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Evaluating and Prioritizing Meadow Restoration in the Sierra

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Introduction

Over the last ten years, results from a series of meadow restoration demonstration projects in the Sierra Nevada have shown that large-scale meadow restoration will likely provide multiple benefits including water supply, water quality and habitat (Heede 1979; Swanson, Franzen, and Manning 1987; Klein et al. 2007; Tague, Valentine, and Kotchen 2008; Hammersmark, Rains, and Mount 2008; Loheide et al. 2009). With support from NFWF, the US Forest Service, the Sierra Nevada Conservancy, Bella Vista Foundation and others, this work is now proceeding to a second phase of full-scale implementation across the Sierra. In order to leverage the necessary support to make a landscape-level impact and efficiently learn from these restoration experiences there is a need for individuals and organizations who are involved in this exciting process to come to agreement around four dimensions of this future work:

1) What meadows are there and how are they doing?
2) Which ones should we restore or protect?
3) How should we restore or protect them?
4) Did the restoration succeed and can we do better next time?

The objective of this project was to develop the framework and needed tools for answering these four questions and apply them in the Yuba and Mokelumne watersheds of the North-Central Sierra. More specifically we groundtruthed meadow delineations and developed a rapid method for assessing their condition (question 1); we developed and applied methods for prioritizing meadows for restoration (question 2); we evaluated meadow restoration methods and populated a database of meadow restoration projects throughout the Sierra (question 3) and standardized data collection and reporting procedures for monitoring the effects of restoration (question 4).

The methods we developed and the on-the-ground data for the Yuba and Mokelumne watersheds supply a replicable template that may be applied in other watersheds to focus meadow restoration effort where it will provide the greatest value. The prioritized list of meadows we developed galvanized support of the top restoration candidate (see From Prioritization to Restoration, below) and, within six months, resulted in completed permits and three funding proposals.

Our experience showed prioritization’s power to accelerate and focus restoration efforts. We also wanted to aid development of market-based funding for restoration, so funding may keep pace with increased restoration effort. We compared costs of restoration using the database we developed, and where possible, estimated benefits of restoration. The resulting cost to increase groundwater storage defines a price-point for market research on the demand for a meadow restoration credit (See Towards a Meadow Restoration Credit, below).

Our ultimate goal is to accelerate and improve meadow restoration. The steps we took in this project focus on providing the infrastructure necessary for meadow restoration to gain and sustain momentum into its next phase, where watershed-scale impacts are anticipated. This report briefly describes the methods we developed and presents findings from applying the methods in the Yuba and Mokelumne River watersheds.

Meadow Definition

An existing mountain meadow is an ecosystem type that is dominated by herbaceous species and supports plants that use surface water and/or shallow ground water (generally at depths of less than 1 m). Woody vegetation (e.g., trees and shrubs such as alder and willow) may occur, and be locally dense, but are not dominant. Historical mountain meadows are areas that once supported meadow vegetation as above but have been altered either hydrologically or by disturbance or both. These alterations can be part of natural cycles or induced by human activity (from Weixelman, Cooper and Berlow, unpublished).

Delineating Meadow Areas

Thirty five meadows were delineated using GPS in the Yuba and Mokelumne watersheds and the resulting meadow outlines were compared with those in the California Department of Fish and Game (CDFG) meadow database, where meadows were identified from aerial photographs. We found that GIS-derived values overestimate the meadow area in the Yuba and Mokelumne Watersheds by 100%.

Our goal on the ground was to delineate the historic meadow area, including any conifer or shrub encroachment in order to estimate the potential area, if all meadows were restored. To do this, we identified slope breaks and consistent boundaries of herbaceous meadow vegetation and selected these as the meadow edge. In addition we estimated conifer encroachment (see Assessment, below). Thus, the current meadow size can be determined by scaling the historic meadow area by the encroached-upon fraction. The current meadow is also what would be visible on an aerial photograph –that is, one would expect our groundtruthed areas to be larger, rather than smaller than sizes estimated from aerial photographs. However, we found that, without exception, the CDFG aerial delineation overestimated meadow area, largely because the CDFG delineations include steep (>6% slope) alder and willow stringers (Figures 1 and 2) that are not considered meadows under the definition given above.

