MokeWISE Program Scope of Work:
Project 1b: High Country Meadow Restoration Program

April 2015

Problem Statement and MokeWISE Stakeholder Interests

Many higher elevation meadows in the Mokelumne watershed are in a degraded condition, due to a number of factors, including the effects of roads, timber management, tree-brush encroachment, fire exclusion, over grazing, and hoof-channel erosion. These factors that often lead to stream incision, combined with increasing brush and tree encroachment, has reduced available water to meadows and contributed to meadow dewatering and drying earlier in the season. Because of their degraded condition, these meadows no longer function effectively in receiving and holding water through the spring and summer months and slowly releasing it to streams through the drier months. Instead, water tends to run off earlier in the season and the watershed doesn't benefit from the meadows' natural, proper function as the water table drops and encroaching trees transition meadows into forest habitat.

Wildlife habitat also suffers as a result. Aquatic species are adversely affected by alteration of meadow hydrology. Species such as the threatened and endangered Sierra Nevada Yellow-Legged Frog and Yosemite Toad that depend on wet, open meadows are increasingly left with tree and brush covered, dry forests. A comparison of photographs of meadows over the past 100 years shows the extent of tree-brush encroachment on meadows. Restoration of meadows and the watersheds above them would improve natural environmental function, wildlife habitat, and more reliable downstream water yield as a result of anticipated delays in flow release throughout the year.

The High Country Meadow Restoration Project will identify and assess potential meadows for restoration to functioning condition as well as seek funding for the planning phases of identified meadows in the upper Mokelumne River watershed. The project includes involving a stakeholder group and compiling existing data with additional, new meadows identified as in need of restoration in the watershed. Once meadows have been compiled, assessment by a specialist team will be conducted to recommend the type and amount of restoration, and the potential expected benefits to be achieved in each meadow. The collaborative group, potentially the Amador Calaveras Consensus Group (ACCG), will work with the Forest Service, BLM, and other interested former parties from the MCG, to prioritize the meadows on the list for implementation.

The Foothill Conservancy developed this project after working on several meadow restorations with the USFS and the ACCG. While federal funds may be available for meadow restoration work, there is little funding available for prioritizing, analysis and planning. In addition, there is incomplete information on file between the El Dorado and Stanislaus National forests in terms of historic and damaged meadows. This project would fund the compilation of that data, and comprehensive necessary additions, along with assessment of the meadows, to allow a collaborative group to strategically prioritize meadows for restoration. Implementation of the highest-priority restorations through additional phases of

grant applications or other funding sources that become available could then take place using the prioritized list.

Conservation groups think that meadow restorations benefit all watershed stakeholders as the benefits derived from restoration include a wide array of categories ranging from water quality and water supply reliability, to environmental services and ecological enhancement.

Based on funding one staff person compiling existing information and the addition of newly identified meadows in need of restoration, and the procurement of a specialist team to assess the complete list, project costs are estimated to be $40,000 plus $10,000 per acre restored.

Background Information

Reference Programs

The specific number of meadows that exist within the upper Mokelumne River watershed is currently unknown; however, it is generally agreed upon that there are many meadows that likely need some level of restoration; therefore, the ultimate purpose of the project will be to evaluate the meadows to determine restoration needs, set priorities for restoring meadows, and estimate restoration costs.

In 2010 the National Fish and Wildlife Foundation (NFWF) developed a Business Plan to guide restoration of meadows within the Sierra Nevada (NFWF 2010). The meadow restoration efforts in the Sierra Nevada have many similarities to the proposed meadow restoration in the Mokelumne Watershed; specifically, in both locations, meadows are recognized as a critical component of watershed hydrology, yet they have been substantially degraded.

The NFWF found that of the estimated 10,000 meadows in the Sierra Nevada, only approximately 30-40 percent exist in in a non-degraded state (USFS 2010). The long-term goal of the Sierra Nevada meadow restoration program is to restore 80-90% of the existing meadows; given the magnitude of meadow restoration needs in the Sierra Nevada and the long-term restoration goals, one of the first steps in the NFWF's meadow restoration efforts was to develop a prioritization methodology (NFWF 2010). The NFWF found that the prioritization methodology should include stakeholder input, be watershed-specific, and have qualitative and quantitative criteria. Additionally, the NFWF's efforts began with identifying a list of ready-to-proceed meadow restoration projects, which would be prioritized due to their ability to move forward before other projects.

The meadow evaluation and prioritization efforts conducted by American Rivers and the NFWF resulted in development of a Meadow Scorecard that was used to rapidly assess the condition of meadows during field work (American Rivers & NFWF 2012). The score card allows field staff to jot down various physical features of each meadow, and then use those

features to score the health of each meadow relative to one another. This method ensures that all meadows considered for restoration are evaluated in a similar manner and that data about each meadow is available for the prioritization process. **Appendix A** includes a copy of the Meadow Scorecard for reference (American Rivers & NFWF 2012).

