Papoose Meadows Restoration Project
Eagle Lake Ranger District
Lassen National Forest

Applicant and Contact Information:

Applicant Name: Lassen National Forest with cooperation from Colorado State University, Fort Collins

Type of organization: U.S. Forest Service

Address: **Lassen National Forest**
Supervisor's Office
2550 riverside Drive
Susanville, CA 96130
(530) 252-6662 or 257-2151
(530) 252-6428 (fax)

Contact person(s): Allison Sanger, Forest Botanist, Lassen National Forest
asanger@fs.fed.us

Tax Identification number: N/A

Project Information:

Project Title: *Papoose Meadows Restoration Project*

Requested amount: $72,215 **TOTAL project cost:** $98,215

Project duration: August 2007 to August 2009

Project summary: Papoose Meadows is a large 270 acre meadow located south of Eagle Lake in Lassen County (Map 1). At present, approximately 160 acres are a seasonally flooded wet meadow and marsh system. Historically this wetland complex was ditched to dry it out to improve hay production for livestock. The project objective is to assess the restoration potential of the meadow and them implement a restoration plan to restore Papoose Meadows to its pre-settlement hydrologic and vegetation condition.

Project Description:

Project Summary and Background Information:

Papoose Meadows is a 270 acre meadow located south of Eagle Lake in Lassen County (Map 1). At present, approximately 160 acres are a seasonally flooded wet meadow and marsh system. Historically this wetland complex was ditched to dry it out to improve hay production for livestock. This wetland provides habitat for the rare plant species *Senecio hydrophiloides* and *Utricularia minor*, though a complete floristic inventory of this unique area has not been conducted and other significant species could be present. In addition, recent surveys in the meadow have also discovered an undescribed species of spring snail.

Systematic archaeological and historic research on Papoose Meadows is limited, but available information indicates the area has attracted human habitation for at least the last

several millennia. Archaeological sites recorded within the meadow and at its margins suggest seasonal use of meadow resources by prehistoric aboriginal populations. A proliferation of groundstone artifacts at several sites demonstrates that prehistoric resource extraction was focused on plant foods endemic to the meadow itself (probably epos, *Perideridia* sp.), which figures prominently in ethnographic accounts of plant processing at the meadow). One archaeological site contains rock rings indicative of long term habitation or consistent seasonal use of the area over a period of time.

Ethnographically, Papoose Meadows falls within the ancestral territories of both the Maidu and the Northern Paiute, although it is unlikely that either group established permanent villages in the immediate area. Papoose Meadows and neighboring Eagle Lake were most likely used as seasonal hunting and plant gathering locations by several tribes with no firm territorial boundary attributable to one or the other. It is certain, however, from both the ethnographic and archaeological records that Papoose Meadows provided prehistoric people with needed resources, minimally on a recurring seasonal basis.

Recent history mentions several tribes camping at the meadow for short durations or simply traveling through the area, but Northern Paiute remain the most historically linked to meadow. In 1866, a small group of Native Americans camped at Papoose Meadows was attacked by Euro-Americans from the nearby town of Susanville. Euro-American and Native accounts of the tragedy differ, but it is clear that several Native Americans were killed and at least one, whose Northern Paiute descendants still live in Susanville today, survived by evading the attackers. Though a minor incident in the period of intense Indian-white conflict in northeastern California between 1848 and 1880, the “Papoose Meadows Massacre”, as it is known today, figures significantly in the local traditions of contemporary Indians and whites in Honey Lake Valley (Budy 1982). Local lore additionally has it that the meadow was named for another potential survivor of the massacre: a baby found cradled in a papoose.

During the latter part of the 19th century, Papoose Meadows was increasingly utilized by Euro-American settlers who effectively pushed out the Native Americans. The meadow was homesteaded in 1873, and multiple structures were built around the meadow. It was used as a dairy operation until it was sold in December of 1886. At some point, prior to 1941 (Figure 1), at least two ditches were constructed into the meadow to channelize the water, most likely to increase the available forage in the meadow for livestock grazing (Map 1). A variety of structures and corrals still exist adjacent to the meadow. Historic archaeological sites in and around the meadow also show a significant Basque presence probably around the turn of the century. In addition, remnants of the Susanville-Eagle Lake road can be seen just northwest of the meadows.