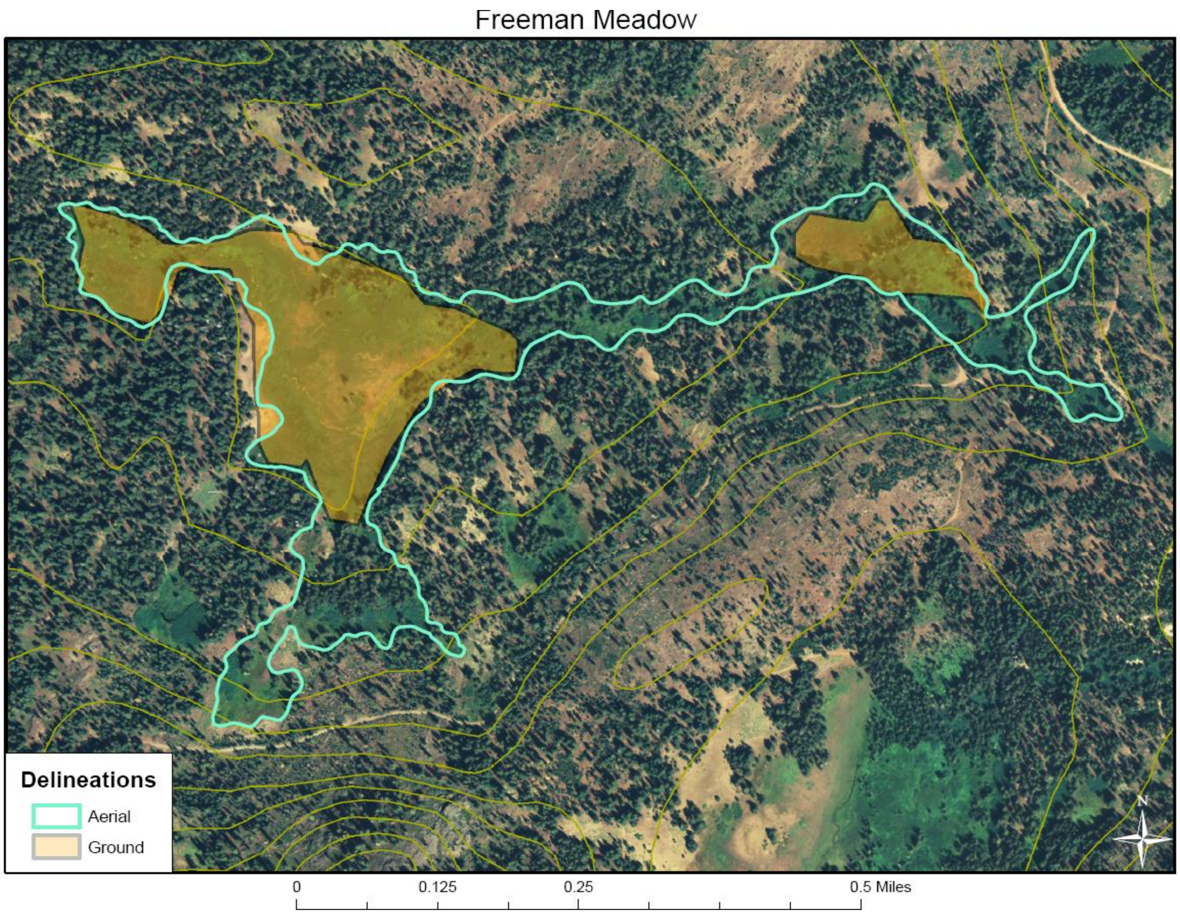


Figure 1. Freeman Meadow in the Yuba watershed is an example of the discrepancy between the CDFG aerial delineation (58 acres) and the groundtruthed meadow boundary delineation (34 acres). Excluded areas are either >6% slope (bottom left) or narrow riparian stringers lacking meadow characteristics (center and right).

In the Yuba River Watershed, the average groundtruthed area was only 52% ± 8% (95% CI, 20 meadows) the size of the CDFG-delineated areas (Figure 2). A similar discrepancy was found in the Mokelumne watershed, where the groundtruthed area is 53% ± 10% (20 meadows) the size of the remotely determined area. The total groundtruthed area of all meadows in both watersheds was 51% of the total CDFG-delineated meadow acreage.

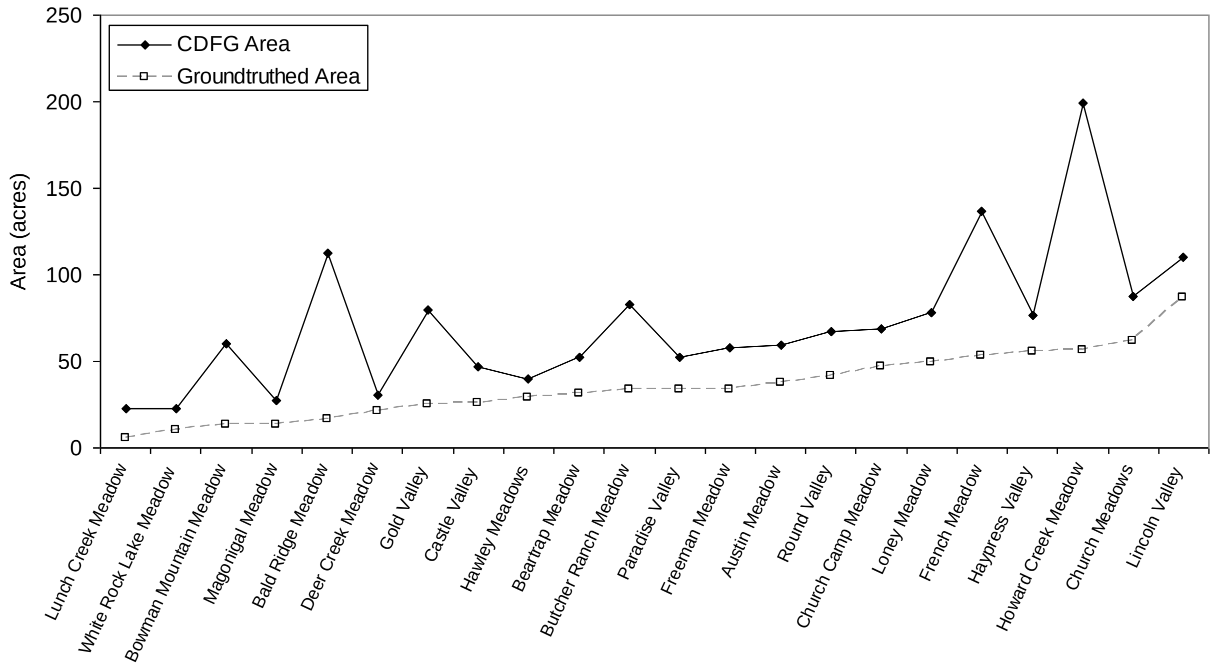


Figure 2: CDFG-delineated and corresponding groundtruthed areas for each meadow. Groundtruthed areas were always smaller than CDFG-delineated areas.

In the Mokelumne and Yuba watersheds, the CDFG delineation overestimated meadow size in a consistent manner (R2 = 0.73, Figure 3). The relation is simple: a factor of 0.5 corrects the CDFG estimate of average meadow size for these watersheds. However, our watershed-specific approach will not allow us to extrapolate to correct estimates Sierra-wide, until the relation is verified in other watersheds. Furthermore, we considered only meadows larger than 20 acres in the CDFG delineation (corresponding to an actual average size of 10 acres). Because the current CDFG delineation often misclassifies riparian stringers as meadow, it seems likely that the aerial delineation may be more difficult for smaller meadows.