Project Information

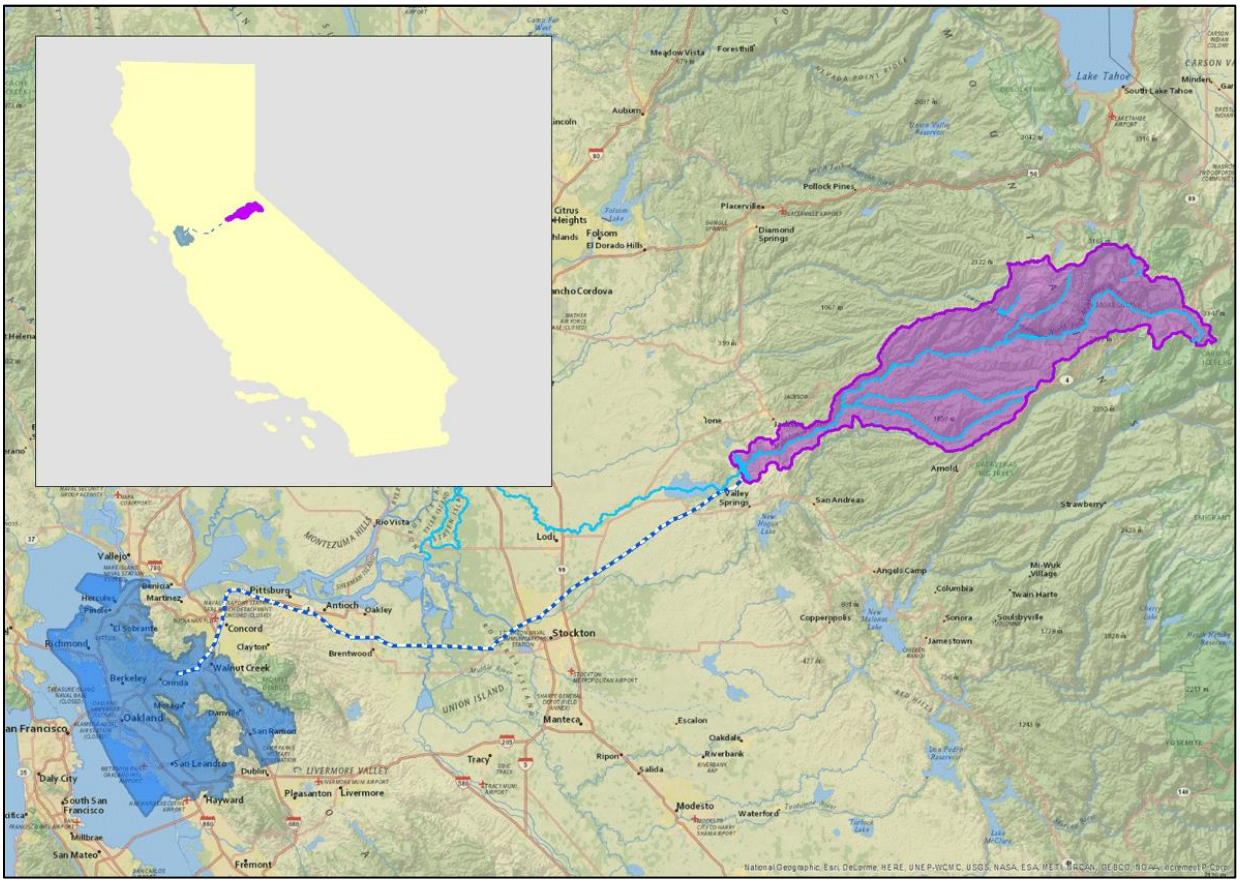
Project Description

The purpose of this project is to develop a two-phased program to restore high-elevation meadows to their approximate natural functions, including providing water supply, water storage, and ecosystem enhancement benefits. The first phase of the program includes compiling available data, assessing meadows within the upper Mokelumne River watershed, and prioritizing meadows for restoration. Phase II includes implementation of the prioritized meadows from Phase I, including securing funding and acquiring the appropriate environmental documentation. Costs of phase 1 may be reduced through volunteer efforts that are ongoing to ground truth the existing data and establish a list that could then be assessed by a specialist team. The project would likely be most successful through coordination and implementation with the Amador Calaveras Consensus Group, a local collaborative group that is closely involved in meadow restoration projects in the watershed.

