintaining the forest.

The ACCG membership is open to all stakeholders, individuals, and organizations. Current membership includes a diverse community (see side left side box and website for updated membership: <http://acconsensus.org/>) including job training agencies and organizations, county, state, and federal agencies, consultants, environmental groups, industry and utility representations, non-profit groups, and private citizens. ACCG has five workgroups: Administration, Planning, Operations, Finance and Monitoring. Work conducted in the workgroups is brought to the entire ACCG for concurrence.

The ACCG Planning Workgroup collaboratively works to develop restoration projects that are consistent with ACCG adopted triple-bottom-line principles (ecological, social, and economic benefits). The planning workgroup also involves community members and representatives of state and local agencies early in the Forest Service project planning to ensure that projects are supported by conservation, business, and Native American groups in addition to state and other federal agencies. It has served as a model for early involvement in project planning that will not only produce better projects, but will reduce conflicts and appeals. The Monitoring Workgroup was a subgroup of the Planning Workgroup. As of October 2016 the monitoring workgroup became a standalone group.

One of the requirements under the CFLR funding is to conduct ecological, economic,

and social monitoring to record the benefits and lessons learned from restoration efforts in the Cornerstone project area. Restoration and monitoring efforts are designed in a collaborative, multi-party environment. This document represents the first iteration of the Cornerstone Monitoring Strategy, a living document which was compiled through the collaborative process. This document can be revised as the monitoring process is evaluated and new information becomes available. This monitoring strategy outlines the collaborative process used to develop this strategy. This strategy covers the process that went into developing the CFLR monitoring questions from identifying current and desired conditions and defining sampling methods and data analyses to inform management actions.

CFLR National Monitoring Framework

Representatives from the initial 10 CFLR projects, the Washington Office of Forest Management, and the National Forest Foundation, among others, met in June 2011 to create a draft proposal for a national CFLR framework of outcomes and indicators. The national framework was designed to:

- Tell part of a national story about CFLR;
- Measure outcomes and indicators consistently across projects so there is valid national data;
- Regular collection and reporting of data to track work accomplished and results achieved; and
- Provide a coarse-scale picture of CFLR's impacts.

The national framework was not designed to:

- Answer research questions;
- Inform adaptive management;
- “Be all and end all” of monitoring or reporting;
- Tell the entire CFLR story; or
- Replace individual CFLR site monitoring plans.

The outcome of the workshop was “agreement” on five national outcome and indicators that met the above criteria. The five indicators include:

- Ecological
- Fire costs
- Jobs/Economics
- Leveraged Funds
- Collaboration

Monitoring and reporting direction on these indicators are described in Appendix B. The Cornerstone Monitoring Strategy was designed to address ACCG monitoring interests and concerns or unknowns related to project implementation and beyond the CFLR national monitoring framework.

Purpose of Monitoring

Monitoring the effects of treatments using repeatable measures is an essential part of landscape restoration and a core activity of an adaptive management approach (Thompson et al. 2013).

Adaptive management is the process of continually adjusting management in response to new information, knowledge, or technologies. The adaptive management cycle is illustrated in Figure 2. Goals and objectives are developed to drive management actions that transition the resource towards a desired condition. The result of management actions are monitored

to evaluate achievement towards the desired condition, to establish changes in a system and to alleviate uncertainty (Thompson et al. 2013). If the management action is not achieving the project's objectives, then management is adapted or changed and monitoring continues. Therefore, monitoring involves learning from experience and adapting activities accordingly.



Figure 2. Adaptive management process.

The Cornerstone Monitoring Strategy is designed to accommodate the adaptive management process by choosing tractable questions, identifying indicators that measure a specific attribute over time that documents changes in a specific condition, and by selecting a set of indicator target values or conditions and trigger points that would inform management action. These metrics and questions are only valuable if developed utilizing the best available

science for a particular system. The monitoring questions and indicators were formulated to evaluate achievement of the CFLR goals and Cornerstone objectives.

Monitoring is designed as a tool for leadership to use in the decision making process in a timely manner and can serve as a framework for sharing of information and coordinating efforts (Thompson et al. 2013).

Types of Monitoring

The Cornerstone monitoring strategy contains three components: implementation, collaborative, and effectiveness monitoring.

Implementation monitoring assesses actions taken relative to target outputs, and answers the question of whether or not the restoration treatments were implemented as planned. Implementation monitoring would be conducted primarily by members of the ACCG and Forest Service personnel as an ongoing, required element of project implementation.

Collaborative monitoring assesses how collaborative efforts enhanced planning and implementation efficiencies. Collaboration monitoring indicates the efficacy of the all lands process to planning and implementing projects.

Effectiveness monitoring can be defined as measurable changes in specific conditions relative to desired outcomes. Effectiveness monitoring would utilize citizens, agency staff, and partner organizations to identify and collect relevant information on treatment effects that would provide immediate feedback as well as showing the long-term trajectory of restoration (DeLuca et al. 2010). Three categories of effectiveness monitoring would be

conducted throughout the duration of the Cornerstone project: ecological, social, and economic monitoring.

MONITORING STRATEGY PROCESS

The Cornerstone Monitoring Strategy should be considered a dynamic document, and would be updated as new information becomes available or new projects are pursued. The Cornerstone CFLR began with the identification of undesirable current landscape and watershed conditions and short-comings in the social and economic aspects of the communities within the Cornerstone area. CFLR goals and Cornerstone objectives were designed to guide management towards desired conditions through the implementation of management actions. Monitoring management actions is directed through defining appropriate questions, indicators, conditions, and thresholds. Determining data collection methods, where to monitor, when to monitor, and data analysis and interpretation constraints further define the monitoring program. Each step in Figure 3 is discussed below.

Current Conditions

The Mokelumne watershed provides municipal water for more than 1.4 million East Bay area residents (Buckley et al. 2014). In addition to producing high-quality water for agricultural and urban domestic and industrial uses, the watersheds in the Cornerstone project area, including the Mokelumne watershed, provide habitat for state and federal threatened, endangered, candidate and sensitive wildlife, including



Figure 3. Steps used to create the Cornerstone Monitoring Strategy.

the valley elderberry longhorn beetle, California red-legged frog, Sierra Nevada yellow-legged frog, foothill yellow-legged frog, Yosemite toad, California spotted owl, American marten and willow flycatcher.



Sensitive species are common in the Cornerstone area

In Cornerstone, frequent fire was common prior to Euroamerican settlement. According to the Fire Return Interval Departure database maintained by the US Forest Service Region 5, 65% of the area would have on average experienced fire every 11-20 years, 31% of the area would have experienced fire every 25-50 years, 2% of the area would experience fire every 51-100 years and less than 2% of the area would have experienced infrequent fire at a length of 150 years or longer (Safford and Van de Water 2014). Eighty-one percent of the area is characterized as extremely departed (>66%) from historic fire regimes which means that the majority of Cornerstone is burning less than pre-Euroamerican settlement.

This departure means that the area is characterized by high fuel loads and a high risk of uncharacteristic fire (Buckley et al. 2014). The area also has experienced large, stand-altering fire, which unless mitigated, will continue into the future, potentially exacerbated by the effects of climate change (Westerling et al. 2006). Fires such as these pose a significant risk to watershed function and biodiversity and threaten lives, property, water quality, and cultural resources.



Changes in stand composition and density as a result of fire exclusion.

Past fires have resulted in a shift in seral stage from mixed conifer forest to chaparral in areas that burned at high severity. These areas are predisposed to burning at high severity in the future, prompting a potential type conversion (Coppoletta, Merriam and Collins 2016). In addition, the overall exclusion of fire across this landscape has transformed from shade intolerant to shade tolerant species through development of non-natural, overly dense stands (Collins, Everett and Stephens 2011). This change greatly increases the risk of uncharacteristic fire, which can be particularly concerning in local communities within the WUI (Buckley et al. 2014).

The forested mountain and foothill landscapes in the Cornerstone project area include historic and active Miwok and Washoe cultural sites. These watersheds have served as the region's socio-economic foundation for thousands of years. Before the 1849 California Gold Rush, the native

Miwok and Washoe people employed fire as a management tool as they moved seasonally through the watershed and lived sustainably on its rich abundance of plants,



Evidence of historic fire is present in the Cornerstone area where trees have scars from past fires

fish, and other animals (Anderson and Moratto 1996). After the Gold Rush, cattle ranchers continued to employ fire. As settlement expanded, fire was excluded as timber harvest dominated forest management and urban sprawl brought more residents to the WUI. Over time, these forests have decreased in fire resiliency and have become less fire-resistant and resources are more at risk.

The watersheds are also home to thousands of WUI residents, many of whom struggle with poverty in part by the near-collapse of the local timber industry. Cornerstone communities suffer unemployment rates more than twice the national and state

averages, with accompanying stresses that have frayed the social fabric. Consequently, the ACCG's guiding principles recognize that an All-Lands forest strategy must be grounded in locally based economic activity, local markets, and local jobs that can be sustained for years to come.

CFLR Goals and Cornerstone Objectives

Congress required each CFLR proposal to include how each project would address specified goals listed under Section 4003(c) of Title IV of the Omnibus Public Land Management Act of 2009 (Table 1, 2, and 3). Cornerstone objectives are tailored to the specific needs of the ecological, social, and economic needs of the Cornerstone project area. Objectives are specific to each community type/feature and are measureable to insure actions will follow the triple-bottom-line (TBL), an accounting framework that incorporates three dimensions of performance/sustainability: social, economic, and environmental.

Table 1. CFLR Goals, Cornerstone objectives and their future desired conditions for each ecological effectiveness monitoring community type/feature.

CFLR Goals	Cornerstone Objectives	Community Type/Feature	Desired Condition
<p>(1) Reduce the risk of uncharacteristic wildfire, including through the use of fire for ecological restoration and maintenance and reestablishing natural fire regimes, where appropriate (Legislation: Sec. 4003 (c) (3) (A)).</p>	<p>(1.1) Transition toward a more characteristic fire regime by restoring a landscape that is more consistent with a frequent fire regime.</p>	<p>Fire and Fuels</p>	<p>Forest structure and condition allow fires to burn in a mosaic of low and mixed severity within the range of their natural variability and result in the reduction of threats to human life and property loss.</p>
	<p>(1.2) Increase the pace and scale of prescribed or natural fire for multiple resource benefits.</p>		
	<p>(1.3) Transition toward a resilient and diverse forest species composition and structure following large scale, stand replacing disturbance events.</p>		
<p>(2) Fully maintains, or contributes toward the restoration of, the structure and composition of old-growth conditions characteristic of the forest type, taking into account the contribution of the stand to landscape fire adaptation and watershed health and retaining the large trees contributing to old growth structure (Legislation: Sec. 4003 (c) (1)(D)).</p>	<p>(2.1) Create resilient forest communities by developing a mosaic of forest density, size and age classes.</p>	<p>Sensitive Plants</p>	<p>Forest structure, function, and ecological processes promote aquatic and terrestrial health, biological diversity, and habitat for a variety of native species, especially Forest Service sensitive species.</p>
		<p>Terrestrial Wildlife</p>	
		<p>Aquatic Wildlife</p>	
		<p>Conifer Forested Communities</p>	
		<p>Hardwoods</p>	
<p>(3) Improve fish and wildlife habitat, including for endangered, threatened, and sensitive species (Legislation: Sec. 4003 (c) (3)(B)).</p>	<p>(3.1) Maintain and enhance forest structure and understory plant communities, function and ecological processes to promote aquatic and terrestrial health, biological diversity, and habitat for a variety of native species, especially species at risk.</p>	<p>Sensitive Plants</p>	<p>Forest structure, function, and ecological processes promote aquatic and terrestrial health, biological diversity, and habitat for a variety of native species, especially Forest Service sensitive species.</p>
		<p>Terrestrial Wildlife</p>	
		<p>Aquatic Wildlife</p>	
		<p>Conifer Forested Communities</p>	
		<p>Hardwoods</p>	

CFLR Goals	Cornerstone Objectives	Community Type/Feature	Desired Condition
<p>(4) Maintain or improve water quality and watershed function (Legislation: Sec. 4003 (c) (3)(C)).</p>	<p>(4.1) Maintain and enhance watershed functions of Special Aquatic Features.</p>	<p>Riparian and Special Aquatic Features</p>	<p>Water quality, quantity (yield), and sequestration (timing and duration of runoff) are maintained or improved for human and wildlife use. Stressors to watershed conditions are minimized and watersheds outputs meet state and federal water quality objectives.</p>
	<p>(4.2) Maintain or improve soil and landscape attributes characteristic of features that reduce the risk of sedimentation or other water quality stressors.</p>	<p>Watershed</p>	
		<p>Aquatic Wildlife</p>	
<p>(5) Prevent, remediate, or control invasions of exotic species (Legislation: Sec. 4003 (c) (3)(D)).</p>	<p>(5.1) Prevent, remediate, or control invasions of invasive/noxious species.</p>	<p>Aquatic Wildlife (Invasives) Noxious/Invasive Plants</p>	<p>The cover, abundance, and extent of noxious/invasive plants and the extent and abundance of aquatic invasive animal species remain stable or are reduced to levels that are not influencing native biodiversity.</p>
<p>(6) Maintain, decommission, and rehabilitate roads and trails (Legislation: Sec. 4003 (c) (3)(E)).</p>	<p>(6.1) Maintain, decommission, and rehabilitate roads to standard.</p>	<p>Soils</p>	<p>Soil and landscape attributes have features that reduce the risk of sedimentation or other water quality stressors and that control/prevent erosion to improve or maintain soil productivity and hydrologic function.</p>
	<p>(6.2) Construct, maintain, decommission, and rehabilitate trails to standard.</p>		
<p>(7) Facilitates the reduction of wildfire management costs, including through reestablishing natural fire regimes and reducing the risk of uncharacteristic wildfire (Legislation: Sec. 4001 (3)).</p>	<p>(7.1) Reduce suppression costs by reducing the risk of uncharacteristic fire, threats to lives and property, and by encouraging the restoration of lands outside the CFLRP planning area to reduce the risk of wildfire spread.</p>	<p>Fire and Fuels</p>	<p>Forest structure and condition allow fires to burn in a mosaic of low and mixed severity within the range of their natural variability and result in the reduction of threats to human life and property loss.</p>

Table 2. CFLR Goals, Cornerstone objectives and their future desired conditions for monitoring social and economic outcomes.

CFLR Goals	Cornerstone Objectives	Community Type/Feature	Desired Condition
<p>(8) Use woody biomass and small-diameter trees produced from projects implementing the strategy (Legislation: Sec. 4003 (c) (3)(F)).</p>	<p>(8.1) Maintain or enhance infrastructure to utilize woody biomass such as: energy and heating, soil amendments, compost, landscaping chips, firewood, animal bedding, sawlogs, designer fencing, agricultural and architectural posts and poles, furniture wood, wood pellets, non-timber forest products.</p>	<p>Economic</p>	<p>Local economies have benefitted by providing local sustainable employment or training opportunities through contracts, grants, or agreements for restoration, planning, design, implementation, or monitoring.</p>
	<p>(9.1) Create, maintain, and enhance sustainable local economic activity based on restoration treatment work through project design and implementation that is consistent with the triple-bottom-line emphasis.</p> <hr/> <p>(9.2) Create sustainable local, restoration stewardship-related economic activity and local jobs based on restoration treatment work and development of diverse woody biomass and small-diameter tree by-products and local markets, consistent with the triple-bottom-line emphasis on coordinating improvements to the local environment, community and economy.</p>		<p>Local communities are healthy due to an increased number of available activities resultant from restoration on public and private land. Local youths are more educated on forest resources through presented learning activities and volunteer programs.</p>
<p>(9) Benefit local economies by providing local employment or training opportunities through contracts, grants, or agreements for restoration planning, design, implementation, or monitoring (Legislation: Sec. 4003 (c) (7)).</p>	<p>(9.3) Maintain and enhance local contractor completeness and success in obtaining contracts and employment.</p>	<p>Economic</p>	<p>Local economies have benefitted by providing local sustainable employment or training opportunities through contracts, grants, or agreements for restoration, planning, design, implementation, or monitoring.</p>
	<p>(9.4) Maintain and enhance forest employment of local residents to forge multi-generational relationships with the forest landscape.</p>		<p>Local economies have benefitted by providing local sustainable employment or training opportunities through contracts, grants, or agreements for restoration, planning, design, implementation, or monitoring.</p>
	<p>(9.5) Enhance youth forest resource education through activities, interaction, and volunteerism.</p>		<p>Prehistoric, historic, and active cultural sites and resources are maintained, restored, and protected.</p>
	<p>(9.6) Maintain, enhance, and protect native cultural and historic sites and practices.</p>	<p>Social</p>	<p>Prehistoric, historic, and active cultural sites and resources are maintained, restored, and protected.</p>

Table 3. CFLR Goals, Cornerstone objectives, and their future desired conditions for monitoring the Collaboration’s planning and implementation efficiencies.

CFLR Goals	Cornerstone Objectives	Community Type/Feature	Desired Condition
<p>(10) A collaborative forest landscape restoration proposal shall be developed and implemented through a collaborative process that includes multiple interested persons representing diverse interests and is transparent and nonexclusive (Legislation: Sec. 4003(c) (2) (A)).</p>	<p>(10.1) Collaboratively involve the diverse ACCG interests in project planning, implementation, monitoring and adaptive management.</p> <hr/> <p>(10.2) Demonstrate the benefits of collaborative resource management in the region.</p>	<p>Collaboration</p>	<p>A collaboration exists among private, non-profit, local, state, and federal entities to enhance planning and implementation efficiencies that sustain an increased pace, scale, and quality concerning forest restoration practices and the building of fire-safe communities through trust and partnerships while sustaining local economies.</p>

Management Actions

In the Cornerstone project proposal, land management actions were identified that would transition the landscape from the current condition towards a desired condition. Specific acres were proposed to be accomplished within the 10 year time frame of the project (Table 4).

Table 4. Management actions and expected accomplishments listed in the Cornerstone Project proposal.

Proposed Management Actions	Expected Accomplishment	Units
<i>Watershed Improvement</i>		
Acres of water or soil resources protected, maintained or improved to achieve desired watershed conditions	930	Acres
Number of stream crossings constructed or reconstructed to provide for aquatic organism passage	10	Number
<i>Habitat Improvement</i>		
Acres of lake habitat restored or enhanced	32	Acres
Miles of stream habitat restored or enhanced	6.5	Miles
Acres of terrestrial habitat restored or enhanced	3,820	Acres
Acres of noxious weeds and invasive plants managed	5,480	Acres
Acres of rangeland vegetation improved	72	Acres
Acres of restored culturally sensitive sites	400	Acres
<i>Road and Trail Improvements</i>		
Miles of road decommissioned	5	Miles
Miles of high clearance system road improved	84	Miles
Miles of high clearance system roads receiving maintenance	84	Miles
Miles of passenger car system roads improved	132	Miles
Miles of passenger car system roads receiving maintenance	482	Miles
Miles of system trail maintained to standard	200	Miles
Miles of system trail improved to standard	50	Miles
<i>Forest Improvements</i>		
Green tons from small diameter and low value trees removed from NFS lands and made available for bioenergy production	66,403	Tons
Acres of forest vegetation established	8,620	Acres
Acres of forest vegetation improved	13,117	Acres
Acres of forestlands treated using timber sales	14,442	Acres
Volume of timber sold (CCF)	143,305	CCF
<i>Fuel Treatments</i>		
Acres of hazardous fuels treated outside the wildland/urban interface (WUI) to reduce the risk of catastrophic wildland fire	21,952	Acres
Acres of hazardous fuels treated inside the wildland/urban interface (WUI) to reduce the risk of catastrophic wildland fire	11,317	Acres
Acres treated with prescribed fire	33,000	Acres
<i>Inventory and Monitoring</i>		
Miles of property line marked/maintained to standard	15	Miles

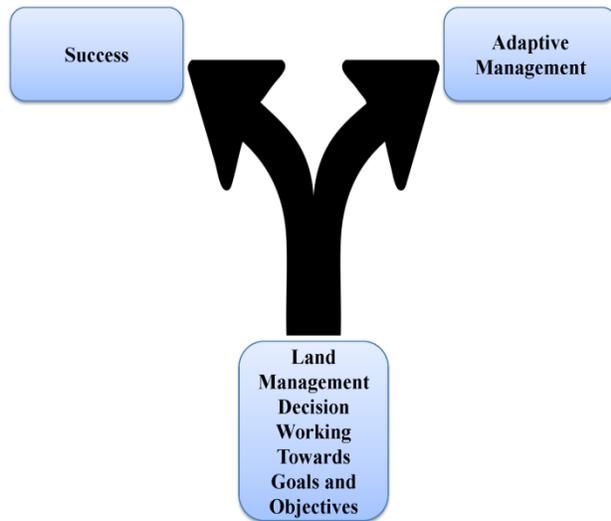


Figure 4. Thresholds are decision points to determine if adaptive management is needed.

Monitoring Questions

Monitoring questions articulate the main issues to be explored through project or program monitoring efforts. Questions are developed after the goals and objectives have been decided and the management actions that support objectives have been determined. Monitoring questions:

- Focus and provide structure to the monitoring program;
- Address information gaps, issues, concerns, or uncertain management outcomes;
- Relate to making sound conclusions regarding CFLR goals and Cornerstone objectives and desire conditions;
- Guide the monitoring process, including data gathering and assessment; and
- Inform how monitoring results will be incorporated back into planning and implementation of future projects.

Monitoring questions were developed by the ACCG Monitoring work group through a collaborative process. The workgroup started with a broad array of questions, and

then narrowed those to a subset of questions relevant to ACCG and the Cornerstone project. A week-long monitoring workshop focused on developing sound questions, indicators, and target conditions. Participants are listed in Appendix A.

Indicators

An “indicator” is the specific attribute measured over time that documents changes in a specific condition. The indicator is what would be measured to address the question. Most useful indicators are expressed in specific terms and measure aspects of the goal that people care about.

Target Condition

Target condition is a description of the post-treatment condition of the indicator that the monitoring program is attempting to explain, predict, or modify.

Threshold

The threshold provides a decision point to inform whether management decisions are working toward the goals and objectives, or if an adaptive management change is needed (Figure 4). Thresholds should be derived from the scientific literature, Forest Standards and Guides, and professional knowledge.

Items to consider in identifying thresholds and the appropriate post-treatment data collection time intervals include:

- Periods during the year when indicator sensitivity to change is highest;
- Indicator response time to treatment (lag time?);
- How precise the estimates need to be to make a decision;
 - The need to clearly define trend;

- Cause-and-effect relationship or correlated relationship;
- Current knowledge base (uncertain outcomes).

Spatial and Temporal

The “where” and “when” to monitor are critical components of a monitoring program. However, describing the spatial and temporal perspectives in a monitoring strategy can be challenging, especially when designing a landscape monitoring program. Large landscapes have varying existing and desired conditions and likely have multiple goals and objectives based on their management needs. Likewise, management actions may have varying degrees of known outcomes or cause and effect relationships, depending on the heterogeneity associated with project treatment areas.

Our changing environment also limits our ability to fully understand where all known treatment areas across the Cornerstone landscape or within the all-lands boundary would occur. Likewise, we typically do not have a full understanding of which management actions will be implemented and what their effects will be to resources prior to the National Environmental Policy Act (NEPA) project planning process.