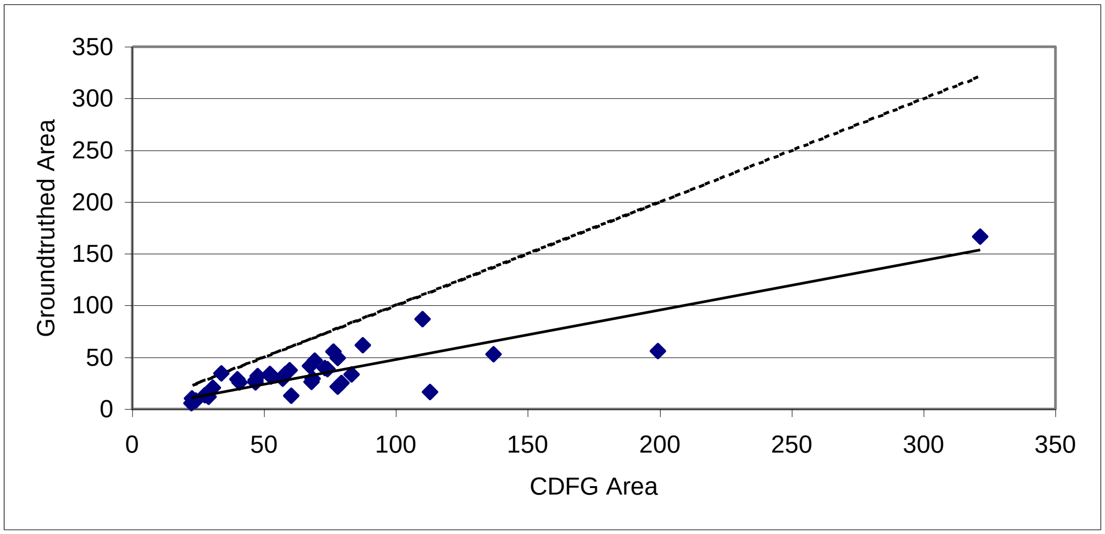


Figure 3 Meadow area calculated from the CDFG remote delineation consistently underestimates actual meadow area (y= 0.48x, R^2= 0.73). The 1:1 line is shown.

Our results suggest a method to correct the current CDFG delineation. The steeper slopes were easily flagged using GIS for likely exclusion from the delineation. In addition, riparian stringers were usually visible in an aerial photograph, and after subtracting steep slopes and viewing a few images like Figure 1, we were able to improve the delineation markedly before going into the field.

Meadow Assessment

Our goal was to develop a rapid assessment method that can be used to quickly classify whole meadows based on condition. The resulting Condition Scorecard (Appendix B) is based on the framework of the EPA Physical Habitat Assessment (Barbour et al., 1999), with questions specific to mountain meadow ecosystems in the Sierra. The assessment expands the methods of Purdy and Moyle (2008) to include condition indicators from outside the channel, such as conifer encroachment and the proportion of bare ground. The scorecard is qualitative in nature; however the scoring is based on quantitative measurements, such as bank height, percent bare ground, and length of gullies. These measurements enable observers to be field-calibrated and return similar results.

The meadow condition scorecard was developed and revised in collaboration with the following individuals:

Katie Burdick, CABY IRWMP

David Cooper, Colorado State University

Kevin Cornwell, California Stat University, Sacramento

Steven Loheide, University of Wisconsin
Amy Merrill, Stillwater Sciences
Sabra Purdy, University of California, Davis
Rodney Siegel, Institute for Bird Populations
Jeff TenPas, US Forest Service
Josh Viers, University of California, Davis
Dave Weixelman, US Forest Service

The scorecard was field tested and revised in collaboration with an interdisciplinary team from the Tahoe National Forest that included:

Toby Bakos	Leigh Sevy
Tim Biddinger	Dan Teater
Genice Froehlich	Marilyn Terney
Carol Kennedy	Kathy Van Zuuk
Victor Lyon	Dave Weixelman
Tina Mark	

The original scorecard went through multiple revisions, based on field testing and peer-review. A portion of the data we present for the Yuba Watershed was collected with an early version of the scorecard. These data are identified with decimal scores. All the low-scoring meadows assessed with an early version of the scorecard were reassessed in the field with the final version to ensure that a uniform assessment was used for all meadows that were potential restoration priorities (see Rankings and Prioritization, below).

Meadow condition was scored using six qualitative measures:

1. Bank height
2. Bank stability
3. Length of gullies and ditches
4. Vegetation cover (graminoid / forb ratio)
5. Bare Ground
6. Conifer or upland shrub encroachment.

In addition, a checklist records anecdotal observations such as past restoration efforts, roads in or adjacent to the meadow and the amount of gopher disturbance.

An experienced field crew could conduct the assessment in 1-3 hours, depending on the size of the meadow and number of distinct meadow reaches. Usually, including travel time, three meadows could be assessed in one day by a team of two observers.

Scorecard Results

American Rivers used the meadow scorecard to assess 47 meadows in the Yuba and Mokelumne River Watersheds. This represented all publicly accessible meadows 20 acres or larger that were within a one-mile walk from a road.

Six attributes of meadow condition were scored. We will refer to the *average* meadow condition as scores averaged across all attributes. The *acute* meadow condition indicates the fraction of attributes which scored in the lowest category. This is calculated as one minus the fraction of scores in the lowest category, and results in acute conditions from 0 (all attributes scored in the lowest category) to one (all attributes scored in the highest category). For the lowest scoring meadows, the acute scores paralleled the average scores (Figure 4). Thus the score ranking is robust to the choice of either average condition or acute condition, and we are not led astray by a meadow with high average scores, but some categories in heavily impacted condition.

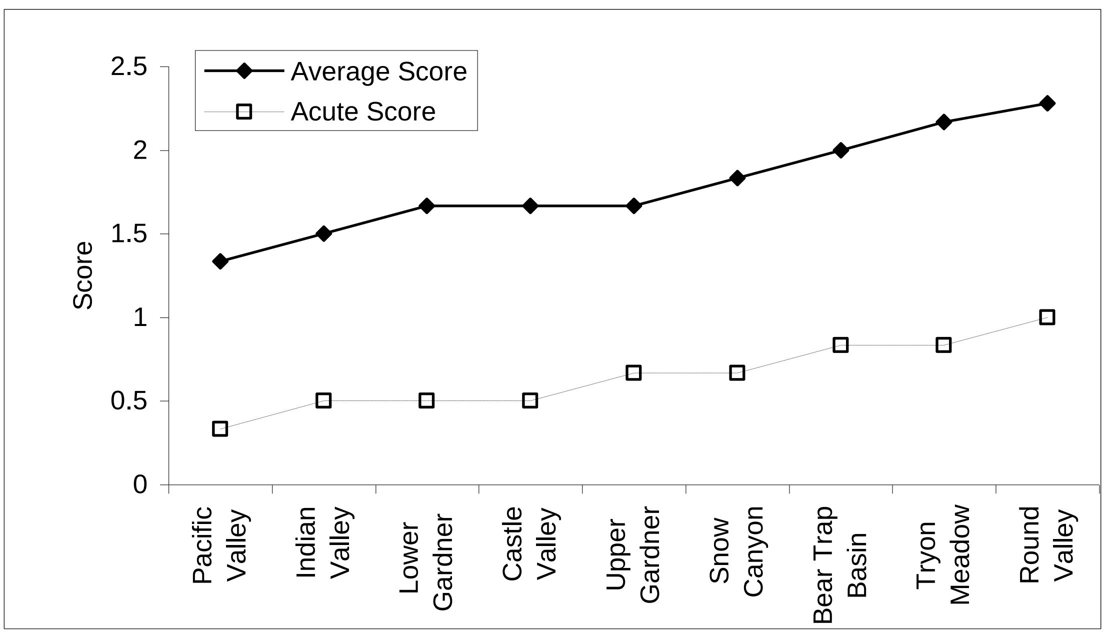


Figure 4 Average score (the average across all six categories) and acute score (a measure of the number of categories receiving the lowest score) resulted in the same ranking for the lowest-scoring meadows.

Meadows in the Yuba river watershed had fewer meadows in poor condition than the Mokelumne River Watershed (Figure 5)

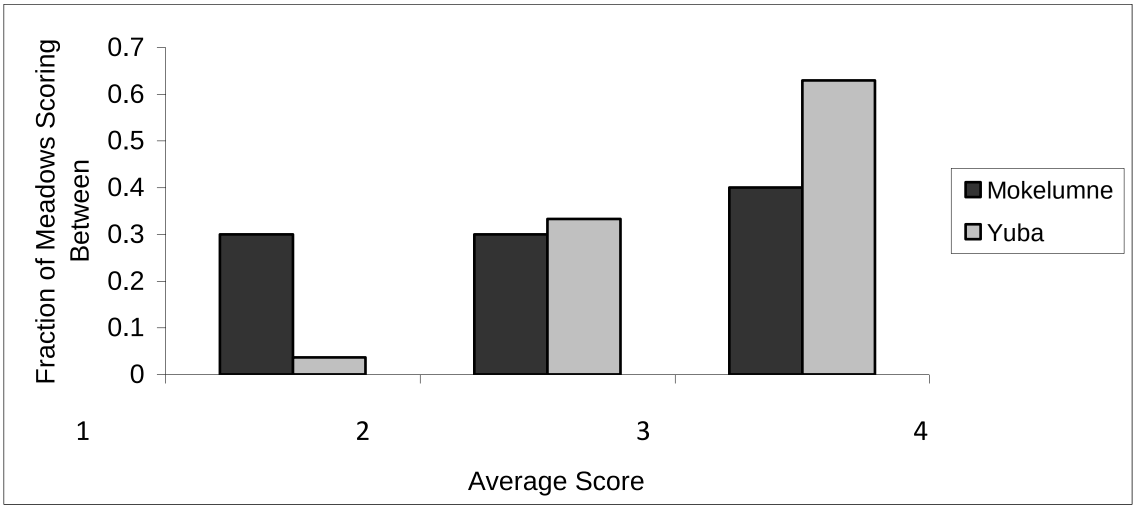


Figure 5. The distribution of average scores in the Yuba and Mokelumne watersheds. Meadows with an average score between 1 and 2 were heavily impacted. The Mokelumne watershed had more meadows in heavily impacted condition (30%) than the Yuba watershed (6%).

American Rivers currently maintains the database for scorecard data. In addition to our work in the Yuba Watershed, UC Davis used the meadow scorecard to assess 65 meadows distributed throughout the Sierra Nevada (Jensen and Viers 2011) , and Stillwater Sciences used the scorecard to assess 12 meadows in the El Dorado National Forest.

The rapid assessment data from the scorecard was used in conjunction with other attributes to rank meadows in their priority for restoration in the Yuba and Mokelumne River watersheds.

Ranking & Prioritization

We chose a structured prioritization process because it is repeatable, exportable to other watersheds, and can be tailored to work with the data available. This method of prioritization uses a list of criteria that quantify restoration potential and ranks meadows based on these attributes.

The alternative to a structured prioritization is a ranking by an expert panel or stakeholder group. This alternative method enables consideration of "one-of-a-kind" features that might move a meadow to top priority, but which can not be uniformly incorporated into a structured prioritization. For example, if one meadow contains an interpretive trail, and would be an excellent teaching example, this would not show up in our prioritization structure. Other special case attributes could include the presence of sensitive species in a meadow and water rights concerns (a potential barrier to restoration). In these cases, it should be recognized that the prioritization rubric we suggest may be accompanied by a parallel process, whereby meadows are nominated for prioritization as special cases.

In the Yuba River watershed, we convened a facilitated one-day meeting with 30 stakeholders in which we attempted to codify a value system that we would use to prioritize meadows for restoration. This was patterned after other successful natural resource prioritizations in which values were used to rank restoration options, based on a hierarchy of locally-agreed-upon values. This turned out to not work for meadows, given the level of information currently available. That is, most meadows do not have a restoration plan, thus there is no proposed action, endpoint, or anticipated appreciation in value that is quantifiable for most meadow sites. For example, an agreed upon value accruing from restoration in the Yuba watershed was improved fish habitat. It is then relatively simple to rank *projects* based on the benefits to fish habitat (here conifer removal projects would rank behind stream bank stabilization efforts), but it is impossible to rank each meadow *site* in the watershed based on how much fish habitat may improve, because the options for restoration (will it be conifer encroachment or bank stabilization?) have not been agreed upon. Yet looking forward to the time when multiple meadow restoration projects are described and seeking restoration funding, it will be possible to rank projects based on the anticipated values they provide. The prioritization method we prototyped collaboratively for the Yuba watershed is available at www.americanrivers.org/meadowpubs. It summarizes stakeholder values that not only rank projects; they can also be used to evaluate the special cases mentioned above. Without project-level information for most meadows in the Yuba and Mokelumne watersheds, we developed a structure for prioritizing meadow sites for restoration planning and design.

We began the prioritization process with a desktop culling of meadows more than one mile from a vehicle-accessible road, smaller than 20 acres (which corresponds to an average on-the ground acreage of 10 acres, see Delineation section above), and those meadows for which we could not gain landowner support. Our rationale was that restoration of remote meadows is challenging because of difficult access, and restoration programs have shied away from quite small meadows because of assumed increasing returns to scale (although see Figure 9).

The resulting list of meadows (27 in the Yuba watershed, 20 in the Mokelumne watershed) was assessed using the condition scorecard and prioritized based on site condition, and accessibility. The top ten priority meadows are shown in rank order in Table 1. The condition attributes from the scorecard are included and color coded. Spatial data that includes the prioritized meadows (Figure 6) are available at www.americanrivers.org/meadowpubs.

Meadow Name	Watershed	Bank Height	Gullies outside Main Channel	Bank Stability	Vegetation Condition	Bare Ground	Encroachment
Pacific Valley	Mokelumne	1	2	1	2	1	1
Indian Valley	Mokelumne	1	1	2	2	1	2
Castle Valley	Yuba	1	2	3	2	1	1
Deer Creek	Yuba	4	4	3	1	1	3
Tryon Meadow	Mokelumne	2	2	2	2	1	4
Little Indian Valley	Mokelumne	2	1	3	3	2	3
Magonigal	Yuba	2	3	3	1	4	3
Beartrap	Yuba	4	4	2	3	4	1
Loney	Yuba	3	1	3	3	2	3

Table 1 Meadows in rank order of priority for restoration. Scores are shown for the six condition attributes.

From Prioritization to Restoration

After prioritization, we assisted the El Dorado National Forest in bringing one meadow to point where restoration is ready to proceed. On behalf of, and in close partnership with the El Dorado National Forest, American Rivers completed CEQA and Water Quality (401) permitting for the second-highest scoring meadow, Indian Valley. The top restoration candidate (Pacific Valley) is home to a campground and cabins and will need to balance more interests than Indian Valley, thus we decided to invest our effort in Indian Valley first. Currently there are three funding proposals submitted for restoration in Indian Valley, and a strong collaboration has been built to support restoration of this important meadow.

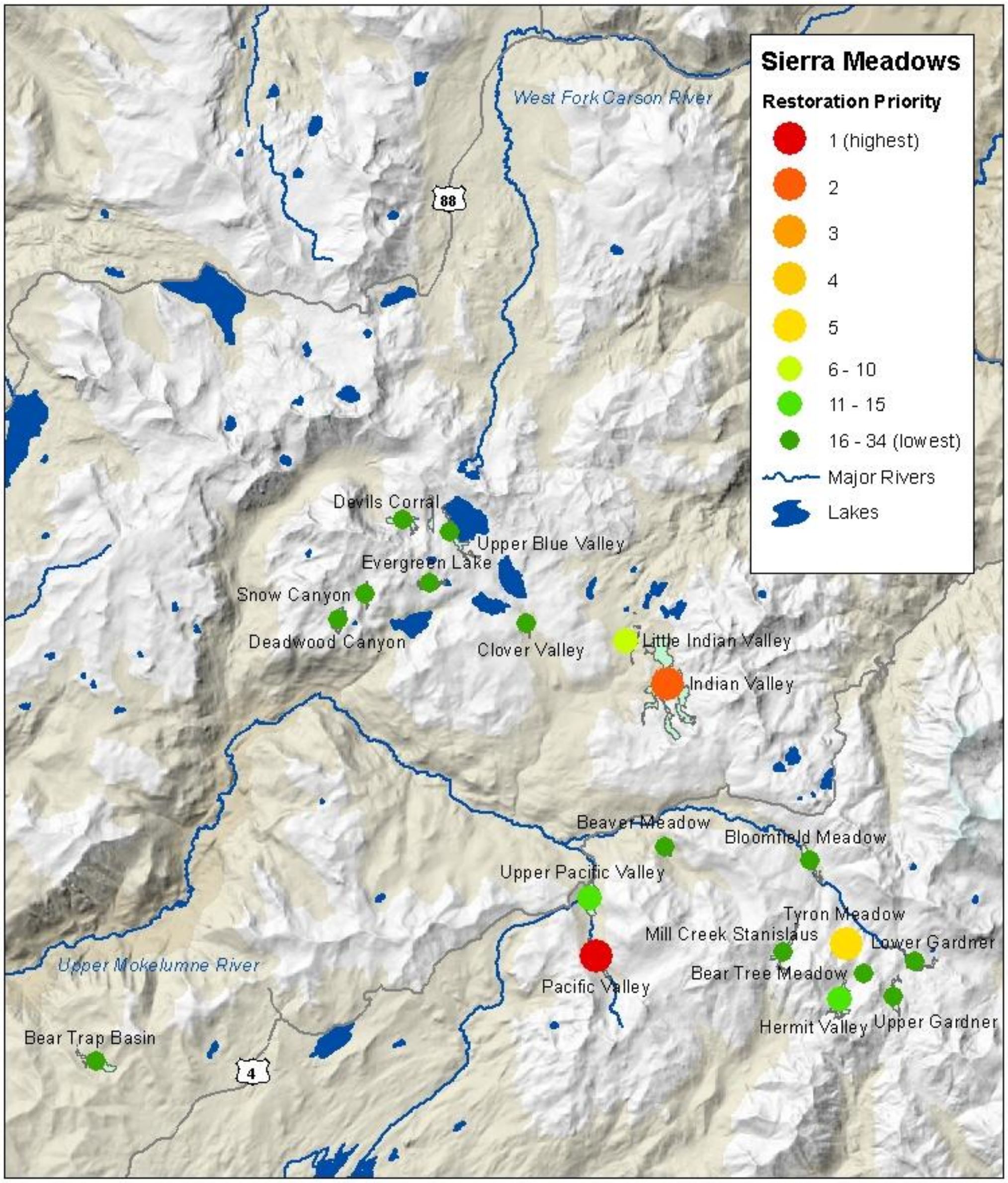
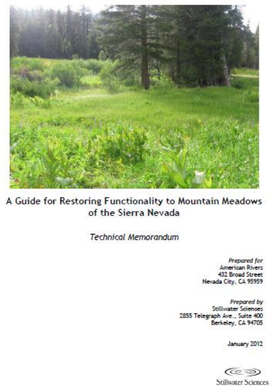


Figure 6. The location of top priority meadows for restoration in the Mokelumne watershed. The meadows of the Yuba and Mokelumne watershed were prioritized together, so, for example, the third priority meadow (Castle Valley) is to the north of this map.

Evaluating Restoration Methods

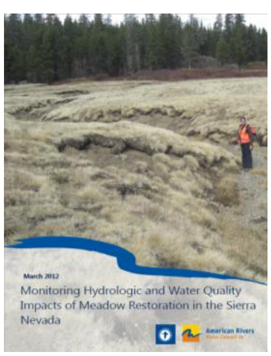


Stillwater Sciences completed an extensive literature review of existing restoration techniques and available monitoring data under subcontract from American Rivers. Quantitative data were insufficient to provide a basis for analysis; therefore, Stillwater Sciences reviewed techniques based on qualitative data and experience of experts. Data gaps were identified and incorporated into monitoring recommendations. The full report (Stillwater Sciences 2011) is available at www.americanrivers.org/meadowpubs.

Monitoring to Improve Management, Increase Investment and Support Innovation

There is a resounding call for monitoring from all sides: restoration practitioners, downstream landowners, land managers and investors. To date, monitoring efforts have been accomplished on shoe-string budgets. These have provided critical information to initiate support for meadow restoration and quantify initial results (notably monitoring by the Feather River CRM). Yet substantial gaps exist, which can only be filled by a coordinated and well-supported monitoring effort that is planned with the same commitment as restoration itself.

The goal of the monitoring plan we developed is a standard, quantitative description, so that multiple restoration projects can be compared (See, for example Stewart 2009, Figure 2). In the documents shown below, we identify methods of data collection and analysis, as well as statistics to report, and when possible, we suggest hypothesis tests. Both monitoring protocols are designed to dovetail with methods for avian and fish monitoring (Loffland, Siegel, and Wilkerson 2011; Purdy 2011) also sponsored by NFWF.



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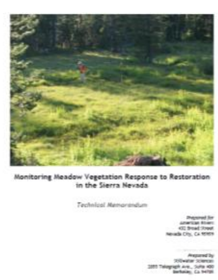

Stillwater Sciences 2011

Figure 7 Monitoring protocols available at www.americanrivers.org/meadowpubs

The goal of this nascent monitoring program is to spur data collection in support of three main purposes:

1. Monitoring enables post-project management. Adaptive management is especially important for restoration, where the goal is to employ natural processes, with the caveat that natural uncertainties are built in.
2. Monitoring also provides the information to gauge success. Documented successes and quantified benefits are critical for attracting investment and insuring continued support for meadow restoration.
3. Monitoring enables advancement of the state of the art. Effective monitoring enables learning and highlights unexpected outcomes. This is particularly important at this stage of meadow restoration because techniques continue to develop, established techniques are applied in new geomorphic settings, and climate change is predicted to have a significant effect on the hydrology of the Sierra Nevada.

In sum, monitoring is designed to improve management, promote investment and enable innovation. The importance of integrating monitoring into the design and budget phases of a project cannot be overstated. Not only will this ensure that sufficient pre-project information is collected, but a project with a stated monitoring plan will often be more successful, as it will be designed to match the project goals and evaluation criteria.

Costs of Restoration

Restoration projects differ greatly in scope, even within one restoration technique. For example treating a channel that is one meter wide using pond and plug is a much smaller project than treating a channel 10 meters wide with the same technique. The cost per meter of rehabilitating the 1 meter wide channel is much smaller. However it is not yet possible to compare the value of the two projects because benefits are seldom possible to quantify using available monitoring data (see Standard Monitoring Methods, below).

The cost data we present here are derived from 59 meadow restoration projects that reported costs. It is seldom clear whether the cost reported is an accurate total. For example, if the US Forest Service completed the permitting, their personnel costs may or may not be included. The costs we present are the best available, and the only summarized cost information we are aware of. However, because of the above caveat, they should be considered order-of-magnitude estimates.

The costs per acre of various restoration techniques are shown in the boxplot in Figure 8. The cost per acre of channel reconstruction and bank stabilization are somewhat higher than the cost per acre of other techniques. Channel reconstruction involves filling the channel and creating a new channel in the meadow. Pond and plug may involve creating a new channel for isolated portions of the project, but it is distinct from channel reconstruction in that the majority of the time historic ("remnant") channels are used, rather than constructed, and the restored channel is not completely filled (Lindquist and Wilcox 2000). Grazing management includes exclosure fencing and construction of out-of channel watering troughs. Bank stabilization includes plantings and reshaping, but not in-channel protections such as rock vanes and weirs.

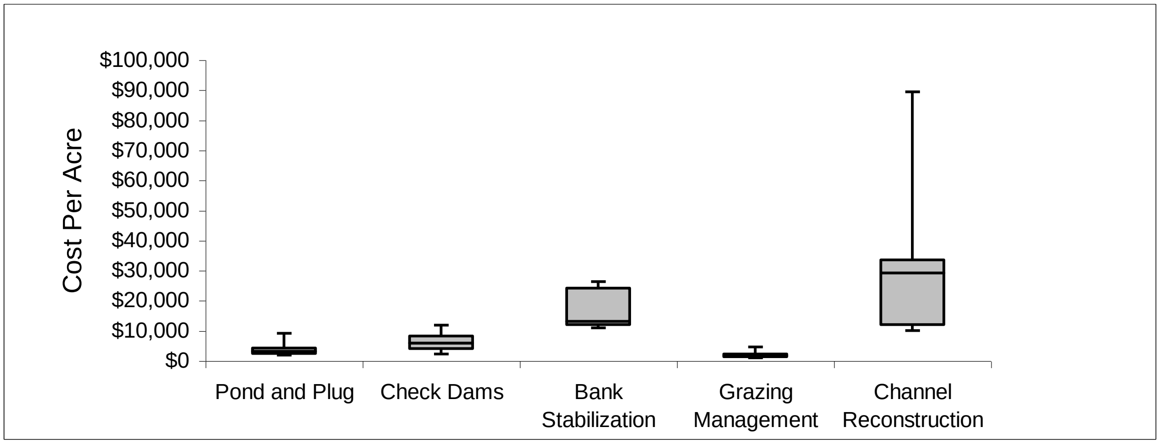

Figure 8 Costs per acre of meadow restored for pond and plug (n=18), check dams (n=3), bank stabilization (n=3) and channel reconstruction (n=5) techniques. Data shown are median values, quartiles (boxes) and extreme values (whiskers).

Figure 9 shows the cost per by meter of restored channel for the different techniques. Channel reconstruction remains more costly per meter, but bank stabilization has a similar per-meter cost to check dams and pond-and-plug. Note that projects included in these two figures differ, because some reports included channel lengths but not area, and vice versa, and some reports included both measures. Grazing management is excluded from this plot because these data are reported only on a per-acre basis.

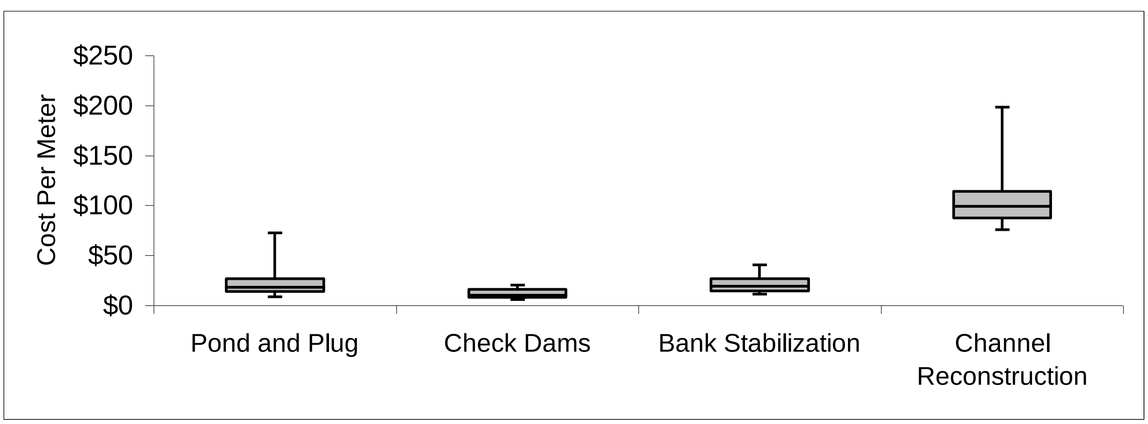

Figure 9. Costs per meter of channel restored for pond and plug (n=16), check dams (n=3), bank stabilization (n=4) and channel reconstruction (n=8) techniques. Data shown are median values, quartiles (boxes) and extreme values (whiskers).

Restoration projects ranged in size from three acres to 800 acres. We expected to see an economy of scale reflected as a decrease in cost per acre for larger projects, but, no such relation is apparent (Figure 10, R^2 =0.02 for both relations). Is there no economy of scale after all? One possible explanation is that projects which address a larger area may also address a bigger and more systemic issue and therefore, incur a higher cost per acre. If this is so, we would expect an increased benefit per acre, due to solving a bigger problem in a bigger meadow (for example a more deeply eroded channel) and the lack of scale-dependant cost savings could be consistent with positive returns to scale. Furthermore, costs such as mobilizing equipment, and to some extent permitting, should increase returns to scale. Again, the primary uncertainty here is in the benefits which accrue from meadow restoration.

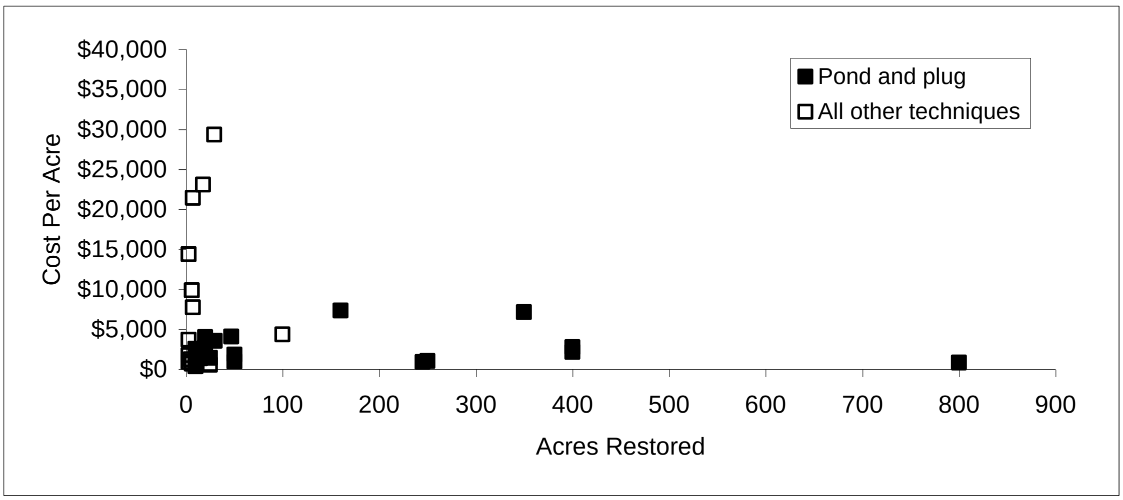

Figure 10. Project size does not predict project cost (R^2=0.02). See text for discussion.

Toward a Groundwater Credit: Ballparking the Cost of Increased Storage

Bonneville Environmental Foundation's Water Restoration Certificates™ provide a model for businesses to offset their water use by funding the return of instream flows to a critically dewatered stream (http://www.b-e-f.org/business/products/wrcs/). This program sparked interest in a groundwater credit for meadow restoration, whereby businesses could sponsor increases in groundwater stored high in the watershed by supporting meadow restoration. Our first goal in this nascent effort was to quantify the groundwater benefits of meadow restoration and estimate a price for restoring a gallon of groundwater to a dewatered meadow.

The groundwater effects of pond-and-plug restoration have been quantified by five studies (Table 2). One study (Hammersmark et al 2008) estimated total acre feet restored. The other four studies reported changes in groundwater depth. We used the relation between raised groundwater calculated from Hammersmark et al. (2008) to convert the average change in groundwater depth in the other studies to increased acre feet. This assumption presumes that the other meadows respond identically, and that a change in groundwater of four feet results in four times the storage of a one-foot increase in groundwater.

	Average change in Groundwater Depth (ft)	Acres Restored	Acre Feet Increased	Acre Ft Increase/Acre
Tague et al. 2008	1.3	67	10.6	0.2
Cornwell and Brown 2008	8.1	68	67.2	1.0
Hammersmark, Rains, Mount 2008	4	568	277.0	0.5
Loheide and Gorelick, 2007	6	90	65.8	0.7
Feather River CRM 2009	5	400	243.8	0.6

Table 2 Published estimates of the change in groundwater depth and acres restored using the pond and plug technique. See text for assumptions made in volume (acre feet) calculations

We used the cost estimates (Figure 8) and the increased storage estimates (Table 2) to compute an expected range for the price of 1,000 gallons of increased storage as a result of pond and plug implementation. We estimate a price point of $10 (range is $5-$21) for 1,000 gallons of additional groundwater storage in a meadow rehabilitated using pond and plug. The low estimate of cost per $1,000 gallons restored is computed from a low cost estimate (the 25th percentile cost) and a high estimate of groundwater increase (the 75th estimate).

Cost per 1,000 gallons of increased groundwater storage	
25 percentile cost/ 75 percentile increase in storage	$ 5
Median cost/ Median increase in storage	**$ 10**
75 percentile cost/ 25 percentile increase in storage	$ 21

Table 3. The cost of increasing groundwater storage by 1,000 gallons with the pond and plug technique. The table provides high, middle and low estimates.

Next Steps

Reporting and Monitoring

Now that standard monitoring protocols are in place, the next step is to ensure that the information is collected and that we learn from it. Monitoring and reporting standards require a budget and pre-implementation planning. Once meadows are prioritized for restoration, pre-project monitoring should be the next priority. During the monitoring effort, a collaborative of partners may be nourished to support and guide the implementation. After implementation, the project sponsors must require that monitoring continues and that project information is submitted to a database such as NRPI, and that data are freely available. These requirements were made early-on for gene sequence research and had a great impact on the field (see the NCBI example: http://www.ncbi.nlm.nih.gov/). The lesson learned is that, when information sharing is required by a sponsoring organization, it rapidly becomes the norm and benefits the field. Monitoring will rapidly become a priority if organizations pursuing restoration funding are evaluated on their successful monitoring history, and if projects are not ready-to-proceed until pre-implementation data are in place.

Evaluation and Prioritization

We observed that evaluation and prioritization of meadows can lead almost immediately to on-the ground restoration (From Prioritization to Restoration). Furthermore, tight collaborations build rapidly around a published focus.

A promising strategy for accelerating meadow restoration is to support meadow assessment and prioritization by organizations poised to take a leadership role in meadow restoration in a given locality. We expect that if organizations within the watershed, county, National Forest, etc. completed the assessment, and prioritization, it would be much more effective than if the list were produced by an outside contractor. Our experience with the Forest Service is that, when we collaborated on generating the assessment and prioritization, the next steps were already aligned and proceeded very quickly.

There is likely no substitute for on-the ground assessment and two field technicians using the meadow scorecard who are paid $30 per hour would be able to assess meadows on-the ground for approximately $150 per meadow. At 30 large meadows per watershed, this would be less than $5,000 per watershed, plus additional funding for partnership building during the prioritization process. Again, the value upon completion is more than an assessment; it is buy-in, momentum, and established support for meadow restoration from individuals who have visited numerous meadows.

The NFWF Business Plan and Logic Model

The NFWF Business Plan for meadow restoration (2010) identifies the goals of restoration and strategies to increase support. At a surface level, the document identifies NFWF's position; however because of NFWF's lead role framing the discussion and setting objectives, numerous individuals and organizations (for example, ranching organizations and the USFS) seek to offer revisions, additional data, and counterpoints. Participants in the meetings we held frequently asked us "How can we comment on the NFWF Business Plan?"

We observed that the Business Plan is often interpreted as the "State of Sierra Meadows and Meadow Restoration", which is different from its role as a strategy document for NFWF. This is exciting, in that it solidifies NFWF's lead role in meadow restoration. It also suggests that the two components of the document: 1) benchmarking progress and the state of knowledge and 2) identifying NFWF's viewpoint and strategy, be updated separately.

The State of Meadow Restoration (component 1) would benefit from a biannual literature review and stakeholder comment process, in which new information is synthesized and progress is tracked. This may be best accomplished through a partnership with an academic or agency research lab. The standard monitoring and reporting methods described above support and call for this synthesizing effort. When new findings arise, they would update the logic model and provide strategic direction for NFWF and others promoting meadow restoration.

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