Project Location

Based on data from American Rivers and the National Fish and Wildlife Foundation (NFWF), roughly 580 acres could potentially be conserved in 21 meadows in the Mokelumne Watershed (American Rivers & NFWF 2012). Phase I of this program will assess all meadows in the upper watershed and determine the number of meadows that can be restored. **Figure 1** shows the location of the upper Mokelumne River watershed (in purple).

Figure 1: Upper Mokelumne River Watershed



Source: Sierra Nevada Conservancy 2014

Project Sponsor

Foothill Conservancy would serve as the lead; no co-sponsor has been identified.

Scope of Work

PHASE I

Task 1. Planning for Meadow Restoration

As previously stated, the number of meadows that exist within the Mokelumne Watershed is currently unknown, but it is anticipated that the restoration needs are extensive. As such, the

first step in this effort is to conduct planning work that would identify basic information about the meadows within Mokelumne Watershed.

Subtask 1.1 Pursue Project with Stakeholder Group

It is anticipated that restoration efforts in the Mokelumne Watershed will require integrated efforts among multiple stakeholders. The Amador Calaveras Consensus Group (ACCG) is an established stakeholder group that would likely provide a strong setting for interested parties to participate in formal planning, prioritization, cost estimating, and implementation stages of restoration efforts. Having stakeholder buy-in and support for restoration efforts will help ensure that these efforts are successful on a long-term basis. The stakeholder group should include interested former members of the MCG that guided development of the MokeWISE program.

Subtask 1.2 Map/Compile Meadows in the Mokelumne Watershed

Compile and assess data on:

The first step in mapping is to compile existing data and add any new sites that come from analysis of aerial maps. Some aerial mapping efforts have already been completed in the Mokelumne Watershed by American Rivers, NFWF, Eldorado National Forest and the Stanislaus National Forest. The aerial mapping data should be shared with the established stakeholder group to verify the accuracy and completeness of the data.

Field Assessments

Once meadows have been preliminarily identified, an on-the-ground delineation should be conducted to identify the current extent of existing meadows and conduct an assessment of each meadow utilizing a specialist assessment team. Once complete, the delineation should be able to identify the historic meadow area, current meadow condition, and necessary actions for restoration that will help guide prioritization as well as the future phases of implementation.

Subtask 1.3 Identify Existing Restoration Projects

As stated previously, the Sierra Nevada meadow restoration efforts prioritized restoration projects that were ready-to-proceed (NFWF 2010). Compiling a list of existing restoration projects that could be implemented in a short time period and would provide direct meadow restoration benefits could help move restoration efforts forward in the Mokelumne Watershed. It is assumed that existing projects will be identified and evaluated by the stakeholder group.

Task 2. Prioritize Meadows for Restoration

Subtask 2.1 Determine a Prioritization Process

There are two commonly used methods for prioritization: quantitative and qualitative. Quantitative methods use a structured approach that often involves numerical ranking based on a set of pre-determined criteria. Qualitative approaches typically rely on discussions with stakeholders or the formation of an expert panel that provides input on what should be prioritized. Qualitative approaches can allow for consideration of unique features of individual meadows that cannot be easily classified and ranked in a quantitative scoring process. In some cases, quantitative scoring can be used to inform a qualitative approach.

The stakeholders will agree upon considerations that will be used for the final prioritization process, which may include, but are not limited to:

- Readiness to proceed (see Subtask 1.3)
- Available species that could directly use or colonize meadow – additional consideration may be given if the species are rare, endangered, threatened, or locally important
- Environmental services and ecologic benefits
- Relationship to water supplies, such as groundwater and water reservoirs
- Feasibility, which may include but is not limited to the following considerations:
    - Landowner support
    - Site access for equipment
    - Environmental documentation
- Restoration Costs

PHASE II

Task 3. Implement Restoration Projects

Phase II of the project involves implementing the projects identified in Subtask 2.2. This includes acquiring the appropriate environmental documentation, securing funding, and developing scopes of work for each project to outline the specific restoration efforts needed for each meadow. Each project that is selected by the stakeholder group will be evaluated for potential restoration costs. The scopes of works developed under this task will be used to develop detailed budgets that outline tasks as well as personnel hours, experts, equipment, and other costs that will be required to complete restoration.

Budget

The budget for this project is anticipated to be $40,000 for assessing and prioritizing meadows. Costs associated with the project are broken down as follows:

- Planning Costs (Phase I): $40,000
- Implementation Costs (Phase II): $10,000/acre (this is an estimate that will be refined after Phase I)
- **Total Project Costs: $40,000 + $10,000 * number of acres restored**

Specific implementation tasks have not been provided in this work plan given that further budget and scope development is included as part the second phase of the project (see Task 3). It is assumed that both the acreage of meadowlands and the restoration costs will be updated through implementation of the tasks outlined in this scope. Operational costs for the project are expected to be minimal based upon information from NFWF that demonstrates that completed meadow restoration projects require almost no operational costs (NFWF 2010).