The meadow system is maintained by a set of large springs that discharge from the natural lava outcrop on the eastern edge of the wetland. At least two of the springs were channelized to flow north out of the wetland into Papoose Creek, preventing water depths from reaching historic levels and reducing the area of meadow that is wetted each year.

The wetland was grazed nearly continually since it was homesteaded, and in recent years approximately 70 cow/calf pairs used the wetland annually during the summer and fall seasons. In addition to impacts from grazing, there were significant impacts from trailing as cattle moved back and forth to the springs, which was the primary water source in the allotment. In 2006 Papoose Meadows was closed to grazing. To completely return it to a proper functioning condition the ditches must be filled and the wetland returned to its original hydrologic condition, and vegetation.

Objectives:
The project objective is to restore Papoose Meadows to its pre-settlement hydrologic and vegetation condition. The project tasks would include: (1) assess the impacts of the ditches on the area of wetland, the water level, and vegetation, (2) determine the restoration potential, (3) design and implement the restoration, and (4) implement a post restoration monitoring plan to assess the effectiveness of the restoration. Historically the meadow included 270 acres of wetland. Today approximately 160 acres are wetland, and this project could realize a total net wetland gain of 110 wetland acres (Figure 2).

Description:
This project will characterize the current condition of Papoose Meadows, design the restoration project, work with Forest Service staff to implement the restoration, and provide post-restoration monitoring to quantify the changes.

Scope of Work;
(1) Assess the impacts of the ditches on the area of wetland, the water level, and vegetation. Historic ground and air photos would be analyzed to determine the current and historic area of the wetland. This analysis would provide a project goal for area of wetland that could be restored. Based upon a cursory analysis of the site, between 30 and 110 acres could be restored (Figure 2). We would also analyze the soil seed bank to determine whether viable seeds of desirable wetland plants occur in the currently drained areas of the former wetland. Seed bank analysis involves collecting soils from drained areas that we suspect were part of the wetland. These soils are spread on trays in a greenhouse and watered to mimic wetland conditions. Then we identify the species that germinate and compare them with the modern vegetation. The seeds of many wetland species can survive a century or more in the soil, and germinate when hydrologic conditions are suitable. If desirable wetland plant seeds are present in the drained areas, then a rapid recovery of the sites vegetation at the site can be anticipated. If not, some transplanting of desirable species from intact parts of the wetland may be necessary.

(2) Determine the site restoration potential. The site restoration potential would be determined using topographic surveying, the results of the soil seed bank analysis, and the air photograph mapping. We would determine the elevation that water would pool once the ditches are blocked and filled. This elevation would be mapped through the wetland basin to determine the final wetland size. This increase in pool area would also increase the water depth in the interior of the basin, and could cause shifts in the zonation of vegetation. We would analyze and map site plant communities and measure water depth in these communities during the summer prior to ditch filling. A gradient analysis would be created which would indicate the distribution of communities along a water table depth gradient. This gradient analysis would be used, along with a future water depth map of the basin, to predict where each plant community would establish in the post-restoration years.

(3) Design and implement the restoration. Ditches would be mapped, their depth and cross sectional area measured and the fill stored adjacent to the ditches calculated (Figures 3-7). These data would give us an estimate of the volume of fill needed to completely fill the ditches, and the volume of material stored on site from the period when the ditches were excavated. Due to erosion during the past several decades, it is unlikely that all of the material excavated to construct the ditches is still in place. Hence Lassen NF staff would either have to import fill to completely fill the ditches, or just plug the ditch in a number of places. It is most desirable to completely fill the ditches, because that will completely and finally restore the meadow. We will work with Forest Service staff to plan a temporary path for vehicles to bring the necessary fill into the site in late summer when water levels are at the annual low. The fill would be carried

onto the stockpiled fill along the ditch margins by a front end loader. When the necessary fill is in place, a loader or track hoe would push the stockpiled material into the ditch progressing from south to north. The project design would identify the volume of fill needed