Monitoring activities would be conducted both prior to treatment initiation (to establish baseline status) and across post treatment time periods at appropriate intervals to determine the response of various conditions.

Spatial and temporal constraints and considerations were discussed during the Cornerstone Monitoring Strategy development. The appropriate spatial and temporal monitoring associated with

effectiveness monitoring is contained in the project specific monitoring plans.

Sampling Methods

Both qualitative and quantitative data gathering methods can be used to estimate the results of a treatment or outcome. The complexity and interconnectedness of ecological systems, combined with technological and financial limitations, makes a complete understanding of all the components and linkages between a management action and resource outcome virtually impossible, during the timeframe of this project.

The data collection rigor needs to be at a level sufficient to answer the monitoring question and inform adaptive management procedures. Some questions may only require qualitative assessments of indicators to understand management outcomes, while other topics may have a greater amount of uncertainty and require quantitative assessments with adequate statistical power. Of course, there is a tradeoff between data collection rigor and cost (Figure 5). Qualitative assessments are typically cheaper to implement. As such, a monitoring program with limited resources may be able to address additional questions compared to a monitoring program based on quantitative measurements, but may carry a greater amount of uncertainty associated with adaptive management decisions.

There are a variety of established ecological data collection protocols, both qualitative and quantitative, used by the Forest Service including Common Stand Exams (CSE), Stream Condition Inventory (SCI), Proper Functioning Condition (PFC), Best Management Practices (BMPs), Cultural Resources, and Soil Disturbance, among others. Data collection protocols incorporate a variety of plot, line, or point based sampling. The monitoring workgroup and Forest Service specialists identified applicable sampling protocols and methods for each question. Sampling protocols should be updated as new information becomes available, but updates should not affect the comparison between pre- and post-implementation data.

There are a number of assessment tools that may provide insight into project related outcomes. One of the most popular qualitative techniques used is photographs. Photographs are a central part of monitoring projects and can be used to help interpret or demonstrate statistical differences, and/or they can be the primary qualitative monitoring method. Two general photographic approaches are

common. Photo plots are photographs of a defined small area (a plot), usually the size of the photograph frame or slightly smaller. Photos are usually taken from above at a specified height. Photo points are landscape or feature photographs retaken each time from the same spot and filling the same frame so that differences between years can be visually compared. The value of photo plots or points is that they provide a visual permanent record of the past and they allow for factors to be evaluated that might not have been considered when the monitoring was initiated. Other qualitative examples of monitoring are presented in Appendix C.

Another method to conduct monitoring is to use quantitative methods. This type of monitoring collects information that can be directly measured and then compared to other results. One example would be to track a metric before and after treatment such as canopy cover of a forested system. These values would then be compared to the natural range of variation to determine how the treatments have shifted this value. Other examples can be found in Appendix D. Other applicable qualitative and

Monitoring Rigor and Cost

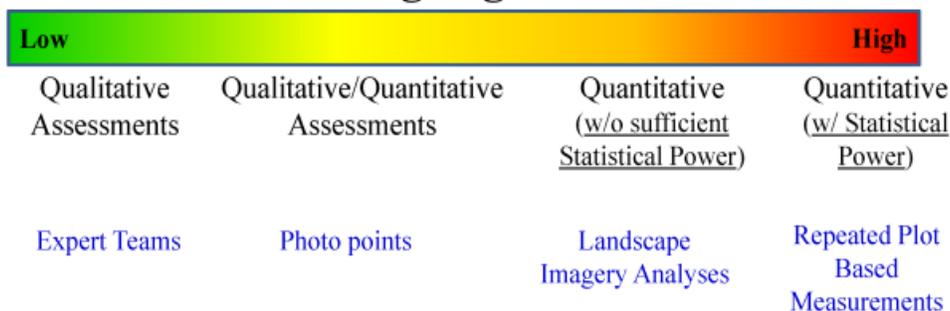


Figure 5. Data collection rigor and cost considerations for monitoring programs.

quantitative methods are described in Elzinga et al. (1998), Thompson, (1992), Bonham (1989), and Welch et al. (2014), among others.

Data Analyses and Interpretation

Qualitative data cannot be analyzed statistically. Data interpretation would rely on visual trends in environmental conditions or qualitative factors, or graphs of qualitative data where numbers of classes were recorded.

Statistical analyses are very important to quantitative monitoring. They enable us to make management decisions when we only have access to part of the information. For example, we may want to better understand how a management action affected a plant population. However, because the area is large, or there is limited resources to count every plant, the best we can do is take a random sample of quadrats or plots within this area and estimate the total number of plants from this sample. The use of statistics enables us to derive an unbiased estimate of the population and, more importantly, assess how good the estimate is (estimate of the variability).

The statistical test chosen does not have to be complicated, but should match the data (data collection method) and objectives. For example, one simple approach is to calculate sample statistics and confidence intervals in each year of data collection and graph these using bars or point graphs with the confidence intervals as error bars. The sample statistic (e.g., mean) and confidence interval of each sample would be compared to the target or threshold to determine if adaptive management is necessary or if the objective has been reached.

There are a variety of guides that offer statistical analyses information, including Elzinga et al. (1998), Zar (1984), Bonham (1989), and Welch et al. (Welch et al. 2014), among others. Additional information can be found in Appendices C and D.

Data Storage

The Cornerstone monitoring program will generate volumes of data that need to be collected and stored so that multiple people can effectively evaluate the data. As such, data that is normally stored in Forest Service databases such as Forest Vegetation Simulator (FVS), will need to be exported to a file format supported by most databases or data analysis programs. Several suggested file formats are Microsoft Excel®, or Microsoft Access. The data format, storage path, and data stewards should be designated in the project specific monitoring plans. Monitoring data may be housed in a centralized location as identified by the ACCG Monitoring Workgroup and maintained by the monitoring coordinator(s).

Monitoring Responsibility

The monitoring strategy was developed by a team with diverse knowledge, technical resource skills, planning expertise, and perspectives on forest restoration and community conditions (Appendix A).

This multiparty effort will continue as ACCG evaluates the Implementation, Ecological, Social, Economic, and Collaborative actions associated with the Cornerstone CFLR project. Specific multiparty monitoring responsibilities are identified in project specific monitoring plans, implementation and collaborative monitoring templates, and the social/economic monitoring templates.

Monitoring questions should be evaluated and compared to the available budget to prioritize on the ground monitoring.

MONITORING FOCUS AND CONSIDERATIONS

A wide array of monitoring questions were identified and discussed by the monitoring workgroup. The monitoring workgroup narrowed the spectrum of monitoring questions to 41 (Table 5). The workgroup recognized the need to prioritize limited monitoring resources; therefore, the 30 ecological effectiveness monitoring questions were prioritized into priority tiers resulting in 15 questions in the top two priorities (Table 6).

Tier 1: Core questions to address.
Monitoring would be funded by Cornerstone dollars when feasible.

Tier 2: Core questions to address.
Monitoring would be funded by other means (existing programs, grants, volunteers, etc...). Funding

Table 5. Number of monitoring questions by monitoring type.

Monitoring Perspective	# of Monitoring Questions
Ecological Effectiveness	30
Implementation	1
Collaboration	4
Social/Economic	6
Total	41

or responsible monitoring parties were identified for these questions.

Tier 3: Secondary monitoring questions to address once funding is identified.

Tier 4: Secondary questions that would provide valuable information, but are likely not needed for adaptive management and would require expensive data collection methodologies or rely on a large scale disturbance prior to monitoring.

Table 6. Ecological effectiveness questions by priority tier.

<i>Discipline</i>	Number of Questions			
	<i>Tier 1</i>	<i>Tier 2</i>	<i>Tier 3</i>	<i>Tier 4</i>
Aquatic Wildlife	1		2	
Conifer Forested Communities	2	1	1	
Cultural Resource	1	1	2	1
Fire and Fuels	2			1
Hardwoods	1			
Noxious/Invasive Plants	1		1	
Riparian and Special Aquatic Features	1			1
Sensitive Plants	1		1	
Soils		1	1	
Terrestrial Wildlife	1		1	
Watershed	1		3	
Total	12	3	12	3

Ecological Effectiveness

Additional prioritization of ecological effectiveness questions may be necessary to adapt to changing or new priorities. For example, controversial issues or value statements identified by ACCG could be used to prioritize limited resources.

Current controversial issues includes:

- Herbicide applications,
- Red fir health and management,
- Plantation management and heterogeneity,
- Harvest of large trees,
- Spotted owl habitat management,
- Roads,
- Riparian treatments.

Potential additional criteria to prioritize monitoring effort includes:

- Monitoring questions or indicators for valued resource (sensitive species/habitat/cultural);
- Questions that fill information gaps;
- Areas without outside factors that may influence the monitoring results;
- Data collection method that may answer multiple monitoring questions;
- Monitoring costs, qualitative methods that could replace quantitative methods;

Implementation and Collaborative

The methods and analyses described in the Monitoring Strategy Process section above may apply to all monitoring categories, although the process was developed to primarily address ecological effectiveness monitoring. For example, assessing whether a project was implemented as planned requires a qualitative review of the NEPA document, contract specifications, and on-the-ground review of key locations.

Data analysis and interpretation is qualitatively driven.

Likewise, assessments regarding how ACCG enhances planning and implementation efficiencies (Collaborative Monitoring) relies on the interpretation of non-random data collection of information. As such, data interpretation is also qualitative in nature.

Social/Economic

The CFLR program reflects the premise that the best way to integrate restoration actions on National Forests is to integrate ecological, social and economic needs. The Cornerstone was awarded with the core goal of moving landscapes towards sustainable ecological conditions and restoring and maintaining rural communities and livelihoods.

Evaluating cause and effect of social or economic outcomes from relatively small scale projects is somewhat tenuous. Communities in the Cornerstone project area are dispersed and small, and social and economic influences occur at scales across the nation, state, and county that are independent of Cornerstone projects. Likewise, sampling these communities through a random sampling procedure to achieve some statistical comparisons is not practical. Likewise indicators that can be tied to project implementation (e.g., number of people hired) have a short temporal scale that is difficult to detect in most affordable social/economic monitoring programs.

As such, the effectiveness of Cornerstone projects on improving the social or economic status of communities in Amador and Calaveras counties will be qualitatively assessed using non-randomly collected numeric data.

MONITORING MATRICES

The monitoring matrices host the core information for the monitoring program, including the monitoring question and associated Cornerstone objective, indicators to be measured, indicator target condition, and adaptive management threshold, and data sampling methods (Table 7, 8, 9, 10, 11, and 12). For some matrices, spatial considerations and sampling guidelines are provided. Specific information regarding the spatial temporal, sampling methods, data analysis and storage, and monitoring responsibility is contained in the Project Specific Monitoring Plans.

Implementation Monitoring

Implementation monitoring matrix questions were narrowed to one that

highlighted if and how a project was implemented (Table 7). These questions are dependent on where there are issues that the collaborative has identified as associated with ongoing projects. Sampling methods are organized field visits to qualitatively assess implementation effectiveness.

Ecological Effectiveness Monitoring

Ecological effectiveness monitoring questions were developed through a process that was described in the sections above. The matrix that is provided below (Table 8) organizes the questions by Priority Tier and community type and represent an exhaustive list developed collaboratively in the ACCG monitoring group

Table 7. Cornerstone project implementation monitoring questions.

Num ¹	Obj ²	Questions	Indicators	Spatial	Sampling Methods
1	10.2	Was project implemented as planned?	<ul style="list-style-type: none"> Implementation compared to planning 	Where ACCG has questions about implementation and where controversial issues occur	<ul style="list-style-type: none"> Field visit

¹ Num refers to the question number.

² Obj refers to the Cornerstone objective number provided in Table 1.

Table 8. Cornerstone ecological effectiveness monitoring questions, indicators, and thresholds.

Num ¹	Tier ²	Obj ³	Community Type	Questions	Indicators	Target Condition	Thresholds
2	1	3.1, 4.1	Aquatic Wildlife	Did the quality/quantity of habitat for Threatened and Endangered and Forest Service Sensitive and other desired species change?	Water temperature; Canopy cover; Fine sediment pool depths; Large woody debris; Stream bank disturbance; Connectivity between suitable habitat	Maintain or improve quality/quantity of habitat for TES and other desired species	Declining quality/ quantity of habitat for TES and other desired species
5	1	1.1, 1.3, 3.1	Conifer Forested Communities	How did treatments affect basal area and canopy cover in canyons and slopes with north-facing aspects compared to ridges and slopes with south-facing aspects?	Basal Area; Stratified canopy cover	Basal area and canopy cover values vary according to aspect and topographic position	No difference in basal area and canopy cover based on aspect and topographic position
6	1	2.1	Conifer Forested Communities	How did treatments affect the tree density and species composition in all size classes?	Basal Area; Trees per acre by size class; Species	Increase in stand heterogeneity in terms of tree species and size class distribution	Stable or decrease stand heterogeneity in terms of tree species and size class distribution
8	1	9.4	Cultural Resource	How did focus treatments improve cultural resource conditions?	Condition of cultural resource	Improved from current condition	No or negative change
13	1	1.1, 1.2, 1.3	Fire and Fuels	How did fuel treatments meet the project goals and objectives?	Treatment monitoring (fuel loading, height to live crown, mortality, canopy bulk density, WUI indicators: acres treated)	Met burn plan objectives, modeled flame lengths 4' or less	Less than 4' modeled flame lengths, within 5% of ranges in burn plan
14	1	1.1, 1.3, 7.1	Fire and Fuels	Will fuel treatments result in future fire behavior consistent with the natural range of variability (size, frequency, pattern, severity)?	Modeled fire behavior; Observed actual fire behavior; Fire Size	Decreased total modeled high severity acres, reduced average fire size on suppression fires (10 yr avg. landscape)	Greater than or equal to modeled high severity fire acres post treatment, less than average fire size on suppression fires
16	1	1.1, 3.1	Hardwoods	Did project activities improve growing conditions for hardwoods?	Density and range of size of hardwoods; Crown position (dominant trees)	Multiple size/age classes, increased density (project)	Minimum 2 age/size classes, greater than existing

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Num ¹	Tier ²	Obj ³	Community Type	Questions	Indicators	Target Condition	Thresholds
17	1	5.1	Noxious/ Invasive	Have target invasive plant populations been reduced?	Percent cover; Abundance; Extent	Reduction in cover and/or abundance, and/or extent	Increase in target species cover, frequency, or extent after 5 years of treatment
19	1	3.1, 4.1, 4.2	Riparian and Aquatic Features	To what degree did the project move Special Aquatic Features or riparian corridors to desired conditions and maintain/improve hydrologic and ecosystem function?	Flood plain connectivity; Herbaceous plant community (cover and vigor); Bank disturbance; Water table alteration (eg. rooting zone utilization); Extent; Percent ground	Maintain or improve Special Aquatic Features desired hydrologic and ecosystem function	Declining hydrologic and ecosystem function and Special Aquatic Features
21	1	3.1	Sensitive Plants	Did restoration treatments or other disturbance result in a change in habitat suitability for sensitive plant species?	Amount of suitable habitat	Suitable habitats remain intact or increase in suitability	Decrease in habitat suitability extent
25	1	3.1, 3.2	Terrestrial Wildlife	Did forest treatments impact habitat of mature Forest Sensitive species across projects?	Habitat quality would infer occupancy or detection probability; Canopy closure; Downed logs; Snags; Habitat heterogeneity; Nesting/roosting/den sites (maintain or enhance large trees, defect trees); Species occupancy	Habitat condition statement from Forest Plan, or best available science	Amount, extent, connectivity, of suitable mature forest is maintained or increased
27	1	4.2, 6.1	Watershed	To what extent are best management practices effective in protecting soil and water resources for Cornerstone management activities?	Regional and national BMP evaluations	Meets state water quality objectives, maintain/improve watershed condition	Not meeting state water quality objectives, decline in watershed condition classification

Num ¹	Tier ²	Obj ³	Community Type	Questions	Indicators	Target Condition	Thresholds
4	2	1.3, 2.1	Conifer Forested Communities	Did plantation treatments encourage a structure consistent with a more resilient forest stand (variable spacing designed to maintain the individual, clump and opening pattern, a desired future tree density consistent with historic forest conditions and moderate levels of shrub cover)?	Density and size of trees; Spacing of trees; Successional conditions	Variable density (40 – 120 trees/acre) by topographic location with groups of 2-8 trees intermixed with 10-35% shrubs and individual trees	Not meeting target condition
9	2	9.4	Cultural Resource	Did restoration and conservation actions protect cultural resources from disturbance?	Condition of cultural resource	Maintain current condition	Negative change in cultural resource
23	2	2.1, 3.1, 4.2	Soils	Are levels of detrimental soil disturbance and erosion increasing or decreasing with project treatments?	Soil erosion; Soil compaction; Displacement; Ground cover	Maintain/decrease detrimental levels of soil disturbance and erosion	Maintain levels of detrimental soil disturbance at <=15% of treatment area, or within applicable forest plan standard
3	3	3.1	Aquatic Wildlife	Did the local abundance/distribution of TE and FS Sensitive and other desired species change?	Change in localized abundance and/or localized distribution	Maintain/increase in abundance and distribution	Decline in abundance and distribution
1	3	3.1, 5.1	Aquatic Wildlife	Did the status of undesired species change?	Change in localized abundance and/or distribution of undesired species	Decrease in localized abundance and distribution of undesired species	Increase or stable in abundance and distribution
7	3	2.1, 3.1	Conifer Forested Communities	Were treatments successful in promoting diverse plant forms or species of plants?	Presence of desired understory plant life forms (grasses, shrubs, forbs, etc) or species	Multiple plant life forms or species are present at higher prevalence than pre-treatment	Less than or equal presence of desired understory plant life forms or species
10	3	9.4	Cultural Resource	How did project actions protect, promote, and make accessible species with ethnobotanical importance?	Abundance; Vigor; Sustainability; Accessibility	Greater abundance, increased vigor, promote sustainability, appropriate accessibility	Reduced abundance, decreased vigor, reduced sustainability, accessibility outside of appropriate level

Cornerstone CFLR Monitoring Strategy 2016

Num ¹	Tier ²	Obj ³	Community Type	Questions	Indicators	Target Condition	Thresholds
11	3	9.4	Cultural Resource	Did vegetation treatments result in increased connectivity between cultural landscapes?	Percent change in landscape connectivity	Fully connected	Decrease in connectivity
18	3	5.1	Noxious/ Invasive	Are target invasive plants spreading throughout the Cornerstone area?	Number of new target plant populations located	Protocol surveys completed in high risk areas are not detecting new populations	Surveys in high risk areas are detecting new populations
22	3	3.1	Sensitive Plants	Did restoration treatments or other disturbance result in a change in population size of sensitive plant species?	Relative abundance of sensitive plant; Localized distribution; Extent	Promote or maintain sensitive plant populations	Decrease in abundance and/or localized distribution
24	3	2.1, 4.2	Soils	Did the project treatments impact total carbon storage in soil?	Soil profile organic carbon; Surface organic carbon (%)	Maintain organic carbon	Maintain levels of long-term stored organic carbon in mineral soil (A horizon), monitor change in short term surface organic matter (litter and duff)
26	3	2.1, 3.1, 3.2	Terrestrial Wildlife	How many snags per acre by size classes were removed/retained during treatments?	Number of snags by size class	Maintenance of large diameter trees for snag recruitment and existing snags on the landscape	4-12 largest snags per acre retained (see Forest Plan)
28	3	4.2, 6.1	Watershed	Are watershed Conditions improving in the cornerstone footprint, as evaluated through the Watershed Condition Ratings, particularly in priority watersheds?	Water quality; Aquatic habitat conditions; Channel geomorphic condition; Degree of watershed disturbance; Forest health	Measures of channel characteristics downstream of actively managed watersheds are similar to those in pristine or nearly pristine reference watersheds, meets state water quality objectives, maintain/improve watershed condition	Measures of channel characteristics indicate reduction of water quality and aquatic habitat, not meeting state water quality objectives, decline in watershed condition classification
29	3	4.1	Watershed	Have treatments been successful in restoring: floodplain connectivity, channel/meadow/riparian habitat, improving water quality and quantity, and/or changed timing of base flows?	Ecological conditions of stream and meadow; Groundwater monitoring; Base flow	Restore floodplain connectivity and meadow function, improve water quality and quantity	Increased meadow plant and wildlife composition, ground cover, restored ecological state

Num ¹	Tier ²	Obj ³	Community Type	Questions	Indicators	Target Condition	Thresholds
30	3	3.1, 4.1, 4.2, 6.1, 6.2	Watershed	Have impacts to water quality or aquatic habitat from roads and trails been reduced?	Hydrologically connected segments; Near stream road density to specific streams; Road stream crossing function (eg. Aquatic Organism Passage (AOP), proper culvert sizing/design); Miles of road/trail improvements; Miles of aquatic habitat made accessible (AOP); Stream crossing density; Sediment samples	Reduction in Hydrologically Connected Segment (HCS), reduction in near stream road density, increase in road improvements, reduction of impacts from road stream crossing, increase in accessibility of aquatic habitat, reduction in road stream crossing density	% reduction in HCS, road density, miles of road improvement, number of failing stream crossings improved, miles increase in available aquatic habitat, specific numerical thresholds determined on a project basis. For areas of higher resource, higher numerical thresholds
12	4	9.4	Cultural Resource	Did wildfire result in impacts to culturally sensitive areas?	Percent of cultural site impacted	Culturally sensitive areas are protected	Impacts are negligible
15	4	1.1, 4.2	Fire and Fuels	Were treatments effective in reducing smoke emissions over the project/landscape area (modeled wildfire)?	PM10 and 2.5	At or below wildfire emissions standards	Increase of particulate matter
20	4	3.1, 4.2	Riparian and Aquatic Features	Are pesticide treatments affecting aquatic resources?	Pesticide concentrations (in water)	Maintaining state water quality objectives or Environmental Protection Agency (EPA) guidelines where no state standards exist, not affecting aquatic habitat or organisms	Not meeting state water quality objectives or EPA guidelines where no state standards exist, adversely affecting aquatic habitat or organisms

¹ Num refers to the question number.

² The ecological effectiveness monitoring questions were prioritized into priority tiers with Tier 1 and 2 being the core questions.

³ Obj refers to the Cornerstone objective number provided in Table 1.

Sampling Protocols

Potential sampling protocols for each ecological effectiveness monitoring question have been identified (Table 9). This list provides the starting point for identifying

an appropriate sampling methodology. Additional applicable sampling protocols may be identified while creating a project specific monitoring plan.

Table 9. Potential sampling protocols for Tier 1 and 2 ecological effectiveness monitoring questions.

Question	Community	PFC	SCI	GIS	CSE	Ocular Estimates	Cultural Evaluation Protocol	FS Species Detection Protocols	S.O. PAC TRT Protocol	Plots, Lines, or Points	FEMO, BEHAVE, FMA	Photo Points	Hydrologic Function Assessment/Watershed Condition	BMP Protocol	Soils Disturb. Protocol	HCS or GRAIP Rapid Carbon Assessment	Remote Sensing
Tier 1 and 2																	
2	Aquatic Wildlife	X	X	X													
4	Conifer Forest				X												
5	Conifer Forest				X	X											X
6	Conifer Forest				X												X
8	Cultural						X										
9	Cultural						X										
13	Fire and Fuels				X	X				X	X						
14	Fire and Fuels				X						X						
16	Hardwoods				X							X					
17	Noxious/ Invasive			X		X				X							
19	Riparian and SAF	X	X										X				
21	Sensitive Plants			X		X				X		X					
23	Soils															X	
25	Terrestrial Wildlife				X			X	X								
27	Watershed													X			
Tier 3 and 4																	
1	Aquatic Wildlife							X									
3	Aquatic Wildlife							X									
7	Conifer Forest				X							X					
10	Cultural Resource					X	X	X		X		X					
11	Cultural Resource						X										
12	Cultural Resource						X										
15	Fire and Fuels				X						X						
18	Noxious/ Invasive					X		X		X							
20	Riparian and SAF							X									
22	Sensitive Plants							X		X							
24	Soils										X						X
26	Terrestrial Wildlife				X	X				X							
28	Watershed		X										X				
29	Watershed		X			X				X		X	X				
30	Watershed			X				X					X			X	

Collaboration Monitoring

The matrix for collaboration monitoring was developed to capture the success of the collaboration in working with an all lands approach to design and implement projects. Four questions were identified as important (Table 10) and protocols were developed that would capture whether the collaboration was increasing the timeline of projects, pace and scale of implementation

and general participation of the ACCG (Table 11).

Social/Economic Monitoring

The socio-economic monitoring questions are still under development. Future work will involve collaboration with socio-economic experts in order to develop a monitoring template and instructions for evaluating results (Table 12 & 13).

Table 10. Cornerstone collaboration monitoring questions and Cornerstone objectives.

Question Number	Cornerstone Objective	Question
1	10.1, 10.2	Was the collaborative successful at streamlining planning and increasing pace and scale?
2	10.1, 10.2	Was the collaborative successful at streamlining implementation and increasing pace and scale?
3	10.1, 10.2	Are the projects being planned/implemented a higher quality than baseline?
4	10.1, 10.2	How effective is the collaboration in engaging the community interests to effectively increase trust and partnerships related to forest restoration practices?

Table 11. Collaboration monitoring indicators, tab name, and data sources.

Question Number	Indicator	Data Source				
		<i>Annual Report</i>	<i>Survey Questions</i>	<i>Project Records</i>	<i>Website</i>	<i>Other</i>
1, 3	Local appeals/objections and comments			•		
1	Project timeline		•	•		
2	Acres accomplished	•				Workplan and FACTS
3, 4	Personal ACCG member input		•			
4	Amount of volunteer hours					Volunteer Spreadsheet
4	Diversity of Participation in ACCG					Volunteer Spreadsheet

Table 5. Conerstone social/economic monitoring questions.

Question Number	Cornerstone Objective ¹	Question
9.1, 9.4	1	What are the effects of the Cornerstone program and individual projects on job and business sustainability?
9.1, 9.4	2	What are the effects of the Cornerstone program and individual projects on local employment?
9.1	3	What are the effects of the Cornerstone program and individual projects on local social community health, stability, and acceptability measures?
9.1	4	What are the effects of the Cornerstone program and individual projects on recreational opportunities?
9.2	5	What are the effects of the Cornerstone program and individual projects on local forest value-added product business capacity (including contractors) and local market expansion?
9.3	6	What are the effects of the Cornerstone program and individual projects in providing work for local forest contractors?

¹ Obj refers to the Cornerstone objective number provided in Table 1.

Table 13. Social Economic monitoring indicators and data sources.

Num ¹	Indicator	Data Source						
		TSA database (FS)	Stewardship contract financial report	Regional profile methods	Questionnaire	TRE AT Model (FS)	Annual Report	TBD
1	Balance of net retained receipts	•	•					
1,2,3,5	Employment numbers in forest-related activities.			•	•			
1,2	Number/percentage of full time permanent jobs, part-time jobs, and seasonal					•		
2	Number/percent of jobs offering employee benefits (vacation, sick leave, health insurance, other)				•			
2,3	Average/Median/Range wage			•	•			
5	Annual Number of locals working on Cornerstone projects				•			
1,5	Value, number, type, and percent of contracts, subcontracts and agreements to locally owned and operated businesses				•	•		
5,6	Number of local bidders				•			•
5	Number of locally owned and operated forestry businesses			•				
5	Number, size, value, volume and types of projects and products offered (local vs nonlocal)				•		•	
4	Miles of trails (created, maintained, or improved) or roads (maintained or improved)						•	
4	Number and type of recreation user days							•
4	Number of campsites created and/or maintained							•

¹ Num refers to the question number in Table 12.

MONITORING TEMPLATES

The monitoring strategy is a living document, and should be updated as new information becomes available. However, once monitoring has started on a project, it is important to use the same attributes, locations, and methodologies to complete monitoring efforts. As such, project specific monitoring plans may not be living documents.

Likewise, different projects will provide different opportunities to implement the Monitoring Strategy. As such, monitoring templates will guide users towards the implementation of strategies provided in this document.

Implementation Monitoring Template

Implementation monitoring is solely focused on if the project was implemented as stated. Due to limited resources, implementation monitoring should focus on controversial issues and/or if ACCG has questions about if a specific implementation leads to results identified in planning documents.

Once a decision has been made then the implementation monitoring form should be considered with the ACCG group (planning team) to identify if any implementation monitoring should occur. Implementation monitoring may occur as planning group field trips (Table 14).

1) Controversial issues (e.g. herbicide use, Ecological Effectiveness section). For example, if the proposed action states that there will be no herbicide use within 10 feet of a channel, implementation monitoring would assess if herbicide use occurred within 10 feet of a channel in key interest locations.

2) Questions related to if implementation plans lead to key results. For example, if the TPA prescription is 100 TPA, implementation monitoring would identify if there are 100 TPA after implementation.

Table 14. Template for Implementation Monitoring. Method and directions considered in the implementation project specific monitoring template. The response field is what would be filled in to plan implementation monitoring. You may need multiple implementation tables for each project/issue depending on issues.

Method	Directions	Response
Issue to be monitored.	This issue should be driven and identified by the ACCG.	
Project name.	Provide the name of the project. The name should be consistent with the NEPA document.	
Planning Document/Implementation Plan	Identify what the planning document and/or implementation plan specified for issue identified. Provide specific details in order to compare monitoring results.	
Locations identified to check	Include detailed information about where these issues should be checked for implementation monitoring. This could be anywhere between 1 to hundreds of locations to check depending on project and issue to be monitored. (Note you may need to develop a separate spreadsheet if there are multiple locations to check).	
Information to collect at field check	This will be specific to the project, clearly identify what should be collected at each field site, for example if checking distance herbicides applied you would record the distance; if checking TPA record number of trees per acre.	
Field visit results	Include results from checks.	
Conclusion	Number of sites were within implementation specifications, number of field sites outside of specifications.	
Discussion	If implementation monitoring showed that project was not implemented as identified in NEPA or implementation document then why? For example, maybe TPA was higher than originally contracted because no trees could be cut if they were greater than a certain DBH and therefore no more trees could be cut to get to the 100 TPA	
Suggestions for future projects	This would be a summary of what might be able to be changed in order to meet implementation specs. This could be to change the specs or change way project is implemented.	

Ecological Effectiveness Monitoring Template

Ecological effectiveness project specific monitoring plans would be created to specifically determine what question to monitor, where and when to monitor, and to estimate the cost associated with effectiveness monitoring. To retain consistency with the Monitoring Strategy,

project specific monitoring plans will tier to the Strategy (Figure 6).

A project specific monitoring plan template (Appendix E) was created to provide step by step direction in compiling information needed for each community type (Table 15). Individual community type templates are then combined to form a project monitoring plan.

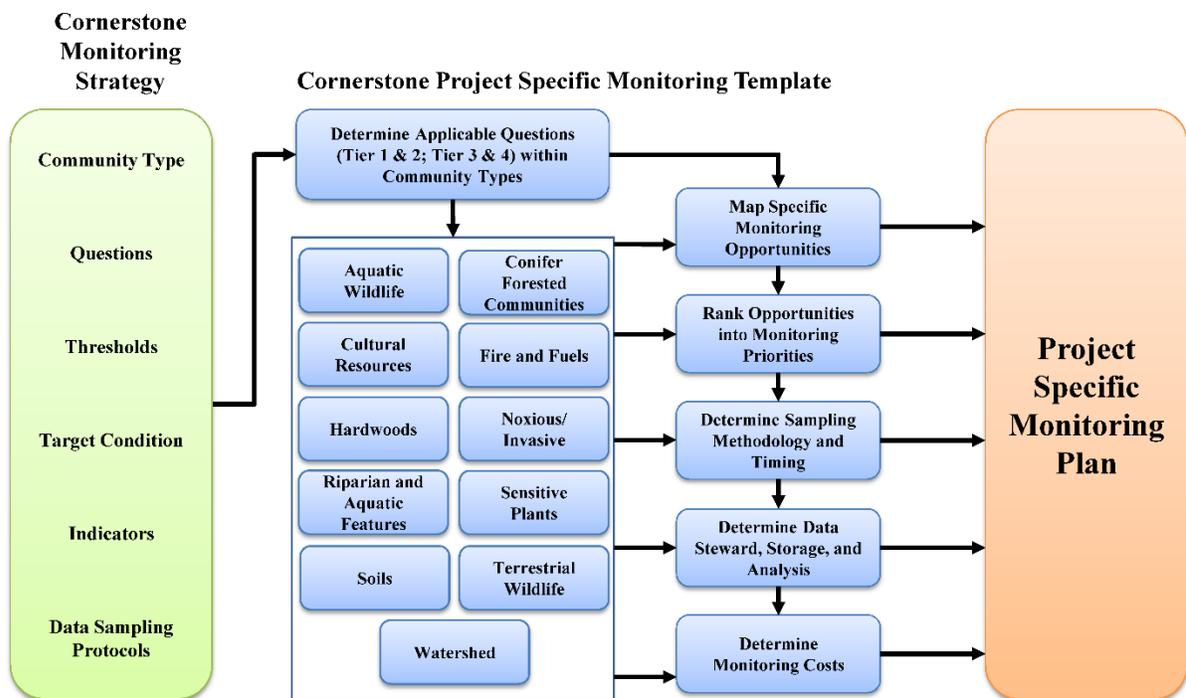


Figure 6. Information flow from the monitoring strategy to Ecological effectiveness project specific monitoring plans.

Table 15. Method and directions considered in the ecological project specific monitoring template.

Number	Method	Directions
1	Project name, location, and community type associated with the template.	Provide the name of the project. The name should be consistent with the NEPA document. Check all boxes that apply to the project location and insert the projects legal description in the table provided.
2	Determine community types associated with template?	Check all boxes that apply
3	Monitoring Questions	Follow the decision tree to determine which monitoring questions would potentially be evaluated for the project.
4	Community Type Question Identification	Copy and paste the question number(s), tier, community type(s), and question(s) that may be considered for project specific monitoring.
5	Spatial Considerations	Spatially map all opportunities associated with the questions indicated above.
6	Ranking	Rank monitoring site numbers or site types in order of monitoring priority (high, medium, low). Provide a short justification for priorities in 2 sentences or less.
7	Sampling Methods	List the indicator to be measured, sampling method, data type (quantitative or qualitative), and protocols or references.
8	Temporal Considerations	Provide the repeated sampling timeframes. Account for any temporal data collection guidance, such as climatic conditions or weather, early or late season, phenological consideration, response lag time, etc....
9	Datasheets	Populate any considerations needed in developing project specific data sheets, including appropriate variables to be collected.
10	Data Steward and Storage	Identify one or more data steward and include the person(s) collecting the data, person(s) who will have oversight of data collection, and the person(s) who will perform data quality review. Identify data format and location of database storage.
11	Data Analysis	Describe the appropriate statistical test(s) associated with data collection and analysis.
12	Target Condition and Threshold	Discuss any implications or considerations relative to the target condition or thresholds outlined in the Monitoring Strategy.
13	Assumptions	Discuss any assumptions associated with addressing monitoring question specific to the project such as data collection limitations or influences on data collection.
14	Estimated Costs	Estimate the number of units to monitor, cost per day, number of days, and number of people needed for each year.
15	References	Provide references for any protocols or literature cited.
16	Glossary of Terms	Provide definitions for any technical terms used.

Collaborative Monitoring Template

Collaboration monitoring would be important to determine whether the input being provided by the group is successful at decreasing the length of a project from planning to implementation. A collaborative monitoring template (Appendix F) was created to provide step by step direction in compiling information needed for each collaborative question (Table 16).

Table 16. Indicator and directions considered in the collaborative specific monitoring template.

Indicator	Directions
Appeals, Objections, Comments	For each project from FY2007 through FY2021, the total number of relevant issues from scoping comment letters, the number of specific comments from EA/EIS documents, and the number of appeals/objections will be compared and the percent total of the number of people that were able to object/dispute for each project will be calculated.
Project Timelines	For each project beginning in FY2007, the project timelines will be populated. If implementation is still occurring on a project, a set of questions will be answered to determine if, and how many contracts have been established, the percent implementation completed, and the type of work that has been completed on a project. Data from FY2007 through FY2011 will be compared with data from FY2012 through FY2021.
Performance Measures	For each project from FY2012 through FY2021 (Cornerstone years) and FY2007 through FY2011 (prior to Cornerstone years), the management actions accomplished will be compared.
Survey Questions	Survey questions will be sent to ACCG members (Appendix G).
Volunteer Hours	The amount of volunteer hours ACCG members contribute is tracked for meetings, field trips, and other associated work members do not get paid for. These data are input into the Participant Hours Spreadsheet and reported in the annual reports as either time or converted to leverage funds.

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APPENDICES

Appendix A. Participants in the Cornerstone CFLR Monitoring Working Group

Core ACCG Monitoring Workgroup members include:

Person	Affiliation
Amy Rocha	Natural Resource Conservation Service
Autumn Olsen	Stanislaus National Forest
Becky Estes	US Forest Service, Central Sierra Province
Cathy Koos-Breazeal	Amador Fire Safe Council
Chuck Loffland	Eldorado National Forest
Eric Kleinfelter	Cal Fish and Wildlife
Gwen Starrett	Foothill Conservancy
John Hofmann	Consultant to Amador County
Julia Stephens	Central Sierra Environmental Resource Center
Katherine Evatt	Foothill Conservancy
Kendal Young	Stanislaus National Forest
Pat McGreevy	Private Citizen
Reuben Childress	Foothill Conservancy
Robin Wall	Eldorado National Forest
Shana Gross	US Forest Service, Central Sierra Province

February 24-27, 2014 Monitoring Workshop Participants:

Person	Affiliation	Person	Affiliation
Cathy Koos-Breazeal	Amador Fire Safe Council	Jann Williams	Eldorado National Forest
Eric Kleinfelter	Ca. Fish and Wildlife	Steve Markman	Eldorado National Forest
Pat McGreevy	Calaveras Co. Parks and Rec.	Matt Brown	Eldorado National Forest
Fred Velasquez	Native American Resource Specialist	Rick Hopson	Eldorado National Forest
John Hofmann	Consultant to Amador County	Robyn Woods	Eldorado National Forest
Gwen Starrett	Foothill Conservancy	Teresa McClung	Stanislaus National Forest
Katherine Evatt	Foothill Conservancy	Zac Croyle	Stanislaus National Forest
Reuben Childress	Foothill Conservancy	Curtis Kvamme	Stanislaus National Forest
Amy Rocha	Natural Res. Conservation Service	Kathy Strain	Stanislaus National Forest
Brandon Sanders	Sierra Nevada Conservancy	Rebecca Carr Wong	Stanislaus National Forest
Ed Smith	The Nature Conservancy	Kendal Young	Stanislaus National Forest
Gary Slade	Trout Unlimited	Jon Lucas	Stanislaus National Forest
John Sikora	Trout Unlimited	Quinn Young	Stanislaus National Forest
Stanley Bucklund	Trout Unlimited	Kevin Zeman	Stanislaus National Forest
Vincent Campa	Private Citizen	Aaron Rieffanaugh	Stanislaus National Forest
Bob Carroll	Eldorado National Forest	Brian Boatman	Stanislaus National Forest
Marc Young	Eldorado National Forest	Becky Estes	USFS, Central Sierra Province
Chuck Loffland	Eldorado National Forest	Carol Ewell	Forest Service, AMSET

Appendix B. National Monitoring Framework

Goal: To develop a system for tracking the ecological outcomes of projects funded under the Collaborative Forest Restoration Act that provides an efficient means for U.S. Forest Service reporting to Congress and provides each Collaborative with a meaningful way of tracking progress towards objectives. The approach should allow a collaboration with limited resources to determine how each Collaborative is moving forward in achieving their stated ecological objectives with the benefit of matching, leveraged, and CFLR funds.

Process: A set of indicators are evaluated based on each individual Project's progress towards its desired conditions, as reflected by a set of key objectives, within the four ecological categories; fire regimen restoration, fish and wildlife habitat condition, watershed condition, and invasive species. Progress towards each desired condition will be evaluated based on the standardized scoring system described below.

Landscape-scale scoring: The Cornerstone project proposes to achieve landscape scale objectives through the mechanical treatment of a subset of acres within their project boundary. Scoring reflects the degree to which individual projects are resulting in desired conditions at broader spatial extents.

- Good = Expected progress is being made towards desired conditions across 66 – 100% of the CFLR project area;
- Fair = Expected progress is being made towards desired conditions across 33 – 66% of the CFLR project area; and
- Poor = Expected progress is being made towards desired conditions across 0 – 33% of the CFLR project area

Expected progress is defined using 5- and 10-year benchmarks for each desired condition based on a percentage of the 10-year outcome specified in the Cornerstone project's proposal.

Project-scale scoring: Project-scale scoring reflects how well the results of an individual management activity met the objectives for that activity. As such project-scale scoring is conducted only completed management activities.

- Good = 75% or more of implemented treatments result in measurable progress towards individual project-level desired conditions;
- Fair = 50% of implemented treatments result in measurable progress towards individual project-level desired conditions; and
- Poor = 25% or less of implemented treatments result in in measurable progress towards individual project-level desired conditions.

Landscape and project-scale assessments should be repeated in years 5, 7, 10 and potentially 15 of the project period.

Ecological Indicator assessments were conducted for the Cornerstone CFLR project in 2014.

Appendix C. Qualitative Monitoring Techniques

1. **Presence/Absence** - Presence/absence techniques note whether the resource (e.g. species) occurs at a site. The disadvantage is that presence/ absence observations provide no information on trend, except when the resource disappears.
2. **Population Estimates** - Population size using qualitative measures may be estimated using classes rather than discrete numbers. The advantage of estimates is that they provide a gross index of population trend. The disadvantage is that because of variability among estimates, only large changes can be monitored with confidence.
3. **Condition Assessment** - A site condition assessment evaluates the condition of the habitat through repeated subjective observations. Assessments can focus on a single activity, potential disturbances, or site characteristics. Existing conditions may have to change dramatically before it is clear from verbal descriptions that a change has occurred.
4. **Boundary Mapping** - Boundary mapping involves measuring or delineating the boundaries of the population of interest and tracking changes in spatial location or size across time. Global Positioning Systems (GPS) may be used, although the accuracy associated with this

Appendix D: Quantitative Monitoring Techniques

Analysis of quantitative data involves the use of statistical analysis to determine if there is a difference from the assigned control or threshold. There are two main classes of statistical tests; parametric and non-parametric statistics. Parametric statistical tests are more powerful than their non-parametric analogues. Parametric statistics are used to estimate population parameters such as means and totals and the interpretation of these tests are usually straightforward.

The use of parametric statistics requires that several assumptions be met, at least approximately.

1. That the sampling units are selected in some random manner from the population.
2. That the population being sampled follows a normal distribution, the familiar bell-shaped curve.
3. Variances are homogenous, that is the sampling units are drawn from populations in which the variances are the same even if the means change from the first year of measurement to the next.

Most of the Cornerstone monitoring data will likely not meet these parametric assumptions, due to low sample size, variability associated with sampling units, or sample unit. In the case that the conditions for parametric statistics are not met, non-parametric analyses may suffice as this class of analyses are not encumbered by the assumption of normality or homogeneous variances. Non-parametric statistics usually involve ordering (ranking) the data from the smallest value to the largest and using the ranks rather than the values themselves.

The table below provides a matrix of parametric and non-parametric statistical tests based on the type of data and the purpose of the test (Elzinga et al. 1998). In addition to parametric assumptions, attention should be placed on the independence of data between years, e.g., independent vs. paired samples.

Independent samples are ones in which different sets of sampling units are selected randomly (or systematically with random starts) in each year of measurement.

Paired samples are randomly selected only in the first year of measurement. The sampling units are then permanently marked, and the same (or at least approximately the same) sampling units are measured in the subsequent monitoring year. Because the two samples are no longer independent (the second sample is dependent upon the first), the use of the independent-sample significance tests is not appropriate.

Purpose of Test	Sampling	Frequency Data	Parametric Test	Non-parametric Test
Testing for change between two years	Samples independent	No	Independent-sample <i>t</i> -test	Mann-Whitney U test
Testing for change between two years	Samples paired (permanent sampling units)	No	Paired <i>t</i> -test	Wilcoxin's Signed Rank Test
Testing for change between two years	Samples independent	Yes		Chi-square Test (2 x 2 Contingency Table)

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Testing for change between two years	Samples paired (permanent sampling units)	Yes		McNemar's Test
Testing for change between three or more years	Samples independent	No	Analysis of Variance; Independent Sample <i>t</i> -tests with Bonferroni Correction	Kruskal-Wallis Test; Mann-Whitney U Tests with Bonferroni Correction
Testing for change between three or more years	Same samples measured each year (permanent sampling units)	No	Repeated Measures Analysis of Variance; Paired <i>t</i> -tests with Bonferroni Correction	Friedman's Test; Wilcoxin's Signed Rank Test with Bonferroni Correction
Testing for change between three or more years	Samples independent	Yes		Chi-square Test (2 x 2 Contingency Table)

Appendix E: Ecological Effectiveness Project Monitoring Template

Project specific monitoring plans tier to the Cornerstone Monitoring Strategy. Monitoring plans are designed to provide the specific information to monitor project’s ecological effectiveness across time. The template is also designed to focus monitoring resources by focusing monitoring attention to questions of concern for the project and prioritizing monitoring areas.

This monitoring template was developed to address a single community type and provide a structure of information that would be similar across community types. As such, information provided in this template can be combined with other community types to form the project monitoring plan. In some cases, multiple resources could be combined on the same template. This template is a living document, and should be updated as new information becomes available.

Instructions to fill out the template are provided in *italics*.

Project name, location, and community type associated with the template.

Provide the name of the project. The name should be consistent with the NEPA document. Check all boxes that apply to the project location and insert the projects legal description in the table provided.

Project Name:	
---------------	--

Check	Land Steward	Check	Land Steward
<input type="checkbox"/>	Calaveras RD, Stanislaus NF	<input type="checkbox"/>	Amador RD, Eldorado NF
<input type="checkbox"/>	Bureau of Land Management	<input type="checkbox"/>	California State Lands
<input type="checkbox"/>	Private		

Township	Range	Section(s)

What community types are associated with this project template? *Check all that apply*

Check	Community Type	Check	Community Type
<input type="checkbox"/>	Aquatic Wildlife	<input type="checkbox"/>	Noxious/Invasive
<input type="checkbox"/>	Conifer Forested Communities	<input type="checkbox"/>	Riparian and Aquatic Features
<input type="checkbox"/>	Cultural Resource	<input type="checkbox"/>	Sensitive Plants
<input type="checkbox"/>	Fire and Fuels	<input type="checkbox"/>	Soils
<input type="checkbox"/>	Hardwoods	<input type="checkbox"/>	Terrestrial Wildlife
		<input type="checkbox"/>	Watershed

Monitoring Questions

Follow the steps below to determine which monitoring questions would potentially be evaluated for the project listed above.

Step 1 - Review tier 1 and 2 questions in Table 1. Determine which questions may apply to the project. Check applicable boxes for the questions in Table 1 and then go to Step 2.

Step 2 - Review NEPA documents (EA and specialist reports) to determine if there are direct or indirect effects, or uncertain outcomes to the resources associated with each community type and question as a result of the implementation of proposed land management actions. Check outcome boxes for those questions and go to step 3.

Step 3 - Are there 2 checks in Table 1 for a question?

If Yes, these are the potential questions for community type monitoring in the specified project listed above and continue to step 4.

If No, go to step 4.

Step 4 - Review tier 3 and 4 questions in Table 2 to determine which question may apply to the project. Check the boxes for those applicable questions in Table 2 and then go to step 5.

Step 5 - Review NEPA document to determine if there are direct or indirect effects, or uncertain outcomes to the resources associated with each community type and question that was checked from step 4 as a result of the implementation of proposed land management actions. Check the outcome boxes for those questions in Table 2. Go to step 6.

Step 6 - If there have been funding/resources identified to complete monitoring for these questions check the box for the question.

Step 7 - Are there 3 checks in Table 2 for a question?

If Yes, these are the potential questions for community type monitoring in the specified project listed above.

If No, no monitoring is needed.

Table 1. Tier 1 and 2 monitoring questions identified in the Cornerstone Monitoring Strategy. Complete ecological monitoring matrix is located in the monitoring questions section.

Question Number	Tier	Community Type	Questions	Step 1 Applicable	Step 2 Outcomes
2	1	Aquatic Wildlife	Did the quality/quantity of habitat for TE and FS Sensitive and other desired species change?	<input type="checkbox"/>	<input type="checkbox"/>
4	2	Conifer Forested Communities	Did plantation treatments encourage a structure consistent with a more resilient forest stand?	<input type="checkbox"/>	<input type="checkbox"/>
5	1	Conifer Forested Communities	How did treatments affect basal area and canopy cover in canyons and slopes with north-facing aspects compared to ridges and slopes with south-facing aspects?	<input type="checkbox"/>	<input type="checkbox"/>
6	1	Conifer Forested Communities	How did treatments affect the tree density, and species composition in all size classes?	<input type="checkbox"/>	<input type="checkbox"/>
8	1	Cultural Resource	How did focus treatments improve cultural resource conditions?	<input type="checkbox"/>	<input type="checkbox"/>

Question Number	Tier	Community Type	Questions	Step 1 Applicable	Step 2 Outcomes
9	2	Cultural Resource	Did restoration and conservation actions protect cultural resources from disturbance?	<input type="checkbox"/>	<input type="checkbox"/>
13	1	Fire and Fuels	How did fuel treatments meet the project goals and objectives?	<input type="checkbox"/>	<input type="checkbox"/>
14	1	Fire and Fuels	Will fuel treatments result in future fire behavior consistent with the natural range of variability (size, frequency, pattern, severity)?	<input type="checkbox"/>	<input type="checkbox"/>
16	1	Hardwoods	Did project activities improve growing conditions for hardwoods?	<input type="checkbox"/>	<input type="checkbox"/>
17	1	Noxious/Invasive	Have target invasive plant populations been reduced?	<input type="checkbox"/>	<input type="checkbox"/>
19	1	Riparian and Aquatic Features	To what degree did the project move Special Aquatic Features or riparian corridors to desired conditions and maintain/improve hydrologic and ecosystem function?	<input type="checkbox"/>	<input type="checkbox"/>
21	1	Sensitive Plants	Did restoration treatments or other disturbance result in a change in habitat suitability for sensitive plant species?	<input type="checkbox"/>	<input type="checkbox"/>
23	2	Soils	Are levels of detrimental soil disturbance and erosion increasing or decreasing with project treatments?	<input type="checkbox"/>	<input type="checkbox"/>
25	1	Terrestrial Wildlife	Did forest treatments impact habitat of mature Forest Sensitive species across projects?	<input type="checkbox"/>	<input type="checkbox"/>
27	1	Watershed	To what extent are best management practices implemented and effective in protecting soil and water resources for Cornerstone management activities?	<input type="checkbox"/>	<input type="checkbox"/>

Table 2. Tier 3 and 4 monitoring questions identified in the Cornerstone Monitoring Strategy. Complete ecological monitoring matrix begins on page 13 of the Cornerstone Monitoring Strategy.

Question Number	Tier	Community Type	Questions	Step 4 Applicable	Step 5 Outcomes	Step 6 Funding/Resources
1	3	Aquatic Wildlife	Did the status of undesired species change across the project?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question Number	Tier	Community Type	Questions	Step 4 Applicable	Step 5 Outcomes	Step 6 Funding/Resources
3	3	Aquatic Wildlife	Did the local abundance/distribution of TE and FS Sensitive and other desired species change?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	3	Conifer Forested Communities	Were treatments successful in promoting diverse plant forms or species of plants?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	3	Cultural Resource	How did project actions protect, promote, and make accessible species with ethnobotanical importance?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	3	Cultural Resource	Did vegetation treatments result in increased connectivity between cultural landscapes?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	4	Cultural Resource	Did wildfire result in impacts to culturally sensitive areas?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	4	Fire and Fuels	Were treatments effective in reducing smoke emissions over the project/landscape area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18	3	Noxious/ Invasive	Are target invasive plants spreading throughout the Cornerstone area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20	4	Riparian and Aquatic Features	Are pesticide treatments affecting aquatic resources?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22	3	Sensitive Plants	Did restoration treatments or other disturbance result in a change in population size of sensitive plant species?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24	3	Soils	Did the project treatments impact total carbon storage in soil?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26	3	Terrestrial Wildlife	How many snags per acre by size classes were removed/retained during treatments?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28	3	Watershed	Are watershed conditions improving as evaluated through the Watershed Condition Ratings, particularly in priority watersheds?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29	3	Watershed	To what degree have restoration efforts been successful in restoring watersheds?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30	3	Watershed	Have impacts from roads/trails on water quality or aquatic habitat been reduced?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Community Type Question Identification

Copy and paste the question number(s), tier, community type(s), and question(s) that may be considered for project specific monitoring (questions that have 2 checks in Table 1, and 3 checks in Table 2).

Question Number	Tier	Community Type	Question

(Add more rows if needed)

Spatial Considerations

Spatially map all opportunities associated with the questions indicated above. GIS files with coordinates should be provided and storage location noted in the Data Steward and Storage section #9 below. A template map should be created and followed for data display consistency for each project area.

Ranking

Rank monitoring site numbers or site types in order of monitoring priority (high, medium, low) by sites specified in the maps above. Site numbers are unique identifier for potential monitoring units. Please use the unique identifier provided in the NEPA document (if one exists). Provide a short justification for priorities in 2 sentences or less. Monitoring priorities will allow resources to be directed in priority areas first.

Site Number or Type	Proposed Treatment	Question Number	Summary of Relevant Pretreatment Data	Pretreatment Data Adequate? (Yes/No)	Monitoring Priority	Priority Justification

(Add additional rows if needed)

Additional Pretreatment Data Considerations:

Sampling Methods

List the indicator to be measured, sampling method, data type (quantitative or qualitative), and protocols or references for data collection in the table provided for each site number. Indicators should be consistent with the Ecological Monitoring Questions Strategy matrix provided in the Cornerstone Monitoring Strategy. Protocols and citations should tier to sampling methodologies provided in the Cornerstone Monitoring Strategy (summarized in Table below). If indicators, data collection methods, or protocols vary, provide additional explanations.

Tier	Community	Question	PFC	SCI	GIS	CSE	RS	Ocular Estimates	FS Species Detection Protocols	Plots, Lines, or Points	FEMO, BEHAVE, FMA	Photo Points	Hydrologic Function Assessment/ Watershed Condition	BMP Protocol	HCS or GRAIP	Cultural Evaluation Protocol	Soils Disturb. Protocol	Rapid Carbon Assess.
3	Aquatic Wildlife	1							X									
1	Aquatic Wildlife	2	X	X	X													
3	Aquatic Wildlife	3							X									
2	Conifer Forest	4				X												
1	Conifer Forest	5				X	X	X										
1	Conifer Forest	6				X	X											
3	Conifer Forest	7				X						X						
1	Cultural	8																X
2	Cultural	9																X
3	Cultural Resource	10						X	X	X		X						X
3	Cultural Resource	11																X
4	Cultural Resource	12																X
1	Fire and Fuels	13				X		X		X	X							
1	Fire and Fuels	14				X					X							
4	Fire and Fuels	15				X					X							
1	Hardwoods	16				X						X						
3	Noxious/ Invasive	18						X	X	X								

Tier	Community	Question	PFC	SCI	GIS	CSE	RS	Ocular Estimates	FS Species Detection Protocols	Plots, Lines, or Points	FEMO, BEHAVE, FMA	Photo Points	Hydrologic Function Assessment/ Watershed Condition	BMP Protocol	HCS or GRAIP	Cultural Evaluation Protocol	Soils Disturb. Protocol	Rapid Carbon Assess.
1	Noxious/Invasive	17			X			X		X								
1	Riparian and SAF	19	X	X									X					
4	Riparian and SAF	20							X									
1	Sensitive Plants	21			X			X		X		X						
3	Sensitive Plants	22							X	X								
2	Soils	23															X	
3	Soils	24				X					X							X
1	Terrestrial Wildlife	25				X			X									
3	Terrestrial Wildlife	26				X		X		X								
1	Watershed	27												X				
3	Watershed	28		X									X					
3	Watershed	29		X				X		X		X	X					
3	Watershed	30			X				X				X		X			

Site Number or Type	Measurement (Indicator)	Sample Method	Type (Quantitative or Qualitative)	Protocols or Citations	Supplies and Equipment

Site Number or Type	Measurement (Indicator)	Sample Method	Type (Quantitative or Qualitative)	Protocols or Citations	Supplies and Equipment

(Add additional rows if needed)

Additional Sampling Explanations:

Temporal Considerations

Some indicators may have different temporal monitoring considerations. Likewise, different sites (identified in Question 6 and 7) may have different temporal monitoring considerations. When that is the case, type the site number (consistent with Question 6 and 7) or the indicator in the gray boxes at the top of the table. If the temporal monitoring time applies to all sites or all indicators, write "ALL" in the gray boxes. Account for any temporal data collection guidance, such as climatic conditions or weather, early or late season, phenological consideration, response lag time, adaptive monitoring based on site conditions, etc....

Indicator(s) _____

	Site Number(s) or Indicator(s)				
Pre-treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Immediately Post-Treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Next Season Post-Treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1 st Year Post-Treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2 nd Year Post-Treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3 rd Year Post-Treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4 th Year Post-Treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5 th Year Post-Treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6 th Year Post-Treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7 th Year Post-Treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8 th Year Post-Treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9 th Year Post-Treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10 th Year Post-Treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (Specify) _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (Specify) _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (Specify) _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Indicator(s) _____

	Site Number(s) or Indicator(s)				
Pre-treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Immediately Post-Treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Next Season Post-Treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1 st Year Post-Treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2 nd Year Post-Treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	Site Number(s) or Indicator(s)				
3 rd Year Post-Treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4 th Year Post-Treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5 th Year Post-Treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6 th Year Post-Treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7 th Year Post-Treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8 th Year Post-Treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9 th Year Post-Treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10 th Year Post-Treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (Specify)_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (Specify)_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (Specify)_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Additional Indicator Guidance:

Datasheets

Data collection sheets need to be electronically attached to the appendix. Populate any considerations needed in developing project specific data sheets, including appropriate variables to be collected, Acceptable level of accuracy, capability with existing databases, or compatibility with data collection devices.

Data Steward and Storage

Identify one or more data steward and include the person(s) collecting the data, person(s) who will have oversight of data collection, and the person(s) who will perform data quality review. Identify data format, database storage (database of record) and discuss the ability to export and save data in Microsoft Excel format. Include the directory path or file structure recommended for data storage.

Person(s) name, email, and phone number associated with:

Data Collection	Data Collection Oversight	Data Quality Review

Data Format and Storage:

Attribute	Explanation
Data Format	
Database Storage	
Directory Path	

Attribute	Explanation
Ability to Export to Microsoft Excel	
Other:	

Other Data Steward or Storage Considerations:

Data Analyses

Describe the appropriate statistical test(s) associated with data collection and analysis. Statistical tests may be based upon the type of data collected, the quality of data collected, and the variability associated with that data. Statistical tests may be parametric or nonparametric in nature. Descriptive statistics (mean, standard deviation, range, etc) may be used, in addition, graphs (x, y plots) may be used to visually display trends and data sets. Review methods listed in the references provided.

Target Condition and Threshold

Discuss any implications or considerations relative to the target condition or thresholds outlined in the Monitoring Strategy. If modifications to the target condition or threshold are required for a project, provide justification for the changes.

Assumptions

Discuss any assumptions associated with addressing monitoring question specific to the project such as data collection limitations or influences on data collection.

Estimated Costs

Populate the Community type (consistent with Question 4), number of units to monitor, cost per day, number of days, and number of people needed for each year highlighted in yellow for the specified resource. Use the following cost per GS level rating for estimates: GS-05 = 150.00 per day; GS-07 = 200.00 per day; GS-09 = 300.00 per day; GS-11 = 350.00 per day.

*Put different GS levels on separate rows. Differentiate between community types. Consider answers to the temporal considerations (Question 8) when addressing cost estimates. Cost is estimated as (Cost per day*People*Days).*

Community Type	Total # of Units to Monitor	Cost Per Day	Year 1			Year 2			Year 3		
			# of People	# of Days	Cost	# of People	# of Days	Cost	# of People	# of Days	Cost
Total Cost											

Community Type	Cost Per Day	Year 4			Year 5			Year 6		
		# of People	# of Days	Cost	# of People	# of Days	Cost	# of People	# of Days	Cost
Total Cost										

Community Type	Cost Per Day	Year 7			Year 8			Year 9		
		# of People	# of Days	Cost	# of People	# of Days	Cost	# of People	# of Days	Cost
Total Cost										

Community Type	Cost Per Day	Year 10		
		# of People	# of Days	Cost
Total Cost				

References

Provide references for any protocols or literature cited. Use standard scientific referencing for citation.

Glossary of Terms

Provide definitions for any technical terms used. Also provide definitions for acronyms.

Term or Acronym	Definition

(Add additional rows if needed)

Appendix F: Specific Guidance on Collaborative Monitoring Approach

The monitoring group still needs to determine the responsible party. Initial discussions involved that it would be an ACCG member who would request the project manager to fill out the spreadsheet and the ACCG member would complete the analysis.

1) Appeals, Objections, Comments Tab

Steps in Worksheet:

1. Go to the “Appeals, Objections, Comments” tab in the Collaborative Monitoring Spreadsheet. Populate all project names with their respective final decision date and category of NEPA. Only populate each project name once.
2. For each project listed, populate the number of comment letters received, the number of relevant issues from scoping, the number of specific comments from EA/EIS submission, and the number of appeals/objections by the location of the groups/individuals that sent the response depending on if the group/individuals were located in the 5 county region (Alpine, Amador, Calaveras, El Dorado, Tuolumne), from groups/individuals within the state of California, but not within the 5 county region, and from groups/individuals outside of the state of California. Project records can be found here: O:\NFS\Stanislaus\Project\Calaveras and here O:\NFS\Eldorado\Project\Amador. Missing projects and data should be stored in each respective district’s NEPA library if not found in the locations listed above.
3. Data analyses: The average of the number of comment letters received, relevant issues, specific comments, and the number of appeals/objections by response location (5 county region, in state, out of state) for projects with a final decision date of 30 September, 2011 and before, and for projects with a final decision date of 1 October, 2011 and after will automatically populate in yellow at the bottom of the “Appeals, Objections, Comments” tab. Graph the averages using with each location as a series and compare the pre-Cornerstone years with Cornerstone years in a bar graph (example included in spreadsheet).

Limitations/Assumptions: CE categories of NEPA may not have been sent out for public comment

Management Implications: Determine whether the data indicates a trend.

2) Project Timelines Tab

Steps in Worksheet:

1. Go to the “Project Timelines” tab in the Collaborative Monitoring Spreadsheet. The project names and NEPA category will already be populated from previous steps above.
2. Go to each project record and populate the timeline information including Project Start Date, Public Scoping Letter Date, Draft Decision Date, Final Decision Date, Contract Start Date, and Contract End Date. The project start date can be derived from initial email communication concerning a project, the signed Project Initiation Letter, or earliest date of any other file associated with the particular project. Contract End Date should be the date when the last contract ends for a project and all other proposed actions in the NEPA are completed. If a project is not completed and is still ongoing, there is additional data that need to be collected including:
 - (a) Have contracts or agreements been established for project related activities?
 - (b) If yes, how many?

- (c) *What portion of the work has been completed (percent in 20% increments 1% to 20%, 21% to 40% etc.)?*
- (d) *What type of work has been completed?*
- (e) *Include the name of the person that fills in these data*

Project records can be found here: O:\NFS\Stanislaus\Project\Calaveras and here O:\NFS\Eldorado\Project\Amador. Missing projects and data should be stored in each respective district's NEPA library if not found in the locations listed above.

3. *Data analyses: The number of days between each NEPA process for each project will be automatically calculated for each project in the "Project Timelines" tab (highlighted in red). Plot a scatter plot with year on the X axis, and number of days on the Y axis. Have a different symbol for each NEPA type (EIS, EA, and CE). On the X axis place a line indicating when Cornerstone started so that pre-Cornerstone and post-Cornerstone can be compared. The data can then be plotted for time for each project. It may make sense to plot based on NEPA type and separate NEPA from implementation/contract timeline.*

Limitations/Assumptions: Projects from FY2007 through FY2011 should be classified NEPA type (EIS, EA, and CE).

Management Implications/Threshold: If the data suggest that projects are taking longer since Cornerstone began then a discussion should occur regarding if this is due to the collaboration or if there is another variable responsible for the increase (e.g. a large fire occurred so resources were redistributed to focus on the fire rather than individual projects, change in staff).

3) Performance Measures Tab

Steps in Worksheet:

1. *Go to the ACCG website located at <http://acconsensus.org/annual-reports/>. Use the information in the annual reports from each fiscal year to populate the management actions listed in the "Performance Measures" tab in the Collaborative Monitoring Spreadsheet for FY2012 through FY2021. (Forest service staff) will need to populate the "Acres of restored culturally sensitive sites" and "Acres treated with prescribed fire" management actions. These actions are not tracked in the PAS (Performance Accountability System) reports as management actions and have not been included in the annual reports.*
2. *Pull the FACTS and Workplan data for FY2007 through FY2011 and populate the management actions for FY2007 though FY2011.*
3. *Data Analyses: The sum of the total units across each management action from FY2007 through FY2011, FY2012 through FY2016, and FY2017 through FY2021 is calculated in red. Create a stacked bar graph with each management action on the y axis. The sum of the units for each 5 year interval is the total that each year adds up to. It would also be good to look at the sum proportional to total dollars available.*

Limitations/Assumptions: Management actions listed in the annual reports include data from both the PAS reports and data that did not make it in to the respective databases by the time the PAS report was pulled. Data from FY2007 to FY2011 will only be collected from Workplan and FACTS databases. Road and trail management actions are not included in the analysis because the database of record for those actions are not readily accessible.

The amount of money awarded for project implementation differs each year and likely has an effect on the number of accomplishments for each fiscal year. Dollars allocated to the Amador and Calaveras ranger districts may need to be populated for FY2007 through FY2021 for assessment of performance measures in determining pace and scale.

Management Implications/Threshold: Determine whether data is showing an upward trend in acres treated.

4) Survey Questions Tab

Steps in Worksheet:

1. Go to the “Survey Questions” tab in the Collaborative Monitoring Spreadsheet. Populate the project names from the “Appeals, Objections, Comments” tab in the same document that have a date of 2013 or after. The survey questions tab will be sent to all ACCG planning team members to fill out his/her responses to the questions for each project.
2. Data analysis: This is a quantitative assessment that assesses the response of each ACCG member as a relative frequency of the total.

Management Implications/Threshold: If the data suggests that ACCG is not satisfied with the amount of input they are giving then there needs to be discussions with the ACCG on how to improve collaboration with the FS and areas in the planning process should be identified where improved collaboration would be useful.

5) Tab Name: Volunteer Hours

STEPS:

1. Go to the Participant Hours Spreadsheet located here
2. Fill in the volunteer hours each member contributed for the fiscal year. Volunteer hours should be gathered from meeting notes and emails submitted to the Cornerstone Coordinators identifying the number of hours each has worked.
3. Any volunteer hours from Non-ACCG members should be placed in the Non-ACCG Members row of the “Volunteer Hours” tab.
4. Data analyses: Determine the total number of hours and determine trends over the years of interest.

Assumptions: FY2012 is not included due to the lack of data

Management Implications/Threshold: Track an increase or remain stable.

Monitoring Specifics

Schedule of data collection for Cornerstone Collaboration Questions.

Question	Indicator	Responsible Party	Baseline	Data collection	Discussion/ Results Summary
1, 3	Appeals/Objections and Comments	Forest Service staff	5 years Pre-Cornerstone (FY2007 – FY2011)	Annually	2017, 2021

Question	Indicator	Responsible Party	Baseline	Data collection	Discussion/ Results Summary
1	Project Timelines	Forest Service staff	5 years Pre-Cornerstone (FY2007 – FY2011)	Annually	2017, 2021
2	Acres accomplished	ACCG members/Forest Service staff	5 years Pre-Cornerstone (FY2007 – FY2011)	Annually	2017, 2021
3, 4	Survey Questions	ACCG members/Forest Service staff	N/A	Annually	2017, 2021
4	Volunteer Hours	Forest Service staff/ACCG members	N/A	Annually	2017, 2021

Appendix G: Collaborative Monitoring Survey

This survey will be presented during a full group meeting after a decision has been made on an individual project. An agency lead (e.g. FS project manager) and an ACCG member will lead the discussion. They will answer questions and provide a brief summary of the collaboration activities they remember.

Amador-Calaveras Consensus Group



Collaboration Monitoring Individual Survey

Amador-Calaveras Consensus Group requests your help. Please complete the following ACCG Satisfaction Survey. Thank you for your time.

1. What work groups do you participate in?

- Planning
 Monitoring
 Full Group
 Admin
 Operations
 Finance

2. Did you attend field trips or meetings where project planning was discussed?

- Yes
 No
 Don't remember
 N/A

2a. If yes, what part of the planning process?

- Proposed Action
 Scoping
 Alternative Development
 Decision

3. Were your concerns about the project expressed to project proponent?

- Yes
 No
 Unsure
 N/A

3a. Were concerns resolved prior to the proposed action?

- Yes
 No
 Unsure
 N/A

3b. Were concerns addressed in an action alternative or analyzed to address concerns?

- Yes
 No
 Unsure
 N/A

3c. Was your preferred alternative chosen by the decision maker?