References

American Rivers and National Fish and Wildlife Foundation (NFWF). 2012. Evaluating and Prioritizing Meadow Restoration in the Sierra. Available: http://www.americanrivers.org/assets/pdfs/meadow-restoraton/evaluating-and-prioritizing-meadow-restoration-in-the-sierra.pdf?65c5e7

National Fish and Wildlife Foundation (NFWF). 2010. Business Plan – Sierra Nevada Meadow Restoration. Available: http://www.nfwf.org/sierranevada/Documents/Sierra_Meadow_Restoration_business_plan.pdf

Sierra Nevada Conservancy. 2014. Mokelumne Watershed Avoided Cost Analysis – Inset Map. Available: http://www.sierranevada.ca.gov/our-work/mokelumne-watershed-analysis/Moke_InsetMap.gif

Appendix A: Meadow Scorecard

Draft: 9/25/11

Meadow Name _____	Date : ____/____/_____ MM DD YYYY
GPS Location: _____°_____'____.____" N _____°_____'____.____" W GPS Datum (e.g., WGS 84, NAD 27) _____	
Elevation (ft)_____Slope (°)_____ County _____ Landowner _____	
USGS Quad Name	7.5' or 15' (circle one)
Observers:	

	CONDITION CATEGORY			
Parameter	**Natural Condition**	**Slightly impacted**	**Moderately Impacted**	**Heavily Impacted**
1. Bank Height in Main Channel (measured in the riffle).	Little or no channel incision, Banks 0-2 feet high along >95% of the channel length.	Bank heights of 2-4 feet along less than 25% of the channel length; 0-2 feet elsewhere. .	Bank heights of 2-4 feet along more than 50% of channel length; higher than 4 feet along less than 25% of channel length.	Bank heights > 4 feet along more than 25% of channel length. Note if sections of channel have banks 0-2 feet high.
Score:	4	3	2	1
Second Channel (if present):	4	3	2	1
2. Bank Stability	<5% of bank length is unstable.	5-20% of bank length is unstable.	20-50% of bank is unstable	>50% of bank is unstable.
Score:	4	3	2	1
Second Channel (if present):	4	3	2	1
3. Gullies/ditches outside of main channel	No gullies or ditches outside of the main channel	Ditch or start of a gully outside of the main channel. Combined length of all gullies & ditches is less than 1/10th meadow length.	Combined length of all gullies and ditches up to 1/2 of meadow length	Combined length of all gullies and ditches is greater than 1/2 of meadow length.
Score:	4	3	2	1
4. Vegetation Cover	Graminoids account for 75-100% of the area covered by vegetation	50-75% graminoid cover	Forbs dominate. 25-50% graminoid cover.	Forbs dominate. <25% graminoid cover.
Score:	4	3	2	1
5. Bare Ground	Bare ground covers less than 5% of the meadow area.	Bare ground covers 5-10% of meadow area	Bare ground covers 10-15% of meadow area.	Bare ground covers > 15% of meadow area.
Score:	4	3	2	1
6. Conifer or Upland Shrub Encroachment	No upland shrub or conifer encroachment. Raised, topographically distinct areas may have upland species present, but not the meadow surface.	Few encroaching upland species; <10% of total meadow area	Encroaching upland species cover 10-20% of total meadow area	Encroaching upland species cover >20% of total meadow area
Score:	4	3	2	1

Total	
Possible Points	
Total/Possible	

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Additional Observations:

1. ☐Yes ☐No Evidence of conservation or restoration efforts (check dams, stabilized headcuts, exclosure fencing, etc.) Photo Numbers:_____
   Description:_____
2. ☐Yes ☐No Headcut present in meadow? Photo Numbers: _____ Number of headcuts _____ .

3. ☐Yes ☐No Fish Observed?

4. ☐Recent ☐Old ☐None Evidence of beavers? Describe _____

5. ☐Yes ☐No Aspen present in or adjacent to meadow?

6. ☐Yes ☐No Accessible by vehicle?

7. Grazing observations. Check all that are present:
   ☐Trails ☐Stubble ☐Dung in channels ☐Hoof prints on banks

8. Human impacts. Check all that are present in the meadow:
   ☐Trail ☐Evidence of OHV use ☐Road ☐Corral ☐Building

9. Adjacent land use. Check all that are present within 200 yards of meadow:
   ☐Culvert ☐Bridge ☐Road ☐Building

10. Gopher disturbance covers _____% of meadow area (from toe-point transects).

11. Willow, alder and aspen cover _____% of meadow area.

12. Comments on ease of/ barriers to restoration (e.g., are impacts localized or disbursed throughout meadow, access, adjacent landuse)

Comments: