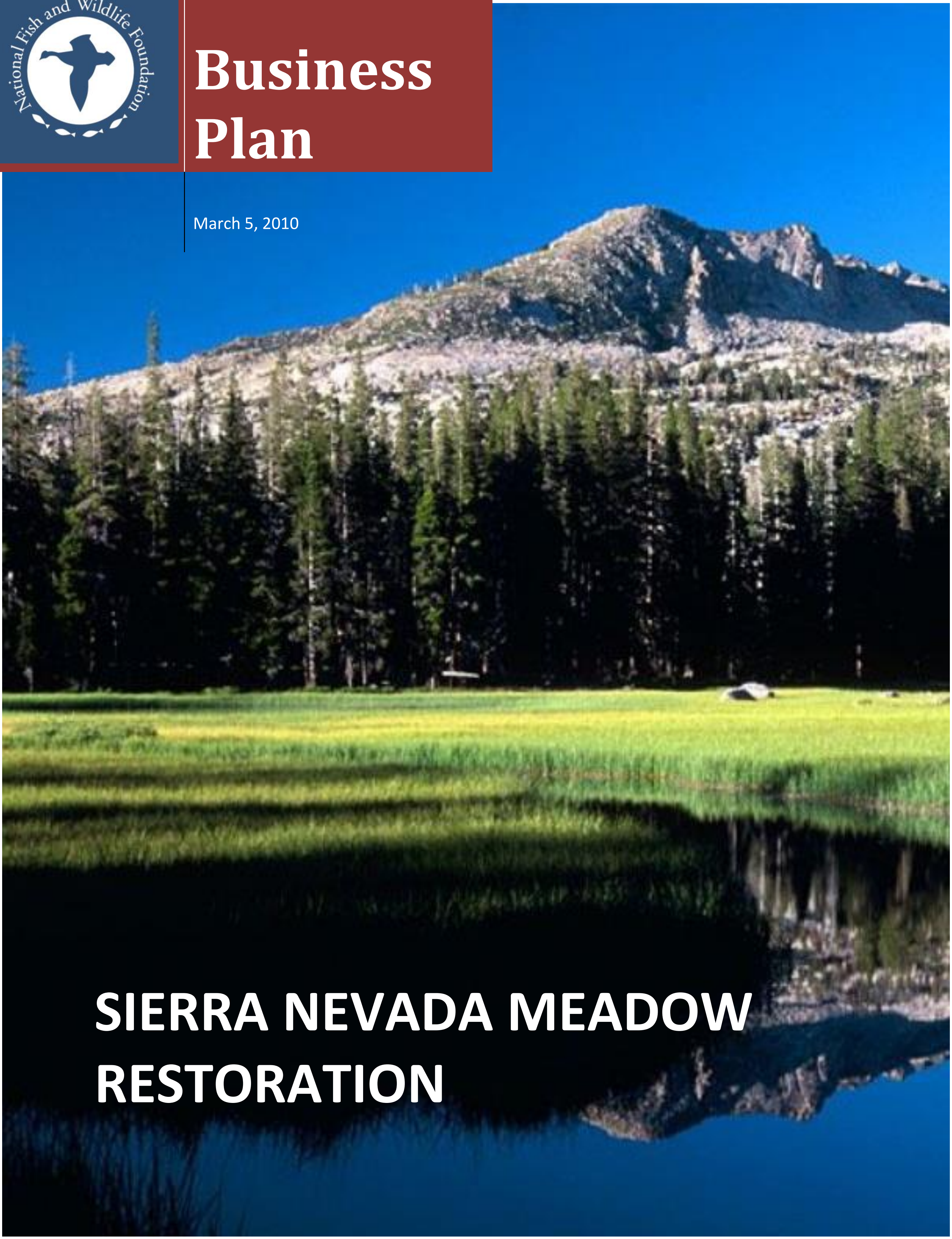
Business Plan

March 5, 2010



SIERRA NEVADA MEADOW RESTORATION

What is a business plan?

Each of the Foundation's keystone business plans has its own unique structure that reflects the conservation problem and the needs of the community working to solve that problem. However, each plan has four elements at its core:

Impact: A concrete description of the outcomes to which the Foundation and grantees will hold ourselves accountable.

Strategic priorities: The specific activities that must take place and have a cause-and-effect connection with the impact we are trying to achieve.

Resource implications: An analysis of the financial, human and organizational resources needed to carry out these activities.

Performance measures: Quantitative outputs and outcomes and a timeline for achieving them that make it possible to measure success and make it possible to adaptively revise strategies in the face of underperformance.

This document reflects the consensus or majority view of the many federal, state, academic or organization experts that we consulted with during plan development, and do not solely represent the Foundation's view of the actions necessary to achieve the identified conservation goals.

The Sierra Nevada Meadow Restoration Business Plan was developed and revised in collaboration with the following organizations, agencies and individuals:

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EXECUTIVE SUMMARY

The majority of California's freshwater comes from the Sierra Nevada, falling in winter as a thick blanket of snow that slowly melts in spring and summer, delivering enormous quantities of fresh, clean water to fill the state's rivers and reservoirs in support of its cities, industry, agriculture and ecosystems. As California's climate warms up, more of this water will fall as rain rather than snow which will run off immediately in large winter pulses that will increase flooding and are likely to be beyond the storage capacity of the existing reservoir system. Meanwhile there will be much less snowmelt that recharges streams and helps keep a reliable water supply for people and wildlife in summer and autumn. These changes are a monumental challenge for the people, economy and environment of California.

An innovative solution may help provide part of the solution to this problem: mountain meadow restoration and conservation.

This business plan maps out a 10 year program to restore and conserve meadow habitat in the Sierra Nevada. This plan puts emphasis on the first 5 years, during which efforts are focused on implementation of strategies that will further build the economic and scientific rationale that meadow restoration and conservation is worth pursuing on a large scale. The first 5 years also focused on building the capacity and large scale projects to make future expanded efforts possible. Contingent on success in years 1-5, years 6-10 will focus on implementing work on a sufficient scale to ensure appropriate restoration and management of the majority of degraded Sierra meadows.

This business plan will guide every aspect of the Foundation's anticipated $10-15 million in grant-making associated with Sierra meadows over 5 years. Ultimately, the hope is that the strategies and activities described herein are adopted by the broader community of agencies and organizations working on similar goals and shared responsibility for the additional $200 million or more of investments identified as necessary to restore all of the Sierra's degraded meadows.

Our resources will be focused on the following strategies:

a. Restoring habitat. The hydrology and ecosystems of most meadows in the Sierra are degraded. Activity – Restore at least 20,000 acres/year by 2014, focused on meadow systems in which it will be possible to quantify benefits.

b. Validating benefits. Restoring meadows may or may not provide water service benefits. Scientific consensus is lacking on the amount of water that can be retained in restored meadows across meadow types, the downstream water quantity and quality impacts of restoration, benefits to downstream flow reliability, and the overall cost-benefit of restoration. Activity – Support hydrologic, water quality, economic and ecological assessments to predict and measure before/after changes in ecosystem services provided by meadow restoration.

c. Building capacity. Current and future expansion of restoration activity is limited by insufficient personnel to plan and implement restoration on public and private lands. Activity – Expand capacity in key watersheds throughout the Sierras to implement restoration.

Table of Contents

Potential Watershed Services Provided by Meadows

Meadows are a critical component of watershed hydrology because they act as natural reservoirs, regulating stream flow through storage and release of snowmelt and rainfall runoff that passes over and through fine-grained, sod-covered meadows.

Flood Attenuation and Flow Reliability

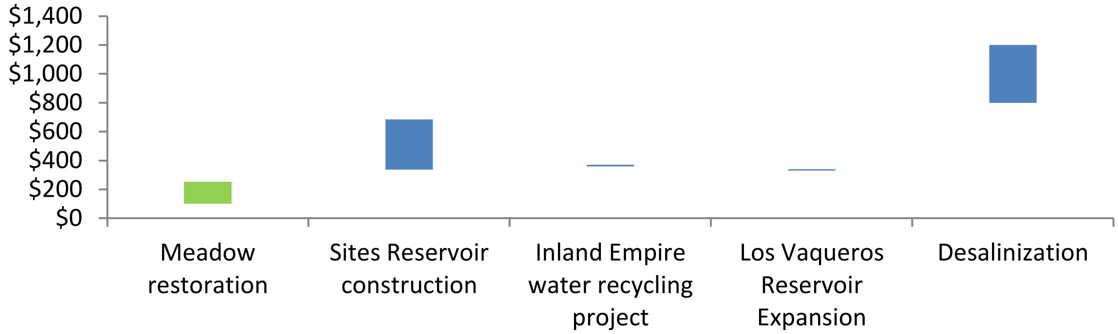
Results from several studies in the northern Sierra indicate that restoring meadows attenuates peak flood flows and increases water storage capacity (Sagraves 1998, Liang, 2006, Loheide and Gorelick, 2006, Cornwell and Brown 2008a). Meadows therefore improve early season water flow reliability availability for downstream farms, communities, and hydropower facilities. The importance of these services is likely to increase as climate change results in a shift from snowmelt to rainfall-dominated runoff at mid-elevations in the Sierra Nevada.

Increased Late-Season Water Flow

A potentially more valuable service may be provided by meadows if they prolong dry-season base flows. Meadow restoration will not create "new" water, but may alter the temporal distribution of streamflow so that less water flows downstream during peak runoff periods in the winter and spring. A significant set of empirical and modeling studies suggest that the increase in groundwater storage will result in an increase in base flow is then released during the summer/autumn low-flow season (Liang et al., 2006), when demand is high. Based on the limited available information and a reasonable range of assumptions, meadow restoration in the Sierra Nevada could increase the amount of groundwater stored in and released from meadows by 50,000 to 500,000 ac-ft annually. The wide range in these estimates results from uncertainties in channel depths and specific yields of meadow alluvium, as well as limited knowledge of bedrock and meadow permeability and groundwater sources and flow paths in mountainous terrain. The potential groundwater-storage benefits of restoring hydrologically functional meadows are comparable to the estimated potential benefits of other water supply proposals, including a new reservoir at Sites in Colusa County (470,000 to 640,000 ac-ft per year) and the Inland Empire Regional Water Recycling Initiative (100,000 ac-ft per year). The benefits of large-scale meadow restoration, therefore, may be significant for statewide water resources.

Costs of recent meadow restoration projects, including planning and environmental compliance, range from roughly $100 to $250 per ac-ft of potential increased water storage over a 10-year period (Figure 1). The higher costs are for projects that require construction of new channels using heavy equipment and hauled fill. For comparison, the California Department of Water Resources estimates the proposed Sites Reservoir will cost between $338 and $685 per ac-ft during the first 10 years of operation after construction, and the Inland Empire Water Recycling Project would cost about $360 per ac-ft over a 10-year period. Meadow restoration therefore appears to be a cost-effective approach to improving surface-water supplies, as initial costs are low and there are minimal long-term operational costs.

Figure 1. Predicted costs per estimated acre foot benefit associated with a variety of proposed water projects versus pond and plug meadow restoration.



However, other research suggests that although groundwater storage in restored meadows will increase and water tables will rise, evapotranspiration (movement of water through plants into the atmosphere) from wetland and other plant communities dominating restored areas will result in no net increase in late season flows or even a decrease in flow. The uncertainty over this water service significantly affects estimates of the value of meadow restoration.

Reduced Erosion

Native meadow sedges have extremely long and dense root and rhizome networks that are inherently resistant to erosion, helping to maintain wet soils through much of the summer (Micheli and Kirchner 2002a, Micheli and Kirchner 2002b, Kleinfelder et al. 1992). Restored mountain meadows support these graminoid communities, while degraded meadows often do not. High flows often overtop the channel in healthy meadows, slowing the water which allows sediment to deposit on the meadow floodplain, and minimizes sediment input from local bank erosion. In one project in the Feather River watershed, restored meadows showed a 17.5 percent reduction in annual sediment loading in rivers and streams. This in turn reduced the amount of sediment deposited in downstream reservoirs, thereby maintaining reservoir storage capacity. Thus, hydrologically functional meadows reduce erosion and capture bedload, aid in floodplain development, and filter sediment. By filtering out sediment, healthy riparian vegetation builds streambanks and increases the seasonal quality of water released for downstream ecosystems and human uses (Lindquist, Bowie and Harrison 1997).

Water Temperature

Increases in groundwater storage and discharge of groundwater into streams also leads to reduction in water temperature during the summer.

Snapshots of Healthy and Unhealthy Meadows

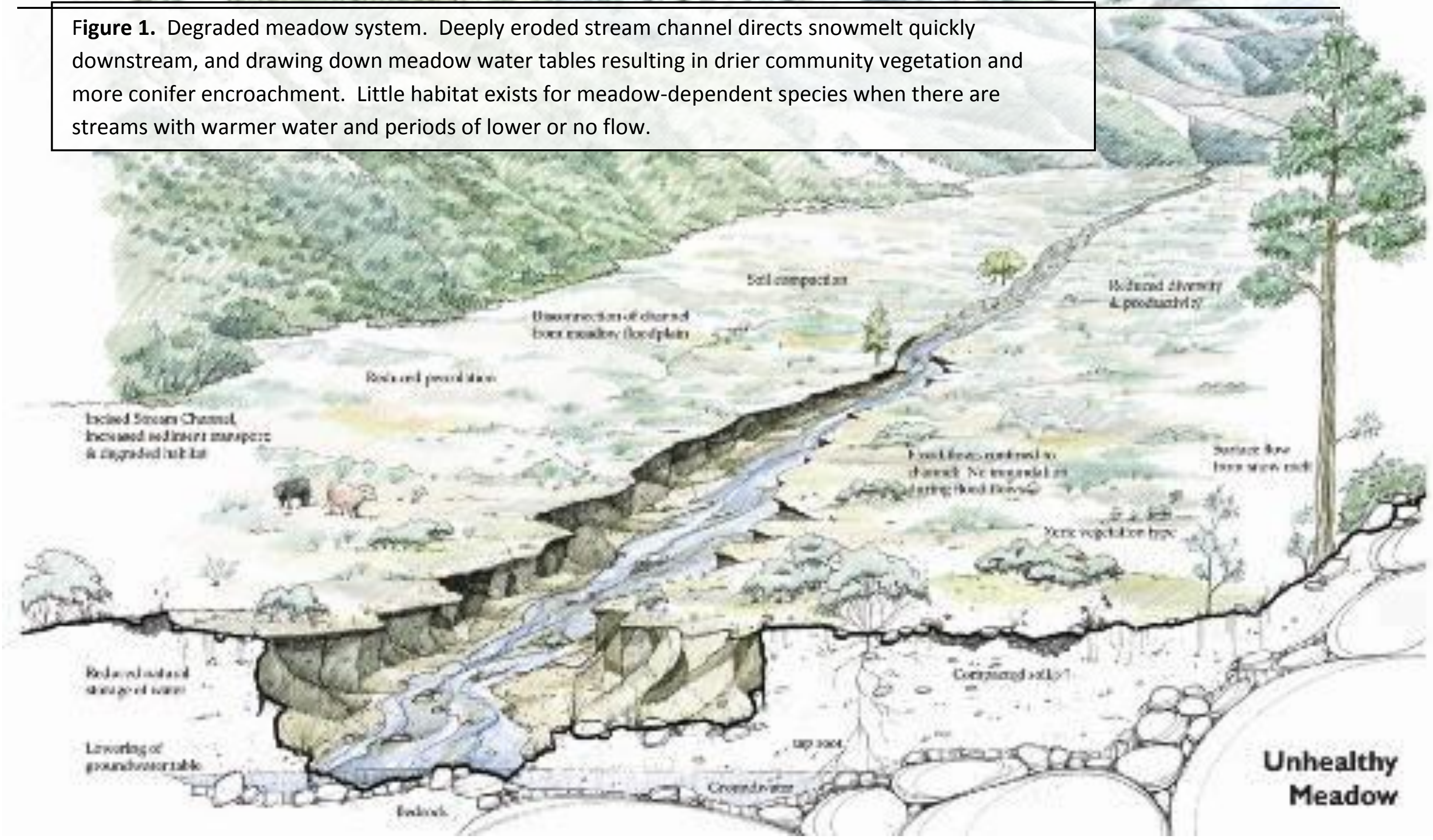


Figure 1. Degraded meadow system. Deeply eroded stream channel directs snowmelt quickly downstream, and drawing down meadow water tables resulting in drier community vegetation and more conifer encroachment. Little habitat exists for meadow-dependent species when there are streams with warmer water and periods of lower or no flow.

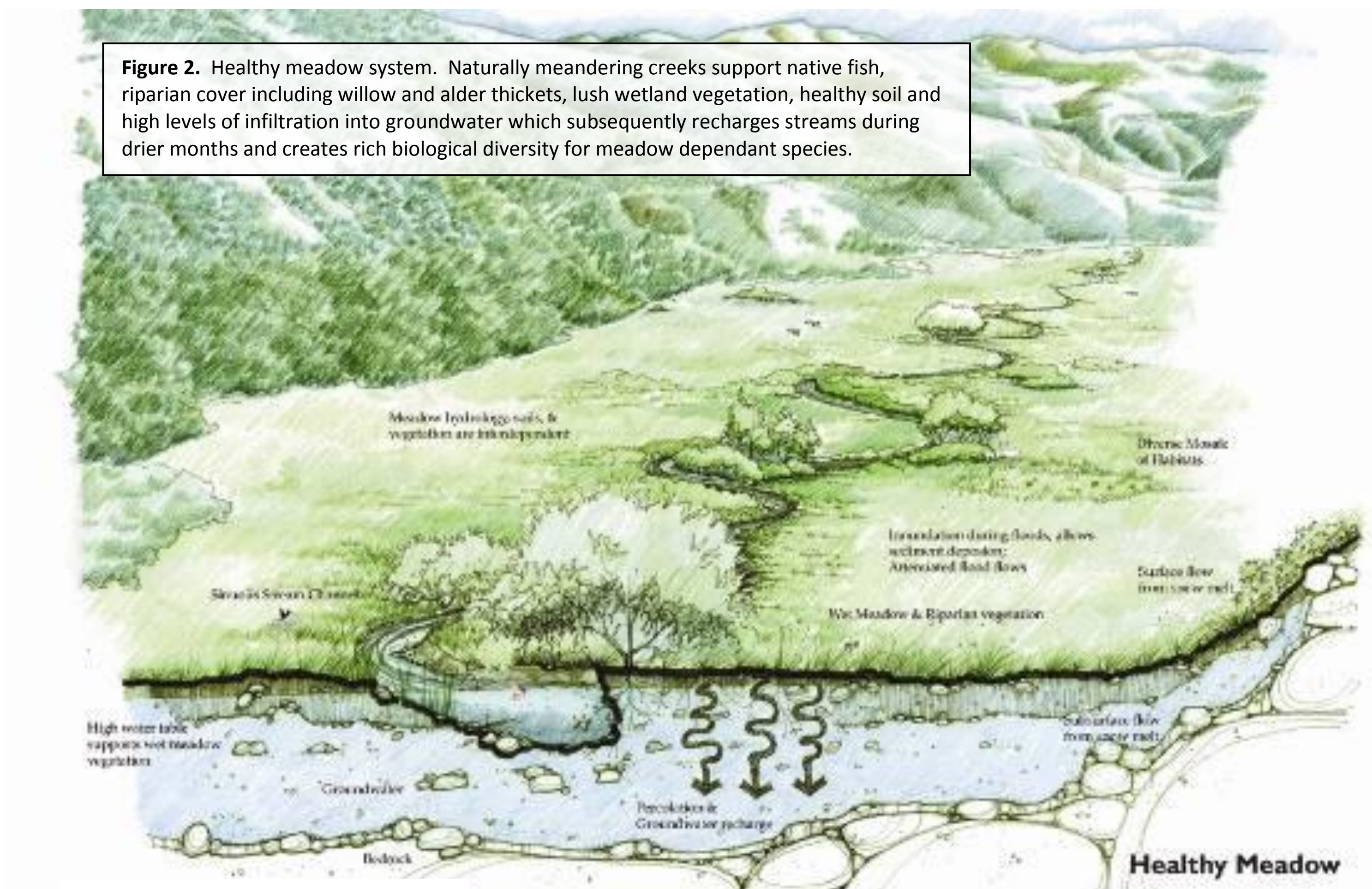


Figure 2. Healthy meadow system. Naturally meandering creeks support native fish, riparian cover including willow and alder thickets, lush wetland vegetation, healthy soil and high levels of infiltration into groundwater which subsequently recharges streams during drier months and creates rich biological diversity for meadow dependant species.

Credit: *American Rivers*

Wildlife Services Provided by Meadows

Meadows are biodiversity hotspots for the animal species of California, particularly birds and amphibians, of which approximately two-thirds depend upon Sierra Nevada habitats. During summer months, montane meadows are considered the single most important habitat in the Sierra Nevada for birds (Graber 1996). Eighty-two terrestrial vertebrate species are considered dependent on riparian and meadow habitat, 24% of which are at risk (Graber 1996). Meadows with streams that flow through them are also important habitat for native trout and other aquatic species (Moyle et al. 1996). Several Threatened, Endangered, and Sensitive fishes protected by California occur in streams flowing through meadows. Approximately 30 rare taxa of vascular plants and bryophytes are found solely in mountain meadows and plant species are extremely diverse within individual and across several meadows (Weixelman et al. 2000). Species dependent or partially dependent on meadows and that will most benefit from implementation of this plan are listed in the Conservation Outcomes section and in Appendix A.

Mountain meadows are key habitats for many animal species because they provide water and shade availability during the three to six month dry season, promote lower summer stream temperatures, higher plant productivity, increased insect prey availability, and special vegetation structures such as willow thickets (Graber 1996). Moreover, these ecologically rich oases often occur along riparian corridors, linking meadow to meadow and creating movement pathways across the broader landscape. The health and connectivity of these ecological corridors is critical for maintaining genetic diversity within species since these corridors facilitate breeding among distant populations and because they enable animals (and, usually more slowly, plants) to find new areas to inhabit. In the face of climate change and growing development pressures, these corridors will be lifelines for wildlife.

Threats to Meadows

Over-grazing in the late 1800s through 1930s and road-building, mining, logging, urbanization and catastrophic wildfire over the last 150 years have resulted in widespread deterioration of meadows in the Sierra Nevada. Meadows are also susceptible to effects of climate change (Wood, 1975). Changes to the meadows attributed to these cumulative watershed impacts include gullying, desiccation, shrub encroachment, and changes in plant species composition and diversity (Wood 1975, Ratliff 1985, Allen-Diaz 1991, and Menke 1996). Today conditions and grazing use patterns in many meadows are improving; however channel incision from heavy historical use has altered many meadows by dramatically lowering streambeds and groundwater tables. These changes in meadow hydrology will not repair themselves. Between 130,000 and 200,000 acres (40-60%) of meadows may be impacted by such degradation.

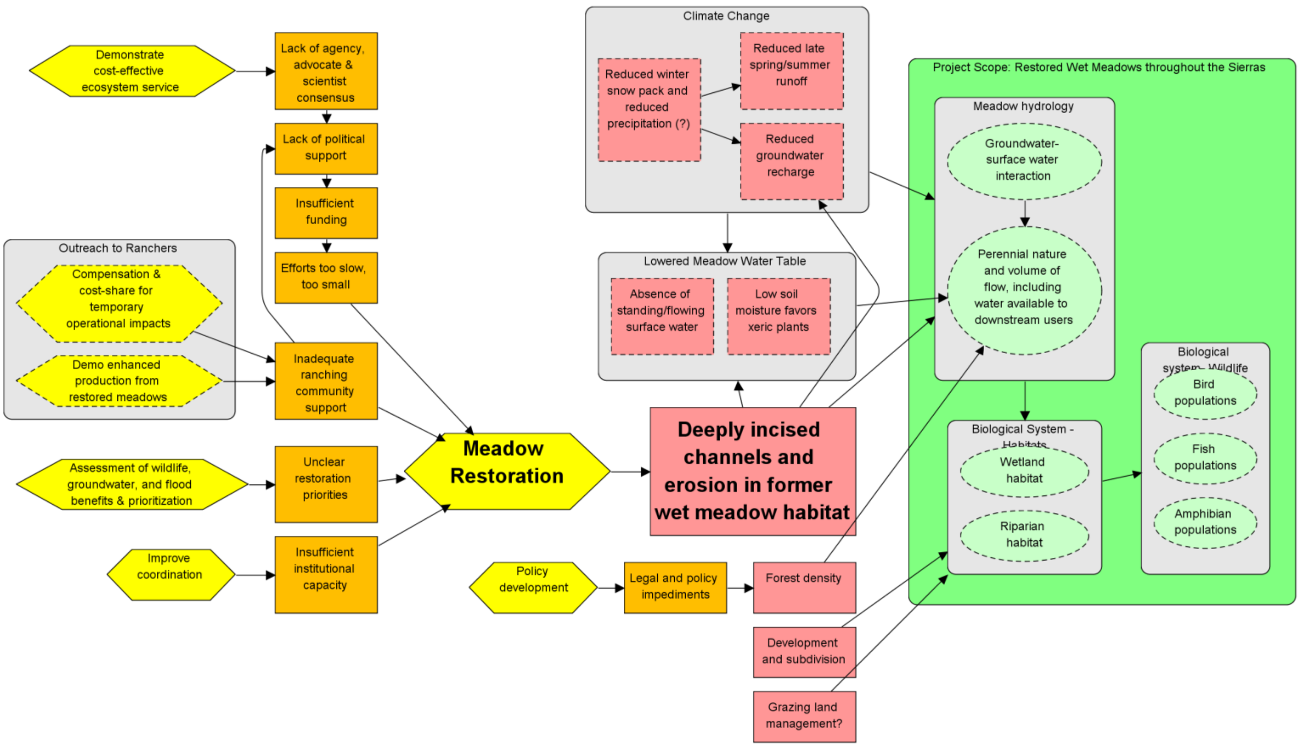
Development creates a pressing threat to many of the largest meadow complexes that are on private land. In the Sierra Nevada, the most high profile conversion of meadow to residential development occurred during the 1960’s with the development of the South Lake Tahoe keys on over 750 acres of meadow. Other former meadow areas likely exist under current urban areas, such as Grass Valley and Placerville. With expectations of increasing populations in the Sierra Nevada over the next 50 years, development pressure on existing meadows is likely to increase. The greatest and most near-term increase in the development pressure is expected to occur within the vicinity of transportation corridors and along the outskirts of established communities. Approximately 30,000 to 50,000 acres of meadow habitat may be at risk from this threat, which can damage the services providing by existing high quality meadows and undermine benefits secured through restoration activities supported under this plan.

Repairing damage from cumulative land use impacts addresses the most pervasive and severe threat that has dramatically reduced the ecosystem services provided by meadows, however, a number of other threats impact one or more potential services and may need to be mitigated or minimized on a case by case basis or in particular watersheds or sub-watersheds that are targeted through this plan. These threats include:

- Roads - Increase runoff, reduce infiltration and groundwater recharge and impact water quality, they often bisect meadows and streams creating head cuts
- Invasive species – Shallow rooted invasive plants increase soil instability and erosion and reduce wildlife habitat value by decreasing diversity and resiliency of the system; priority species are cheatgrass (*Bromus tectorum*) and star thistle (Centaurea solstitialis) orchard grass (*Dactylis glomerata*), timothy (*Phleum pratensis*), several thistle species, tall whitetop (Lepidium latifolium), and purple loosestrife (*Lythrum salicaria*); and introduced muskrat
- Recreation use – Packstock grazing and off road vehicle impacts on meadows can be severe causing soil compaction, erosion and degrading stream banks and may increase with the expected tripling of Sierra-based human population between 1990-2040.
- Abandoned mines and tailings – Old mines introduce heavy metals such as mercury that impact water quality and wildlife habitat.
- Conifer encroachment – Fire suppression facilitates the invasion of conifers into degraded meadows which alters the vegetation community. The Forest Service is evaluating the use of controlled burns to reduce and possibly reverse conifer encroachment in El Dorado National Forest and the Lake Tahoe Basin Management Unit.
- Timber harvest – Harvest practices implemented on adjacent lands could impact quantity and quality of water running off adjacent uplands into meadows.
- Climate change - Plant and animal communities in the Sierra are dependent on water availability, thus current and predicted changes in climate may reduce habitat and water-related services in the least resilient/most vulnerable meadows in the Sierra Nevada.

Logic Framework – Goals, Threats and Strategies

A logic framework is a diagram of a set of relationships between certain factors believed to impact or lead to a conservation target (species representing Keystone Initiatives). Logic frameworks are typically composed of several chains of logic whose arrows are read as "if-then" statements to help better understand how threats contribute to conservation target declines. Logic frameworks are used to define the conservation problem, assess limiting factors, and prioritize key strategies.



Conservation Targets	The conservation targets of this plan – healthier fish and wildlife populations, including of some endangered species, and enhanced water services, are described in the next section of this plan.
Direct Threats	The principle threat to wildlife populations and water services provided by meadows is the widespread and severe degradation that currently exists in the majority of meadows throughout the Sierra Nevada.
Contributing Factor	By building scientific consensus around the benefits of meadow restoration, increasing support for restoration in the ranching community, establishing restoration priorities within and among Sierra watersheds, and building the institutional capacity of NGOs and agencies to implement restoration, in addition to simply funding the restoration of meadows, we will address all aspects of this threat and the contributing factors that allow it to persist.
Strategy	Strategies to address this threat and its contributing factor are described in the Implementation section of this plan, along with proposed 5-year budgets for each strategy.

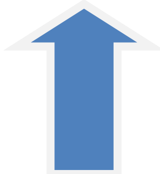
Conservation Outcomes

Of approximately 330,000 acres of meadow distributed in more than 10,000 meadows across roughly 20 million acres of the Sierra Nevada, only approximately 30-40 percent of meadow habitats exist in a non-degraded state. Approximately 47 percent of meadows are on public lands and 45 percent on private lands embedded in U.S. National Forests, and the remaining 8 percent of meadows are private land isolated from National Forests.

Our long-term goal is to see 80-90% of meadows restored. Over 5 years, we expect restoration of 60,000 meadow acres will have the following benefits:

Late Season Water Storage 17,000 – 65,000 acre feet of additional water storage	A functional wet meadow will generally be fully saturated at the end of the annual snowmelt period, and over the summer will lose as much as 45% of stored groundwater to stream flow and evapotranspiration. Groundwater storage in a degraded meadow can be reduced by as much as an additional 30% owing to rapid drainage through incised stream channels during and shortly after snowmelt. Past restoration projects have shown that this 30% water loss can be eliminated within 1-2 years of restoration. If hydrologic research confirms groundwater storage and late season flow benefits, we expect to see Sierra-wide meadow restoration contribute between 50,000-200,000 acre-feet of additional water storage throughout the Sierra Nevada and this initiative proposes to address 1/3rd of that goal.
Flood Attenuation 15% reduced peak flood stage	Restoration of meadows will reduce and delay peak flows on streams that transit through meadows because restored meanders and over-bank flow reduce flow velocity and stream power. A study of flood-peak attenuation on meadows near Lake Tahoe indicated that small and relatively high-gradient meadows do not significantly affect flood magnitudes, but can delay the passage of flood waves, allowing more time for downstream flood-control emergency operations that could save human lives. Larger and low-gradient meadows are likely to have more substantial flood attenuation effects. Preliminary studies suggest a 15% reduction in peak stage as a result of meadow restoration. The economic benefit associated with this degree of flood attenuation throughout the Sierra Nevada is uncertain.

Yosemite Toad



50% increase in occupied range

Yosemite Toad (*Bufo canorus*): This Sierra endemic is restricted to a small range between Alpine and Fresno counties. They are strongly connected to meadows and breed in ephemeral snowmelt ponds and shallow rivulets. They are highly sensitive to changes in the water table and incision in meadows is thought to be a major contributing factor in their decline. Damaged meadows dry out earlier in the season, leaving tadpoles desiccated before they can metamorphose. It is estimated that Yosemite Toads have disappeared from approximately 50% of their historically inhabited sites, with the bulk of the disappearances occurring from lower elevation west-side Sierra Nevada meadows. Quantitative population data does not exist for most of the historic toad sites, but a 1993 study reported sharp population declines at seven sites in the eastern Sierra Nevada from 1971–1991. While there are a number of constraints to the recovery of Yosemite toads, restoring half the meadow habitats in key areas of their range could provide the opportunity to reverse their decline and allow them to recolonize sufficient habitat to increase occupied range by 50%.

Mountain Yellow-legged frog

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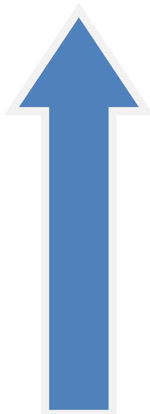
Benefit unquantified

Mountain Yellow-legged frog (*Rana muscosa, southern Sierra Nevada and San Gabriel ranges, and R. sierrae, central and northern Sierra Nevada*) : The endemic mountain yellow-legged frog was once one of the most abundant vertebrates in the Sierra Nevada. A comparison of reports by Grinnell and Storer in the early 1900s to current survey data indicates that the mountain yellow-legged frog has disappeared from 92% of its historic range. These frogs are strongly linked to meadow habitats and use the associated tarns and lakes to overwinter. Their initial declines throughout the 20th century are strongly linked to land use impacts from livestock grazing and the introduction of predacious non-native trout. Meadow restoration would benefit mountain yellow-legged frogs by creating additional wet meadow and 'pond and plug' fish-free habitat. In order to increase the likelihood of colonization, restoration sites will need to be within a few kilometers of extant populations. There may be some opportunity for the Department of Fish and Game to utilize restored meadows as sites for experimental population establishment where individuals can be transferred from other populations. Uncertainty over whether or how extensively this would occur make it difficult to produce an estimate of the benefit to this species of this initiative.

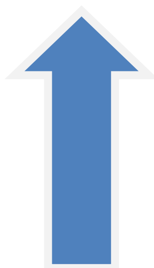
Willow Flycatcher



200% increase in number of occupied meadows

Current estimates of the California willow flycatcher population in the Sierra Nevada bioregion range from 300 – 400 individuals, including portions of the federally endangered subspecies (Southwestern willow flycatcher) and another subspecies that is endemic to California and considered threatened under California endangered species laws. Restoring degraded meadows and changing meadow hydrology so that meadows remain "wet" throughout the breeding cycle comprise two of four Recommended Management objectives listed in the Conservation Assessment of the Willow Flycatcher in the Sierra Nevada (Green et al. 2003). There are an estimated 135 meadows that have at least one willow flycatcher territory. Restoration of 20,000 acres/year by 2014 would represent a total of 60,000 acres and at least 300 new meadows (assuming average meadow size of 200 acres). This would allow a potential 200% increase in the number of occupied meadows and number of flycatcher territories if other threats are also managed.

Greater Sandhill Crane



100% increase in population

Greater Sandhill Crane nest in montane meadows from central and eastern Siskiyou County, east and south to Modoc, Lassen, and northern Plumas counties. Though the population within California appears to be slowly increasing, concern over the decline of breeding and wintering habitat and the lack of young that survive to adulthood prompted its classification by the U.S. Fish and Wildlife Service as a Sensitive Species and as a California threatened and Fully Protected Species. 200- 300 pairs nest in meadows in the northern Sierra Nevada; most forage in large open irrigated pastures, especially pastures which were poorly drained and include small artificial wetlands. Pair territories range from 20 to 60 acres or larger. Only meadow restorations of larger than 50 acres are likely to benefit sandhill crane; of 60,000 meadow acres restored through this plan roughly 20,000 acres will be in meadows large enough to support breeding crane pairs; if winter habitat does not preclude such an increase and the restored meadows are in their range, implementation of this plan should allow another 300 pairs to nest in northeastern California – a 100% increase over the current breeding population.

Great Gray Owl

25% increase in population

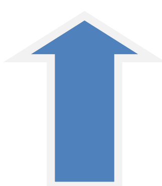
The current breeding population of Great Gray Owl is in the central Sierra Nevada, primarily in the Stanislaus National Forest. The Tahoe National Forest has historic sightings, but no established breeding pairs, however, there are breeding pairs on the Sierra National Forest. The owl is dependent on riparian/meadow habitat for foraging. Great gray owls are listed as a Endangered species in California. There are an estimated 200-300 individuals in the state, all in the Sierra Nevada and all with territories that include significant acreage of meadows. Restoration of 60,000 acres of meadow habitat would improve foraging and nesting habitat and could increase population size by as many as 50 individuals, a 25% increase of the current population.

Yellow Warbler

100% increase in population

Yellow warblers are riparian-dependent species that have declined throughout much of their former range in California. These declines are associated with the loss of riparian breeding habitat, increases in brood parasitism, and increases in nest predation. The yellow warbler is a California Partners in Flight focal species for riparian habitats and depend on montane meadow habitat. A recent study demonstrates that restoring meadow hydrology restricts access to forest-edge-associated nest predators and increases hatching success. At the South Fork Kern River Valley the Yellow Warbler population has increased from 14 pairs to approximately 500 pairs in nine years, an active Brown-headed Cowbird control program is thought to be responsible for this impressive recovery. To the extent that meadow restoration would produce suitable riparian nesting and foraging habitat for Yellow Warbler the California population could increase by 100% in 10 years.

Bird Communities

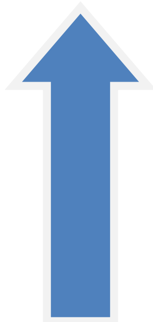


50% increase in potential waterfowl production

50-90% increase in species diversity

Bird Communities: Numerous bird species depend on meadows for breeding, and during the post-breeding periods, there are few species in the Sierra that do not utilize meadows for molting grounds and foraging before migration. Restoration of 20,000 acres/year by 2014, for a total of 60,000 acres, would result in an estimated 30% increase in an “abundance index” and 30% increase in a “richness index” for the avian community.

Eagle Lake rainbow trout



Reestablishment of wild population of 100,000 – 250,000 individuals

Endemic Eagle Lake rainbow trout historically spawned primarily in Pine Creek and the much smaller Papoose and Merrill Creeks, which all feed into Eagle Lake. The entire species has been propagated only in the hatchery since the 1950s, due to the poor condition of the Pine Creek watershed, including that the stream is dry for much of the year. If restoration takes place on the most significant meadows in the Pine Creek watershed, it will restore spawning habitat to enable the Eagle Lake Rainbow trout to once again spawn naturally - this is the most vital conservation activity to the long-term survival and viability of the subspecies. Comprehensive meadow restoration of the 10,000 acres of meadows in the Eagle Lake watershed with approximately 55ft of stream/acre of meadow and release of hatchery fish back into Pine Creek (along with the irradiation of non-native brook trout) would lead to reestablishment of a wild population of 100,000-250,000 individuals.

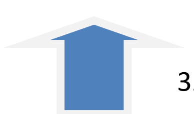
Lahontan cutthroat trout

60%

increase in wild population in California

Native to the arid eastern Sierra and Great Basin, the Lahontan cutthroat trout have been extirpated from 89% of their original stream habitat and 99.6% of land habitat. The trout subspecies is listed on the California Endangered Species List as Threatened. Wild self-sustaining populations in headwater streams of California likely total only a few hundred fish age 1+ and older. They are found in streams that are at the upper limit of thermal tolerance for trout. The predominant impacts to Lahontan cutthroat trout are from alien trout species and habitat degradation. Meadow restoration has been shown to decrease water temperature anywhere from 2-5°C, this reduction in water temperature in Lahontan cutthroat trout's range could mean the difference between survival and extirpation for remaining wild populations. The current population is estimated to be about 300 individuals. Restoration of meadows in their range would increase habitat availability by 70% and would result in an increase of the population to approximately 500 individuals, a sixty percent increase.

McCloud River redband trout



32%

increase in population size

This trout is endemic to the upper McCloud River and its small creeks and tributaries and is is a California species of special concern**.** Redband trout exist in streams of a total length of about 67 km with potential habitat, including the upper McCloud River of about 98 km, or about 50 km in dry years. Populations are currently estimated at a minimum of 2,500 fish, but in wet years it could be many times that, which indicates the potential for a larger population with habitat restoration. 70-80% of adults found in surveys occur in meadows. Meadow restoration in the upper McCloud River watershed could create late season thermal refugia for McCloud River redbands

	50% increase in survival rates	(functioning meadows modulate stream temperatures), and may increase the area of streams with flowing water for all or a greater duration in the summer. This would increase over-summering fingerling and adult survival rates by as much as 50%. Meadow restoration in the McCloud River watershed would increase occupied habitat to 98 km and increase the number of individuals to an estimated 3,300 individuals.
	California golden trout and Little Kern golden trout  55% increase in wild fish density	The California golden trout and its close relative, the Little Kern golden trout are resident trout endemic to the headwaters of the Kern River in the southern Sierra. The California golden trout originally occurred in 30 km of Golden Trout Creek and some 50 km of the south fork Kern River. Golden trout streams currently support 8-52 fish/ 100 meters of stream, a fairly low number indicating poor overall habitat condition. Meadow restoration in the headwaters of the Kern with its approximately 97ft of stream/acre of meadow, such as Templeton Meadows and Monache Meadows would increase Golden trout population to as much as 75-110 fish/100 meters of stream. Nearly all of the meadow habitat within the range of the golden trout is severely degraded. Current population estimates of the California golden trout are as low as 6,400 individuals, if the 15,000 areas of meadows in headwaters of the Kern were restored then numbers could increase to as much as 88,000 individuals.

Implementation Plan

The following strategies describe the threats that currently limit the viability and health of meadows and restrict the potential for large scale implementation of mountain meadow restoration. The strategies and outputs described are intended to take place over 5 years. Although additional threats affect meadows, the group of experts who helped develop this plan prioritized threats and the emphasis of this plan is on the highest priority threats. There are rough 5-year budget numbers assigned to some of the activities herein. If there is no budget next to an activity that activity is not clearly identified as required in order to achieve the conservation impact described above (however in some circumstances, those activities are necessary but are already covered through other organization or agency budgets or staff time). There are additional cost estimates provided on a case by case basis for Years 6-10 costs, based on the expectation that larger scale and more widespread restorations of degraded meadows will occur during that period.

Within the first 5 years of this plan we are focused on implementing strategies that will demonstrate that such a comprehensive restoration of mountain meadow habitat is in the best economic and water-policy interests of California. We proceed with this strategy based on the theory of change that building a case for comprehensive restoration is more likely to stimulate the state and local stakeholder support necessary to achieve all restoration goals within 10 years.

Threat I – Past Meadow Degradation Is Self-Perpetuating

Strategy 1 ---- Implement restoration projects ($20,000,000)
Numerous strategic meadow restoration projects are ready to proceed in regions that span the Sierra. These projects have been chosen based on existing capacity and a range of criteria described below. It is critical that standardized and integrated monitoring of project impacts are embedded within a subset of these projects to provide early results demonstrating the efficacy of meadow restoration across a range of benefits (see Threat II below). Implementing these ready-to-proceed restoration projects in a timely manner not only capitalizes on past efforts but also builds the capacity for future meadow restoration efforts. In some cases, cumulative benefits of restoring a single degraded meadow in a watershed that has had all other meadows restored would have repercussions that span the length of the watershed. In other cases, the proposed meadow restoration project is the first of its kind in the watershed and by implementing the project capacity will be built for the restoration of numerous other meadows in that watershed.

Activity 1 (complete) – Develop list of projects for immediate consideration. Appendix B displays summary information for ready-to-proceed meadow restoration projects that participants in this effort agree are high priorities for restoration. Each of the ready-to-proceed projects have been conceived of and vetted by an existing planning group and in this way utilize broad stakeholder consensus and knowledge base.

Activity 2 – Develop criteria to select which ready-to-proceed projects will be funded first. Projects will be selected based on their potential water-resource and wildlife habitat benefits, and likelihood of success. Factors that influence potential benefits or likelihood of success include:

- Location upstream of a flood-control, hydropower, or water-supply reservoir or conveyance , proximity to previous or other planned restoration projects, hydrogeologic setting as it affects the our ability to measure hydrologic change related to the restoration and proximity to remnant populations of meadow-dependent fish and wildlife species that are the target of this plan.

- Land owner support, participation in IRWMP or equivalent, access for heavy equipment and materials, availability of qualified personnel, and availability of matching funds.

Activity 3 – Develop standardized methodology for measuring impact. At present, we do not have a standardized methodology for measuring the range of benefits expected from meadow restoration, including water quality (sediment, temperature), groundwater storage, flood attenuation, vegetative response, etc. In order to compare a range of restoration methods and types, we need concurrence on how to measure and report project impacts.

Activity 4 – Fund and implement ready-to-proceed projects. Restoration efforts proceed on a rapidly increasing scale with the goal of implementing 20,000 acres of restoration per year by Year 5 of the implementation of this plan.

Activity 5 – Implementing Best Management Practices (BMPs) on restored meadows. During project design, management measures such as grazing management plans, livestock management infrastructure, and timber harvest management need to be identified and funded to ensure long-term sustainability of the ecosystem services.

Strategy 2 – Develop priorities for Years 3-6 Restoration Work ($350,000)

Although numerous meadows have emerged as priority meadows (Appendix B) most of the meadows in the Sierra have not been assessed to determine the need for restoration, nor the potential beneficial impact or restoring or preserving them. An important early strategy aimed at ensuring that meadow restoration in the Sierra results in the biggest impact is to develop a prioritization methodology that includes stakeholder and technical participation for each step, a science-based framework for identifying areas supporting critical ecosystem functions, and a flexible means of weighing the relative importance of multiple factors.

Activity 1 – Develop a watershed-specific, multi-criteria methodology for identifying priority meadows for preservation and/or restoration. One of the first tasks will be to review prioritization methodologies used in other systems and decide on the one that best fits the needs of the Sierra. The selected methodology to measure the hydrologic response to restoration will take into account the different groundwater sources, flow paths, and hydraulic properties and determine flow rates and storage of groundwater in meadows. The methodology to measure the habitat response to restoration will take into account the proximity of remnant populations of meadow-dependent fish and wildlife species that are the target of this plan and will use a focal species region specific approach as a measure of success.

Activity 2 – Pilot methodology on subset of watersheds. The next step under this strategy will be the application of this methodology to an initial set of watersheds in the Sierra to test and refine the approach, and work toward the adoption of this methodology throughout the Sierra over time.

Threat II – Uncertainty over Magnitude of Ecosystem Service Benefits

The most likely sources of non-federal funds for meadow restoration are provided through California state bond sales authorized under Proposition 84, the Safe Drinking Water Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006. These funds are administered primarily by two state agencies, the Department of Water Resources and the Sierra Nevada Conservancy. Grants are funded competitively for a variety of purposes authorized by legislation. Grant eligibility criteria and funding allocations confer competitive advantages to projects that can demonstrate benefits to water supply and flood control. Accurate estimates of potential water-supply and flood-control benefits are therefore important for securing matching funds for NFWF grants. Accurate estimates of water-resource benefits may also provide opportunities to develop partnerships with municipal water agencies and hydropower companies.

In the larger perspective of statewide water supply, the concurrent drought and state budget crises have increased the importance of finding cost-effective solutions to water shortages. Proposals for new dams, reservoirs and conveyance structures are under consideration. The financial and environmental costs of such structures are likely to be significant. Accurate estimates of meadow-restoration benefits would help to provide the public with sufficient information to adequately evaluate alternative structural and non-structural approaches to improving water supplies and lead to increased public support and long-term funding opportunities.

However, current lack of information and disagreement about available evidence among the scientific community significantly undermines the ability to make a case for restoration to state and federal agencies and the public.

Strategy 1 - Validate Benefits ($1,000,000)
A functional healthy meadow has water quality, water delivery and habitat benefits. Hydrologically functional meadows support the wetland species that depend on meadow habitat and protect against competition from invasive terrestrial and aquatic plant and animal species. The underlying common cause of meadow habitat loss is degraded hydrologic function and the primary restoration mechanism is improved hydrology. The integrated functionality of hydrology and biology means that validating the benefits of meadow restoration can be measured as improved hydrology, (water temperature, water levels, and reduced stream incision) as well as by improved biology, (presence or absence of focal specie groups). The range of variability of each of these parameters is perhaps less for the abiotic factors (hydrologic parameters) than it is for the biologic factors (species success). Variability in these parameters is the result of a wide range of hydrogeologic conditions across the Sierra and the nature of multiple threats on species success that makes recovery due to restoration difficult to measure. Site specific monitoring before during and after restoration will insure that success is measured against local and relevant conditions, while at the same time enable the development of region wide analyses.

Activity 1 (partly complete) – Before/after comparison of water and habitat benefits of restoration with coordinated monitoring and analysis. Several recent studies of meadow restoration projects provide before/after analyses of water-resource and habitat benefits, including work by Liang and others (2006), Loheide and Gorelick (2007), Cornwell and Brown (2008), and Hammersmark and others (2008). These studies are generally encouraging, in that all 4 studies showed increases in groundwater storage following restoration. However, these studies were restricted to a relatively small area in the northern Sierra Nevada in watersheds underlain by volcanic rocks. In fact, 3 of the 4 studies were done within a single watershed in Plumas County. Conclusions regarding volume and duration of baseflow were inconsistent between these studies. Liang and others (2006) reported an increase in baseflow, but Hammersmark and others (2008) reported a decrease (the other 2 studies did not directly assess volume and duration of baseflow).

The hydraulic properties of the bedrock surrounding and underlying meadows are highly likely to exert significant influence on the amounts and timing of groundwater discharge in meadows. Therefore, results of these 4 studies are difficult to extrapolate to large areas of the Sierra Nevada underlain by granite and diorite with varying degrees of fracturing and weathering that significantly affect water movement.   Additional monitoring is needed on a subset of new restoration projects (see Threat I, Strategy 1 above) that is representative of the variability in bedrock geology throughout the Sierra Nevada. This variability requires a wide subset of study meadows north to south, high to low elevations and soil/biota types to provide an overall estimate of potential water reliability benefits. This would allow defensible quantification of overall programmatic benefits while recognizing that each individual meadow will provide a varied level of benefit for each ecosystem service at the project level.

Activity 2 - Quantification of groundwater storage and streamflow regulation. Quantification of meadow groundwater storage potential is critical to restoration because changes in water storage will determine the magnitude of hydrologic and habitat benefits. Support is needed for groundwater surveys and predictive assessments of meadow groundwater storage and streamflow regulation throughout the Sierra Nevada (see Threat II, strategy 1, activity 1 above). Linked groundwater-surface water flow models (for example, the WEHY model used at UC Davis and the USGS Modflow modular model) are needed to evaluate the hydrologic linkages between meadows and their surrounding watersheds. Surface-water hydraulics models such as the Corps of Engineers HEC-RAS and the USGS WSPRO models are needed for predictive analyses of flood attenuation.to inform coordinated monitoring efforts and develop more accurate estimates of watershed processes that meadows provide.

Activity 3 – Economic analysis of ecosystem service values provided by restoration. Additional analysis is necessary to reveal whether meadow restoration offers a better cost-benefit rationale than structural or other approaches to provide flow regulation, flood attenuation, supply reliability, water quality and habitat services to California.

Strategy 2 – Build Scientific Consensus ($500,000)

Hydrologic, economic and other studies need to be designed, implemented and disseminated so as to build consensus around the findings of the studies and assessments; projects that do not have ‘buy in’ on methodologies will fail to convince skeptics that the results are valuable and reduce uncertainty.

Activity 1. Annual Sierra Meadow Forum. Because meadow restoration is a relatively new and emerging science, there is a need for an Annual Sierra Meadow Forum/Summit to share results, and receive feedback on meadow science and meadow restoration approaches.

Activity 2. National Academy of Sciences review.   Between now and Year 5 of this plan, sufficient research, analysis and technical and peer-reviewed publications may exist to warrant a national scientific review of the science and findings. This activity should be pursued if it would help resolve any remaining disagreements over potential ecosystem service benefits of meadow restoration or help develop consensus methodologies to assess and monitor subsequent work.

Activity 3. Field visits. As part of the Meadow Forum described above, or as separate events, meadow restoration practitioners, scientists, and managers would all benefit from visiting meadow sites pre, during and post-restoration to get on-the-ground exposure to the restoration process, and associated monitoring.

Activity 4. Reporting on performance. Often when projects are completed, information regarding the restoration process, and monitoring results can be lost. There is a need to ensure that this information is captured and reported on in ways that are easily accessible and informative.

Activity 5. Long-term monitoring of water-supply benefits at the large watershed scale. The quantification of hydrologic benefits for individual meadow restoration projects will not in itself determine the benefits to downstream water supplies. Long-term monitoring of streamflow, sediment loads, and water temperature at downstream monitoring stations will be needed to accurately determine the extent of project benefits at the scale of larger watersheds important for water supply.

Threat III – Lack of Organizational Capacity

The State of California has provided the financial support for the development of Integrated Watershed Management Planning (IRWMP) groups to encourage stakeholder driven, region specific, watershed planning. Proposition 50 was passed in 2005 by California voters and it provided the funding for the initial establishment of the IRWMP framework in order to improve water management for the State. As a result there are IRWMP groups in the Sierra that have diverse stakeholder memberships, meet regularly to discuss the implementation of the Integrated Regional Watershed Management Plan for their region and can submit proposals as a group or individually for the implementation of meadow restoration projects.

Strategy 1 – Continued support of regional Integrated Watershed planning ($250,000)
The current functionality of the IRWMP groups varies in that some are fully fledged and functioning, some are emerging and some regions do not yet have a representative IRWMP. However, it is clear that the IRWMP framework is the most holistic planning effort to date because it integrates watershed conservation, preservation and restoration with brick and mortar type projects that otherwise would not have such components. The IRWMP planning efforts have brought together previously adversarial stakeholders for candid discussion and implementation of watershed improvement projects. The success of the IRWMP model depends on building the institutional capacity to create IRWMPs where there currently are none and supporting the growth, revision, and implementation efforts for those IRWMP that exist in the way of bridge funding.

Activity 1 (in progress). State Bond fund support of regional planning groups throughout the Sierra Nevada. State funding has already provided momentum for a number of planning efforts and the draft state Water Plan provides sufficient emphasis on meadow restoration for planning groups to utilize. Continued implementation of this state policy and funding should expand regional capacity for meadow restoration. The priority should be on supporting the establishment of collaborative, community-based groups that have a significant number of public and private stakeholders partners/landowners.

Strategy 2 – Supporting implementation of regional Integrated Watershed plans
Existing IRWMP groups with a prominent meadow restoration component, such as the Feather River Coordinated Resource Integrated Management (CRIM) Group and the Cosumnes, American, Bear, Yuba (CABY) IRWMP will be extremely helpful in creating models for similar on-the-ground meadow restoration capacity in other regions that may have an under developed or are completely lacking an IRWMP for their area. However, additional support is needed to help these groups actually implement meadow restoration.

Activity 1. Institutional capacity building of existing entities. Support is needed to expand the technical capacity to plan, design and implement restoration projects in watersheds that have not heretofore implemented any or many such projects. Focus should be on groups with defined watershed goals and which propose to use Resource Conservation Districts, local non-governmental organizations (NGOs), special districts or local government to implement work. Capacity is most needed in watersheds with significant acreages of degraded meadows on private and non-federal lands.

Activity 2. Institutional capacity building in areas that do not have an integrated regional watershed management planning entity. Support is needed to form IRWMPs in regions that currently do not have them. These areas include the far northern Sierra (Pitt River area) southern Sierra (Kings, Keweenaw and Kern river area) and the Eastern Sierra where meadow restoration is predicted to have substantial wildlife benefits. The Sierra Nevada Alliance has put forth a strategic effort to organize IRMP's in areas of the Sierra where there are none and this work needs additional funding to be successful.

Threat IV – RISK – Loss of Benefits over time, Post- Restoration

Subdivision, infrastructure and road development are pervasive threats to approximately 10 percent of meadows, including high value meadows that currently provide extensive environmental services and those being restored through this plan. In addition, recreational use, unplanned livestock grazing, fire and other threats may impact and decrease the value of restored meadows over time.

Strategy 1. Land protection through project agreement, easement or acquisition ($3,000,000)
A written agreement among the landowner, project manager, and funder or government agency can be used to define the terms of post-project monitoring, maintenance, and site management. Project agreements are best set up at the outset of a project. A management plan should include best management practices for a range of ecological benefits in addition to agricultural products.

Deeded easements are another option to protect the ecosystem services of meadows from future threats. A land trust would protect land from development in perpetuity. The proceeds to selling off development rights can be used to offset the cost of a management plan. For degraded meadows, proposals to acquire ore ease of land should be associated with a meadow restoration project, rather than acquiring degraded land without the means to restore it. The Foundation will consider land protection proposals for sites with unfunded restoration needs if the proposal includes a plan to raise restoration funds.

The Wetland Reserve Program (WRP) managed by the USDA Natural Resource Conservation Service should be the focus of expanded efforts to protect and restore meadows. Additional efforts should be made at the state level to help the Natural Resource Conservation Service prioritize funding for this activity, to enroll land, and to plan and implement meadow restoration work.

Strategy 2. Deployment of Best Management Practices (see Threat I above). ($100,000)
Best Management Practices vary depending on the type of restoration, the landscape and planned use of the area and in this way should encapsulate the goals of the project and should describe the maintenance activities, roles and responsibilities and be adaptive in nature. For example, it may be necessary after restoration for the land to have a three year complete exclusion for rest before grazing at any intensity can resume, however with adaptive management and monitoring, if conditions warrant, grazing may resume sooner or later than expected. The Best Management Practices should be described in the post restoration management plan which is signed by the landowner, the project manager, the funder, and the appropriate State or Federal agency.

Threat V – Ranching Community is not yet fully supportive

Most meadows on public and private lands in the Sierra Nevada are grazed by livestock, primarily cattle, and many ranches have more than a 100-year history of operation on these lands. In many cases, implementation of this meadow restoration should proceed in concert with and with strong support from ranching communities. Meadows that are hydrologically functional (either as a result of restoration or due to lack of historical impacts) have higher productivity than dried or degraded ones and therefore generate more forage and can support more livestock than degraded meadows, if grazed appropriately (SNEP 2006). Studies have shown that grazing systems that are well tailored to a particular meadow can support more livestock without causing ecological degradation (SNEP 2006). Some of these range-management methods include livestock exclusion from channel edges within meadows and shorter periods of more intensive grazing followed by a month or more relief to allow for regrowth (Dudley and Dietrich 1995; Herbst and Knapp 1995; Odion et al. 1988). Other methods include excluding grazing every other year on some meadows using a rest-rotation system of grazing, and herding of livestock by professional cowhands to keep livestock from concentrating in particular meadows and streambanks for extended periods of time. However, this opportunity for cooperation is at risk because it may not always be clear to ranchers that any voluntary limits on grazing intensity (duration, seasonality and stocking density) would either be compensated or be offset by sufficiently higher forage value (animal performance, weight gain per animal).

Strategy 1. Improve information and technical assistance to ranchers

Healthy meadows, with intact hydrology and appropriate grazing systems, can offer reliable, increased forage for local ranches, thereby helping to support the local agrarian economy. The success of this business plan depends on convincing the community of ranchers than manage private lands and grazing allotments that this is true.

Activity 1: Quantify grazing benefits associated with meadow restoration
In order to promote ranching support of meadow restoration, additional research needs to be done in conjunction with meadow restoration that demonstrates the economic benefit of meadow restoration to cattle grazing. The amount of forage pre and post restoration should be measured in order to quantify success in a meaning full way to ranchers and improve support for meadow restoration.

Activity 2: Showcase restoration efforts that demonstrate nexus between conservation and grazing. Once adequate research and monitoring has been completed that conclusively demonstrates the benefits of meadow restoration for grazing, then these cases need to be showcased in venues that reach the ranching community. Meadow that have already been successfully restored should be compaired to exsisting degraded meadows in order to generate estimated benefits and begin outreach to the farming community immediately. Effective outreach for should include collaboration with the local Resource Conservation Districts and University Extension centers.

Activity 3: Develop and test criteria for integration of ranching and meadow restoration. Where, when and how ranching is compatible with meadow restoration needs to be clearly tested and then articulated to reduce conflict between interest groups. The needs of ranchers must be fully understood on a case by case basis in order to insure effective integration of restoration with existing ranching operations. One method might be a restoration/grazing rotation program so that the farmers immediate needs continue to be met while conducting restoration efforts.

Activity 4: Develop mechanisms to monetize ecosystem services to provide income incentive for landowners to manage for multiple resource services. The most effective way to communicate with the ranching community is on an economic level whereby the number of animal/unit/months can be translated pound for pound of cattle weight. Similarly, additional off set programs that could benefit ranchers may include carbon sequestration and water trusts. In this way, landowners will learn about new and innovative landuse activities and the economic benefits of managing their lands for these multiple benefits as long as these types of offset programs are more than conceptual in nature.

Evaluating Success

All conservation investments are made with a desire to have something change. Monitoring tells us whether that change is occurring. Evaluation tells us whether the combined set of investments being made are being designed and implemented to maximize that change.

The Foundation will work with outside experts to prioritize proposals based on how well they fit in with the results chains and priorities identified in this plan. Success of funded projects will be evaluated based upon success in implementing proposed activities and achieving anticipated outcomes. As part of each project's annual (for multi-year awards) and final reports, individual grantees will provide a summary of completed activities and key outcomes directly to the Foundation. These would likely include outcome metrics identified at the initiative scale.

Periodic expert evaluation of all investments funded under this initiative will occur and will help grantees to monitor key indicators to ensure that data across individual projects can be scaled up to programmatic and initiative levels. Findings from monitoring and evaluation activities will be used to continuously learn from our grant-making and inform future decision-making to ensure initiative success.

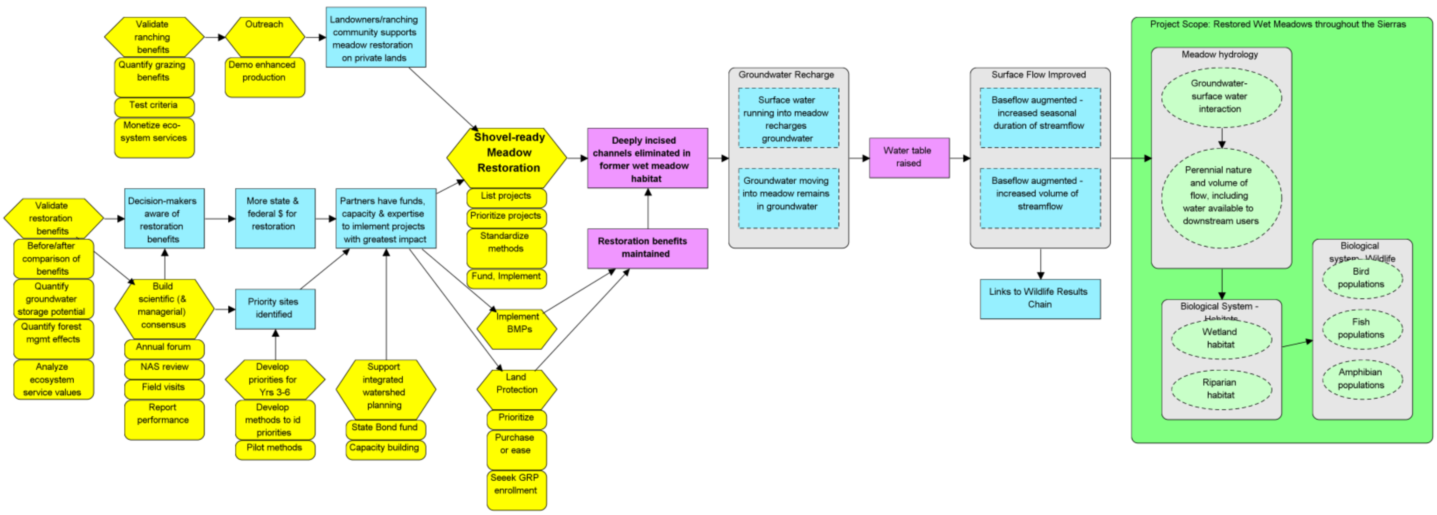
Restoration of meadow habitat in the Sierra Nevada creates a host of integrated benefits described earlier in this Plan. This complexity means that a number of indicators and monitoring programs are needed to adequately evaluate success and guide implementation over time, as described for Threat II, Strategy 1 above. However, all of the potential benefits of meadow restoration are directly related to the extent and duration of saturated conditions within restored meadows – groundwater storage.

<u>Groundwater Storage</u>

As described above, restoration will proceed in the first five years by pursuing what appear to be the projects that have the highest likelihood of success. Thus, we need to make predictions of those benefits as potential restoration projects are prioritized and then test those predictions as restoration proceeds. Changes in groundwater storage resulting from meadow restoration will be predicted based on the following

Storage change = meadow area x average gully depth x specific soil yield x shape factor

Meadow Restoration Results Chain: A results chain is a chain of logic that illustrates how a specific strategy is presumed to reach a particular conservation outcome. Results chains are used to develop a suite of indicators to show progress at different stages in the initiative.



Legend				
Strategy	Activity	Intermediate Result	Threat Reduction Result	Conservation Target

Once predictions are made and restoration projects prioritized, current groundwater storage at selected sites is best measured through changes in the water-table elevations. Water-table elevations can be easily measured in simple, inexpensive cased wells installed in hand-augered holes or with easily fabricated geotechnical probes. Given the generally low topographic gradients of meadows, meadow water tables can be reasonably represented with a relatively small number (roughly 4 to 12 per meadow) of wells in conjunction with periodic field visits to document the extent and duration of sub-surface to surface saturation (water table at or above the land surface) in the summer months.

Relatively accurate measurement of project benefits will require at least 2 years of pre-implementation monitoring and 3 years of post-implementation monitoring. Additional longer-term monitoring should be conducted at a subset of selected meadows to reduce uncertainty of results. This intensive level of pre- and post-restoration monitoring will not be needed on most restorations because an intensively-monitored subset will be selected to represent the variability in geologic, climatic, vegetative, and land-use factors that affect meadow hydrology throughout the Sierra Nevada. Practitioners will be encouraged to use the simplest possible methods to infer benefits for most restoration projects, which will allow monitoring resources to be focused on more intensive measurement and modeling for a smaller number of restoration projects that are designed and implemented expressly for assessment purposes. Partners to this effort will develop an estimate of the minimum number of projects on which this level of study is needed and will attempt to implement monitoring at that level of replication.

Indicators - Results will be reported as increased groundwater storage in acre-feet at the end of snowmelt, as determined by the area of meadow surface saturation, the average specific yield of meadow alluvium, the average difference between gully-bed and water-table elevations, and a shape factor (Cornwell and Brown, 2008). Data will be summarized and expressed as acre-feet of increased water storage per acre of meadow area to allow computation of a regional estimate for all Sierran meadows. The regional estimate will account for changes in evapotranspiration using information from Loheide, et.al., (2005), Wood (1975).

<u>Surface Flow Reliability and Volume</u>
The relations between water-table elevations and base flow augmentation is a major uncertainty that can be addressed through upstream and downstream synoptic stage (stream water level) and streamflow measurements. Stage can be monitored during periodic visits using simple staff plates, and can be easily and inexpensively recorded with submersible transducers with on-board data loggers. In the absence of continuous streamflow data, stage can serve as a surrogate for flow duration. Streamflow measurements can be made using a variety of methods, with varying expense and accuracy. Additionally, stream water temperatures can be accurately recorded during the summer period (June-Sept.) using HoboTemps to characterize water temperature changes through the project both pre- and post project. Temperature change can provide strong evidence of subsurface water retention and release. Existing data (Loheide, et.al., 2006) provides a strong correlation between floodplain/meadow recharge and decreased daily maximum temperatures as well as decreased diurnal temperature fluctuation.

Indicators –

1. Significant rainfall during summers is rare in the Sierra Nevada, and periodic streamflow measurements upstream and downstream of restoration projects can generally provide reasonable estimates of baseflow augmentation in meadows. Results of periodic streamflow measurements will be summarized as the differences between upstream inflows and downstream outflows. Results will be expressed as volumes per unit time (for example, cubic feet per second), and volumes per unit time per unit of meadow and watershed areas to allow regional extrapolation.
2. Baseflow duration between the end of snowmelt and the onset of winter storms will be determined from stage and streamflow measurements and records. Results will be presented as the number of days with measurable base flow.

Wildlife Monitoring
Biological monitoring will focus on documenting vegetative changes and use a "focal species" approach to document trends in wildlife species responses to habitat changes. Vegetation responses to restoration are often immediate, and represent specific changes to the immediate area that has been restored. Documenting vertebrate responses to restoration is also important and will be supported on a case by case basis to improve documentation of desired wildlife outcomes, but can be confounded by animal's mobility and the potential of a lack of response due to other factors negatively affecting numbers and distribution (e.g. impacts on wintering areas for migratory birds. Most meadow re-watering projects require 3-5 years for the aquatic and terrestrial habitats to recover and mature. A minimum of 1 and preferably 2 years of pre-project data collection combined with post project monitoring in years 1, 2 and 5 will be needed where biological monitoring is necessary. Additional species benefits are derived from the availability of surface water within meadows and increased availability in downstream riparian habitat and comparisons of dry season flow before and after restorations and water temperature will be used to estimate the potential fish benefits of this plan.

Livestock Forage

Meadow restoration is expected to produce benefits in summer forage quality and quantity that improve overall weight gain opportunities for livestock. One measure of restoration success will be estimated through forage production plots or line transects pre- and post project by quantifying species composition change and total biomass weight change. In one case pre project biomass was estimated at 300 pounds/acre and post project were estimated to be as much as 3000 pounds of biomass per acres. If enough pre- and post- project animal weight data were collected by livestock operators, animal weights could also be used as a measure of success. Normally the intent is not to promote increased numbers but to promote increased weights/calving success per animal unit.

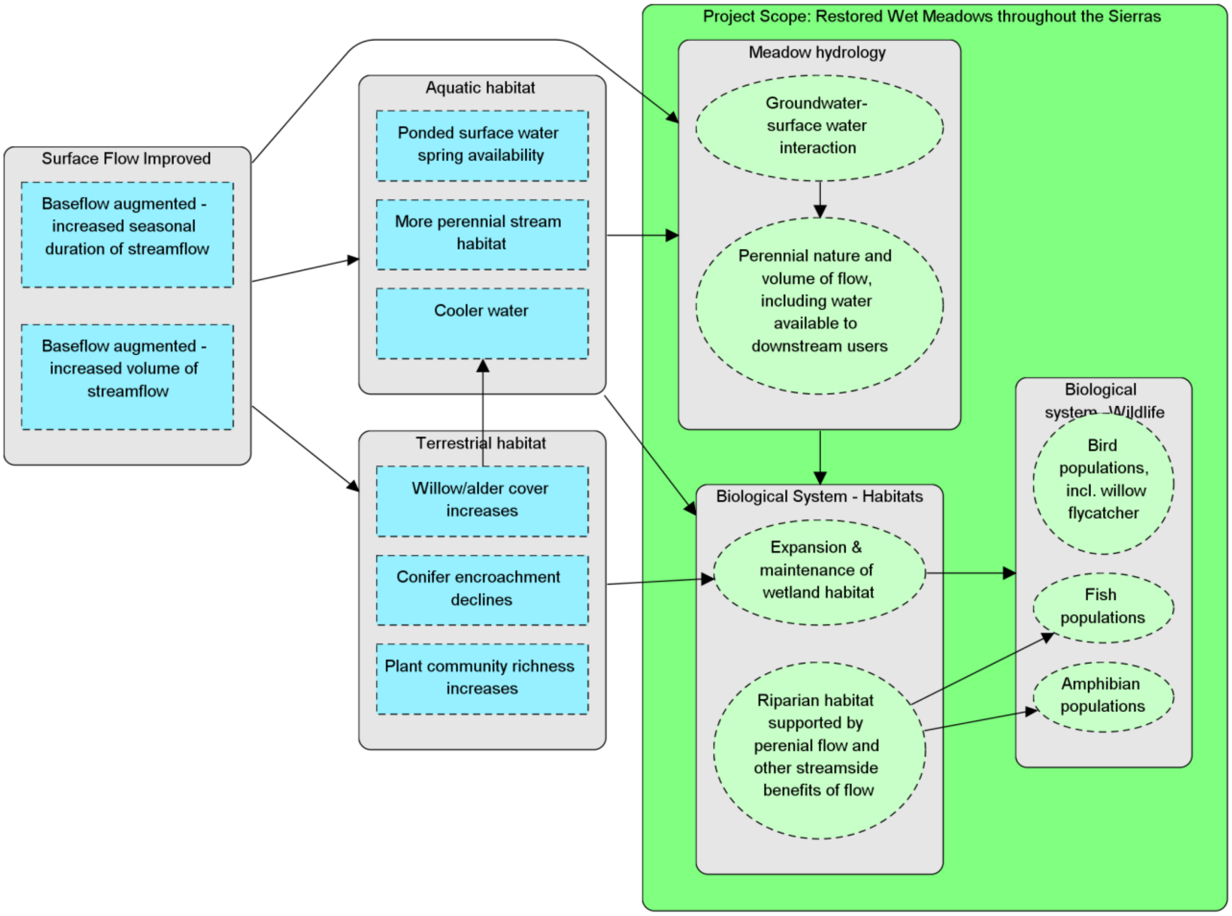
Applying for Funding and Monitoring Grant Results

We expect grantees to provide meaningful reporting on the monitoring they undertake that indicates that desired changes are occurring. We offer the following suggestions to applicants on the outcomes for which we expect you to make predictions in your proposals for meadow restoration funding and on the indicators for which you might monitor. All proposals for funding should include one or more of these or other predictions of outcomes that are meaningfully connected to the ultimate conservation goals of this Business Plan.

Examples of outcomes and indicators to be described in grant proposals to the National Fish and Wildlife Foundation and monitored during funded projects.

Potential Outcomes Described in Proposal	Potential Indicators Monitored through Grant
Change in acre feet of water storage	Reduced depth to groundwater in growing season
Change in willow acreage or quality	Water temperature
Change in sediment load	Reduction in sediment load
Change in wetland vegetation cover	Delay in peak flood height
Change in breeding duck population	Changes in bird, fish or amphibian populations
Change in yellow-legged frog breeding habitat	Increased willow recruitment
Change in reliability of flow	Change in late season flow
Reduction in flood damage	Change in forage biomass
Change in livestock weight gain	Change in livestock weight gain

Wildlife Results Chain



Legend	
Intermediate Result	Conservation Target

Additional Benefits

Standard monitoring techniques are also available to monitor flood peaks, sediment loads, water temperature, hydropower production, carbon sequestration and fuel loading. However, for most projects the expense of these efforts will be difficult to justify and benefits will be inferred from results of the water-table and streamflow monitoring.

Protecting cultural and aesthetic values. Native Americans have used mountain meadows for thousands of years and these ecosystems are a critical part of native cultures (Anderson 2006). Shrubs and graminoids unique to meadows provide important materials for medicinal uses and basket weaving, among other things (Anderson 2006). The loss of meadow specific plans and animals means that native peoples lose their sovereign right to practice traditional and ceremonial acts. Similarly, mountain meadows have important aesthetic values for all cultures since they are lush and verdant, with rich floral displays in the spring, and are attractive sites for local and out of town visitors. Part of the growing tourist economy of the Sierra Nevada is due to its perceived value as a beautiful, 'back-to-nature' destination for both the local rural population and for visitors from distant urban areas.

Improving water temperature. Late summer baseflow from meadows plays an important role in temperature buffering and nutrient cycling, elevating water quality as well as quantity. Stream reaches with high groundwater contributions have lower daily maximum temperatures because groundwater remains cool relative to stream water (Loheide and Gorelick, 2006). Native plant communities dependent on shallow water tables also support soil microbial populations which aid in nutrient cycling processes (Naiman et al. 2005).

Improving water quality. Wetlands improve water quality by sequestering or detoxifying nutrients and some toxins added from the groundwater or adjacent lands (Vellidis et al. 2003, Merrill 2001, Merrill and Benning 2006, Stubblefield et al. 2006, Klein et al. 2005). Numerous studies have shown that riparian and meadow ecosystems act as buffers by reducing nutrient and sediment concentrations of overland and subsurface waters (Vellidis et al. 2003, Naiman et al. 2005, Merrill 2001, Merrill and Benning 2006). Preston and Bedford (1988) and Lowrance and Vellidis (1994) describe the water quality function of wetlands as "the capacity to remove or transform excess nutrients, organic compounds, trace metals sediment, and refractory chemicals from water as it moves downstream." In general, the longer the time during which ground and/or surface water interacts with meadow soils (especially within the rooting zone), the greater the positive effect on water quality (Naiman et al. 2005). Thus, wide meadows with high growing season ground water levels (e.g. <3 feet deep) and fine texture soils are likely to offer the greatest water quality benefits.

Carbon Sequestration. Qualitatively, restoration of hydrologically functional meadows appear to significantly increase soil organic carbon stocks through the much increased root mass as well as increased surface growth (Jungst, 2008). Elemental soil carbon may also be increased due to more effective hyporheic exchange throughout the meadow. Current evaluation of eleven years of completed projects (with control sites where available) should greatly assist in beginning to establish baseline conditions for future projects with marketable carbon stocks. The goal of this effort would be to identify carbon sequestration as a potential income stream for landowners/land management agencies to continue management/restoration strategies for degraded lands.

Funding Needs

Success in achieving the goals of this business plan depends upon the Foundation raising and spending at least $10 million over 10 years on the strategies described herein. It also depends upon government and non-government agencies and organizations providing an additional $200 million over 10 years. USDA's Natural Resources Conservation Service and Forest Service are likely to make a major contribution to this effort, as are the California Department of Water Resources, Sierra Nevada Conservancy, and [others].

Other partners who are already committed to making investments to Sierra Meadow restoration and conservation include American Rivers, the Trust for Public Land, Sierra Fund, The Sierra Nevada Conservancy, The Sierra Nevada Alliance, The Feather River Coordinated Resource Management Group, The Plumas Corporation, The Cosumnes, American, Bear and Yuba Integrated Regional Management Group (CABY).

Budget estimates

Budget Category	**Years 1-5**
Threat I - Repair Past Meadow Degradation	
Strategy 1 ---- Implement restoration projects	$20,000,000
Strategy 2 – Develop priorities for Years 3-6 Restoration Work	$350,000
Threat II – Uncertainty over Magnitude of Ecosystem Service Benefits	
Strategy 1 - Validate benefits	$1,000,000
Strategy 2 – Build Scientific Consensus	$500,000
Threat III – Lack of Organizational Capacity	
Strategy 1 – Continued support of regional Integrated Watershed planning	$250,000
Strategy 2 – Supporting implementation of regional Integrated Watershed plans	?
Threat IV – Risk of Loss of Restoration Benefits over Time	
Strategy 1. Land protection through project agreement, easement or acquisition	$3,000,000
Strategy 2. Deployment of BMPs	$100,000
Threat V – Ranching Community is not yet fully supportive	
Strategy 1. Improve information and Technical Assistance to Ranchers	$1,000,000
TOTAL OVER 5 YEARS	**$26,200,000**

Long-Term Foundation Support

This business plan lays out a strategy to achieve clear outcomes that benefit wildlife, water and other ecosystem services over a 5-year period. If data collected during this period demonstrates that the ecosystem services are significantly more modest than initially expected or less cost effective to secure, the Foundation is likely to reconsider future investments in this initiative. In particular, if the magnitude of estimated water flow and flow reliability benefits from 200,000-300,000 acres of meadow restoration are revised to be less than 100,000 acre feet of new storage benefits, we are likely to cease investments, unless the direct benefits to specific wildlife populations prove more significant than expected.

Even if the Foundation chooses not to continue its investments, we expect that our Years 1-5 investment in capacity-building will create additional opportunities for others to continue to fund this work.

Appendix A. Ancillary Benefits

		Status	Habitat[2]	Potential for Occurrence in Meadows[3]
FISH				
Lahontan cutthroat trout	*Oncorhynchus clarkii henshawi*	FT	Historically in all accessible cold waters of the Lahonton basin in a wide variety of water temperatures and conditions. Cannot tolerate presence of other salmonids. Requires gravel riffles in streams for spawning.	High
Eagle Lake rainbow trout			Currently hatchery propagated, needs meadow restoration in the Eagle Lake watershed to spawn naturally	High
McCloud River redband trout		SC	Meadow restoration in the McCloud River watershed would create late season thermal refugia, this would increase the number of over-summering fingerlings and adult survival rates	High
California golden trout			Nearly all of the meadow habitat within the range of the golden trout is severely degraded, restoration in the Kern River watershed would greatly increase population numbers	High
AMPHIBIANS				
California red-legged frog	*Rana draytonii*	FT	Lowlands and foothills in or near permanent sources of deep water with dense, shrubby or emergent riparian vegetation. Requires 11–20 weeks of permanent water for larval development. Must have access to aestivation habitat.	Moderate
Foothill yellow-legged frog	*Rana boylii*	C	Partly-shaded, shallow streams and riffles with a rocky substrate in a variety of habitats. Need at least some cobble-sized substrate for egg-laying. Need at least 15 weeks to attain metamorphosis.	High
Sierra Nevada yellow-legged frog	*Rana sierrae*	FC	Always encountered within a few feet of water. Tadpoles may require 2–4 yrs to complete their aquatic development.	Moderate
Yosemite Toad	*Bufo canorus*		Meadows and riparian areas south of South Lake Tahoe to Yosemite area.	Moderate
Mountain yellow-legged frog	*Rana muscosa*	FC	Once one of the most abundant vertebrates in the Sierra Nevada. Strongly linked to meadow habitats and use the tarns of meadows to overwinter.	High
BIRDS				
Great gray owl	*Strix nebulosa*	SE	Resident of mixed conifer or red fir forest habitat, in or on edge of meadows. Requires large diameter snags in a forest with high canopy closure, which provide a cool sub-canopy microclimate.	High
Long-eared owl	*Asio otus*	C	Riparian bottomlands grown to tall willows and cottonwoods Also, belts of live oak paralleling stream courses. Require adjacent open land productive of mice and the presence of old nests of crows, hawks, or magpies for breeding.	High
Willow flycatcher	*Empidonax traillii*	SE	Inhabits extensive thickets of low, dense willows on edge of wet meadows, ponds, or backwaters 2,000–8,000 ft elevation Requires dense willow thickets for nesting/roosting. Low, exposed branches are used for singing posts/hunting perches.	High
Bank swallow	*Riparia riparia*	ST	Colonial nester. Nests primarily in riparian and other lowland habitats west of the desert. Requires vertical banks/cliffs with fine-textured/sandy soils near streams, rivers, lakes, ocean to dig nesting hole.	High
Yellow warbler	*Dendroica petechia brewsteri*	C	Riparian plant associations. Prefers willows, cottonwoods, aspens, sycamores, and alders for nesting and foraging. Also nests in montane shrubbery in open conifer forests.	High
Grasshopper sparrow	*Ammodramus savannarum*	C	Dense grasslands on rolling hills, lowland plains, in valleys and on hillsides on lower mountain slopes. Favors native grasslands with a mix of grasses, forbs and scattered shrubs. Loosely colonial when nesting.	High
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*	C	Nests in freshwater emergent wetlands with dense vegetation and deep water. Often along borders of lakes or ponds. Nests only where large insects such as odonata are abundant, nesting timed with maximum emergence of aquatic insects.	Moderate
Northern harrier	*Circus cyaneus*		Occurs from annual grassland up to alpine meadow habitats. Frequents meadows, grasslands, and emergent wetlands, nests on the ground at march edge, plowing of nesting areas during early stages of breeding are a major reason for their decline	High
Greater sandhill crain	*Grus Canadensis tabida*	ST	Nests in montane meadows, forages in wetlands, need areas protected from grazing for young to survive to adulthood.	Moderate

		Status	Habitat[2]	Potential for Occurrence in Meadows[3]
MAMMALS				
Townsend's big-eared bat	*Corynorhinus townsendii*	C	Throughout California in a wide variety of habitats. Most common in mesic sites. Roosts in the open, hanging from walls and ceilings. Roosting sites limiting. Extremely sensitive to human disturbance.	High
Pallid bat	*Antrozous pallidus*	C	Deserts, grasslands, shrublands, woodlands and forests. Most common in open, dry habitats with rocky areas for roosting. Roosts must protect bats from high temperatures. Very sensitive to disturbance of roosting sites.	High
Sierra Nevada mountain beaver	*Aplodontia rufa californica*	C	Dense growth of small deciduous trees and shrubs, wet soil, and abundance of forbs in the Sierra Nevada and east slope. Needs dense understory for food and cover. Burrows into soft soil. Needs abundant supply of water.	Moderate
Sierra Nevada red fox	*Vulpes vulpes necator*	ST	Found from the cascades down to the Sierra Nevada. Found in a variety of habitats from wet meadows to forested areas. Use dense vegetation and rocky areas for cover and den sites. Prefer forests interspersed w/ meadows or alpine fell-fields.	High
Pacific fisher	*Martes pennanti (pacifica) DPS*	FC	Intermediate to large-tree stages of coniferous forests and deciduous-riparian areas with high percent canopy closure. Uses cavities, snags, logs and rocky areas for cover and denning. Needs large areas of mature, dense forest.	Moderate
American badger	*Taxidea taxus*	C	Most abundant in drier open stages of most shrub, forest, and herbaceous habitats, with friable soils. Need sufficient food, friable soils and open, uncultivated ground. Prey on burrowing rodents. Dig burrows.	Low

* The California Natural Diversity Database (CNDDB) was queried for special-status species occurring in the following counties which overlap the CABY Region: El Dorado, Nevada, and Placer counties.

1 Status:
- FT = Federally threatened
- FC = Candidate for federal listing
- SE = State endangered
- ST = State threatened
- C = California species of special concern (CDFG)

2 CNDDB habitat associations.

3 High = Habitat range overlaps with the CABY Region and utilizes meadow habitat (e.g., for breeding, foraging, migration).

Moderate = Slight overlap of habitat

Appendix B. Immediate restoration priorities site list.

Criteria for inclusion on this list of high priority ready-to-proceed meadow restoration projects include the following:

a.) Eligibility - Eligible projects under this category are those in which partners/landowners have already undertaken work and that work will resume in the 2009 field season. Work is defined as conceptual or final designs, resource surveys that are underway/completed, CEQA/NEPA is completed or can be completed within one year, timeline to initiate project construction is the field season of 2010 or before. Project construction will not be authorized until CEQA/NEPA clearances have been obtained and all landowners and partners have executed a project agreement which will identify the management, monitoring and maintenance requirements for the project.

b.) Prioritization – Project activities or areas must be identified as high priority in one or more of the following, including but not limited to: watershed management strategies/plans, Regional Water Board basin plans, Integrated Regional Water Management Plan(s), USFS Land and Resource Management Plans or equivalent for BLM or NPS jurisdictions.

c.) Monitoring/Research - There is one or more significant research or monitoring component associated with the project to quantify project benefits in the following categories: water reliability (flood and/or supply), aquatic or terrestrial wildlife, water quality, vegetation change/forage productivity, carbon sequestration. Ideally, at least two years of baseline data collection should be included with project construction and adequate post-project monitoring (2-5 years) to encompass a reasonable range of natural variability for research quality.

d. Project/Program development - Future project development and program capacity expansion are eligible

Ready-to-Proceed Meadow Restoration Projects				Prioritization						Which target species would directly use or could colonize meadow?										Feasibility				
Meadow Name/Year	**County**	**Watershed**	**Acres**	**CEQA/NEPA**	**Total Budget**	**Land Owner**	**Upstream of hydropower or water-supply reservoir**	**Close to existing or planned restorations**	**Ability to measure hydrologic change**	Yosemite toad	yellow-legged frog	willow flycatcher	great gray owl	redband trout	golden trout	Sandhill crane	yellow warbler	Eagle lake rainbow trout	Lahontan cutthroat	Landowner Support	Participation in IRWMP or other plan	Access for heavy equipment	Personnel capacity	Matching funds
Perazzo Meadows 2010	Sierra	Truckee	600	Y	$1,000,000	USFS	Y	N	N	N	?	Y	?	N	N	Y	Y	N	N	Y	N	Y	Y	500,000
Lower Ash Creek	Lassen/Modoc	Pit	3500	partial	$3,915,205	CDF&G	Y	N	N	N	?	Y	?	N	N	Y	Y	N	N	Y	N	Y	Y	138,000
Last Chance Phase II 2010	Plumas	NF Feather	1000	partial	$2,800,000	USFS/ private	Y	Y	Y	N	?	Y	?	N	N	Y	Y	N	N	Y	Y	Y	Y	2,000,000
Ziegler Meadow	Trinity	Trinity	2	N	$10,000	STNF	N	N			?	N		N	N	N	N	N	N	Y	N	Y	Y	
Trout Creek	Shasta	Sacramento	1200	N	$240,000	STNF	Y	Y	Y			Y	Y	Y	N	N	N	N	N	Y	N	Y	Y	50,000
Crowley Range	Mono	Owens	43	partial	$101,000	INFS	Y	N		N	N	?	N	N	N	N	Y	N	N	Y	Y	NA	Y	41,000
Kern Plateau	Tularie	Kern	180	Y	$134,000	INFS	Y	Y		N	Y	?	?	N	Y	N	Y	N	N	Y	Y	NA	Y	91,000
Glass Mountain	Mono	Mono Lake	20	Y	$60,000	INFS	N	Y		N	N	N	N	N	N	N	N	N	N	Y	Y	NA	Y	
Hawley	Yuba	N. Yuba	70	Y	$150,000	TNFS																		
Butcher	Yuba	N. Yuba	84	Y	$70,000	TNFS																		
Loney Meadow	Yuba	N. Yuba	300	Y	$20,000	TNFS	Y	Y		N	Y	Y	Y	N	N	N	Y	N	N	Y	Y	Y	Y	7500
Cornish Flat	Yuba	N. Yuba	3	Y	$10,500	TNFS	Y	Y		N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	4000
Duncan Fen	Yuba	N. Yuba	5	Y	$20,000	TNFS	Y	Y		N	N	N	Y	N	N	N	N	N	N	Y	Y	Y	Y	7500
Bear	Nevada/ Placer	Bear	350	partial	$500,000	PG&E																		
Big Bear Flat	Siskiyou	Pit	400	Y	$837,710	private	Y	Y	N	N	?	Y	?	N	N	Y	Y	N	N	Y	N	Y	Y	152,150
Carman Valley Ph II 2010	Sierra	MF Feather	500	Y	$460,000	USFS	Y	Y	N	N	?	Y	?	N	N	Y	Y	N	N	Y	Y	Y	Y	230,000
Bear Valley Creek 2010[1]	Sierra	MF Feather	165	N	$1,650,000	CDF&G	Y	N	Y	N	?	Y	?	N	N	Y	Y	N	N	Y	Y	Y	Y	1,000,000

Ready-to-Proceed Meadow Restoration Projects					Prioritization					Which target species would directly use or could colonize meadow?										Feasibility				
McBride/Upper Willow	Lassen	Pit	400	Y	$195,491	USFS/private	Y	N	N	N	?	Y	?	N	N	Y	Y	N	N	Y	N	Y	Y	43,100
Rose Creek	Modoc	Pit	20	Y	$54,000	USFS/private	Y	Y	N	N	?	Y	?	N	N	Y	Y	N	N	Y	N	Y	Y	7,000

8842 $12,227,906

[1]Match includes expended purchase price by DFG

Institutional Capacity Building Projects

Meadow Name	County	Watershed	Acres	CEQA/NEPA		Land Owner
Indian Basin	Fresno	Kings	80			USFS
Osa Meadow	Kern	Kern	90			USFS
Leland Gully	Stanislaus	Stanislaus	10			USFS
Indian Valley	El Dorado	American	500	partial	$1,250,000	USFS
Van Vlec	El Dorado	American	100	partial	$75,000	USFS
Hawley	Yuba	N. Yuba	70	Y	$1,000,000	USFS
Bear	Yuba	N. Yuba	350	Y	$3,915,205	PG&E
Sierra Valley	Plumas	MF Feather	900			private

1) **Hawley Meadow** is 66 acres in size in the Gold Lakes area in the headwaters of the Yuba Watershed. Originally, this meadow was seasonally dammed to supply water for a gold mill located at the output of the meadow. The meadow has been degraded due to a road that cuts through it, but provides excellent restoration and educational opportunities with scenic views of the Gold Valley, waterfalls from the outflow of the meadow, views of the meadow itself, and several buildings in decent condition. The objectives of the project are to restore the meadow, decommission the road, and increase public access to restored meadows and public understanding of meadow function and benefits. The project will include: 1) final technical design for decommissioning the road and restoring the meadow ($25,000) 2) final monitoring plan and quantifying benefits ($35,000); 3) decommissioning of a quarter mile of road and removal of culvert ($22,000); 4) restoring the grade of the meadow ($89,000); 5) revegetating the meadow ($27,000); 6) providing access through construction of a trail around the meadow ($27,000); 7) restoring the adjacent cabin and mill for education and outreach ($53,000); and 8) design and implementation of historical and ecological outreach material ($27,000). Total cost of the project is: $278,000.With funding work would commence in June 2009 and continue through December 2010.
2) **Butcher Ranch** is a heavily disturbed site which has an old road with a culvert that runs through the 83 acre meadow. The culvert has caused a significant head cut. This project would re-route the road, remove the culvert, and restore the meadow. The project will include: 1) final technical design for decommissioning the road and restoring the meadow ($19,000) 2) final monitoring plan and quantifying benefits ($9,000); 3) decommissioning the road and removal of culvert ($17,000); 4) restoring the grade of the meadow ($51,000); and 5) revegetating the meadow ($15,500,000). Total cost of the project is: $111,500.With funding work would commence in June 2009 and continue through December 2010.

3) **Loney Meadow** is 303 acres in the South Yuba Watershed on the southern most end of Bowman Road. It was once the location of a dairy and then became a logging camp. There is currently a camp, a pond, and an interpretative trail around the meadow. This site has been extensively grazed by cattle. The objectives of the project are to replace the existing fences to keep the cattle out of the stream, and to control erosion through revegetating the streambank. The project will include: 1) final bank stability design ($11,000) 2) final monitoring plan and quantifying benefits through monitoring ($22,500); 3) fence replacement and repair ($63,000); and 4) revegetation of banks (83,000). Total cost of the project is: $179,500. With funding work would commence in June 2009 and continue through December 2010.

4) **Cornish Flats** is a meadow complex of 3 meadows in the Middle Yuba with good public access. The complex includes a fen site. The project objectives are to fence the meadow from cattle, revegetate the meadow, and provide interpretative features regarding this unique wetland habitat. The project will include: 1) final design for revegetating meadow ($5,000) 2) final monitoring plan and quantifying benefits ($3,000); 3) fence replacement and repair ($10,000); 4) revegetation of meadow (13,000); and 5) design and implementation of historical and ecological interpretative features ($3,000). Total cost of the project is: $34,000.With funding work would commence in June 2009 and continue through December 2010.

5) **Van Flec Meadow** is 100 acres in size, and is currently degraded due to a road that cuts through it and from pine encroachment due to altered hydrology created by downcutting as a result of the road. The objectives of the project are to restore the meadow through restoring hydrologic function, and decommission the road. The project will include: 1) final technical design for decommissioning the road and restoring the meadow ($25,000) 2) final monitoring plan and quantifying benefits through monitoring ($23,000); 3) decommissioning the road ($73,000); 4) restoring the grade of the meadow ($63,000); 5) revegetating the meadow ($17,000); and 6) burning and removal of invasive pine ($9,000). Total cost of the project is: $210,000.With funding work would commence in June 2009 and continue through December 2010.

6) **Indian Valley** is 500 acres in size with 3.5 miles of stream channel running through it. The objectives of the project are to restore the meadow through pond and plug methods and to quantify a range of benefits. The project will include: 1) final technical design for restoring the meadow ($25,000) 2) final monitoring plan and quantifying benefits through monitoring ($23,000); 3) permitting; and 4) restoration through pond and plug. Total cost of the project is: $1,500,500.With funding work would commence in June 2009 and continue through December 2010.

7) **Foster Meadow** is 50 acres in size. The objectives of the project are to restore the meadow through pond and plug methods, lodge pole pine removal, and to quantify a range of benefits. The project will include: 1) final technical design for restoring the meadow and removal of pines ($25,000) 2) final monitoring plan and quantifying benefits through monitoring ($23,000); 3) permitting; and 4) restoration through pond and plug. Total cost of the project is: $200,00. With funding, work would commence in June 2009 and continue through December 2010.