(4) Implement a post restoration monitoring plan to assess the effectiveness of the restoration. A post restoration monitoring program would be implemented. This plan would include staff gauges to measure water depth in the basin. Long-term plots would be established to measure water levels, vegetation establishment, and stability of the ditch restoration. In addition, the US Forest Service meadow monitoring program conducted by David Weixelman has two existing plots within Papoose Meadows that we will use to develop a long-term data set on past composition. Aspen monitoring transects have also been conducted along the southeastern shore by the Eagle Lake Ranger District Ecologist, Bobette Jones. Monitoring will continue throughout the project to determine the effects of the restoration process on this species as well. Annual progress reports and a final monitoring report will also be developed and provided throughout project implementation.

The Lassen National Forest will contribute time to assist with the collection of vegetation data, project coordination, and consultation with local tribes, as well as NEPA documentation time and development. In addition, long-term plot monitoring (Weixelman), aspen monitoring, as well as permit administration activities are also contributed funds. Total contributed fund from the Lassen National Forest total approximately $21,000.

In addition, Dr. David Cooper will contribute matching funds for Section 404 Permit compliance with the U. S. Army Corp of Engineers. Total contribution could provide a match of approximately $5,000.

Task Number	Task Identification	Projected Start and End Dates
1	Assess the impacts	August-October 2007
2	Determine restoration potential	October-December 2007
3	Design and implement the restoration	April-September 2008
4	Implement a post restoration monitoring	August 2008-August 2009

Key Personnel:

Allison Sanger, Forest Botanist, Project Manager, budget and grant coordinator, Forest Service Liaison.

Dr. David Cooper Senior Research Scientist, Department of Forest, Rangeland and Watershed Stewardship, Colorado State University, Fort Collins, Colorado. Technical lead for pre-restoration site analysis, restoration design, restoration implementation and post-restoration monitoring and report writing.

Evan Wolf, M.S. Research Assistant, Department of Forest, Rangeland and Watershed Stewardship, Colorado State University, Fort Collins, Colorado. Works with Cooper on all technical aspects of the restoration data collection, implementation, and analysis.

Grary Helpinstine, Road Maintenance Supervisor, Lassen NF, LNF Road crew supervision for ditch work.

Terrie Veliotes, Civil Engineer Tech, Lassen NF, Implementation advisor for ditch work.

Chris O'Brien, Forest Archeologist, Tribal Consultation and Liaison, Archeology mitigation.

References:

Budy, E. (1982) The Papoose Meadows Massacre: Comparative Analysis of Indian and White Narrative Reconstruction of the Past. Paper presented at the 18th Great Basin Anthropological Conference. Reno, Nevada.

Appendix A: Budget

Table 1: Proposed Budget, Papoose Meadows Restoration Project:

Cost Categories	Amount
Personnel	
Cooper	$11,500
Wolf	$14,000
Lassen Archaeologist	$2,000
Tribal Minitor	$2,000
Road Crew for implementation	$12,000
Subtotal Personnel	**$41,500**
Direct Expenses (Table 2)	
Equipment (truck rental, trackhoe)	$11,440
Supplies (fill material, wood for stabilization)	$19,275
Subtotal Direct	**$30,715**
Subtotal Personnel and Direct	**$70,215**
Overhead (if applicable)	$ N/A
Contributions	
Long-term meadow and aspen monitoring, NEPA document, permit administration	~$21,000
Section 404-Permit- Cooper	$~5,000
Total Project Costs	**$98,215**
Total Requested	**$72,215**

Table 2: Direct Expenses

Supply and Equipment Costs	Amount
Top Soil- Fill @ $25 yard and transportation from Susanville	$16,275
Other supplies (wood etc..)	$3,000
Supply Total	**$19,275**
Truck Loader @ $6,600 month	$6,000
Belly Dump @ $640/month and $1.60/mile @ 660 miles	$1,370
Dump Truck @ $750/month, $1.85/mile for 660 miles	$1,600
Excavator @$1,508/month, $21.5 hour for 80 hrs	$2,470
Equipment Costs	**$11,440**
Total Requested	**$30,715**

Costs estimated for two weeks of work and 30 miles round trip

Map 1: Papoose Meadows Project Area with ditch locations

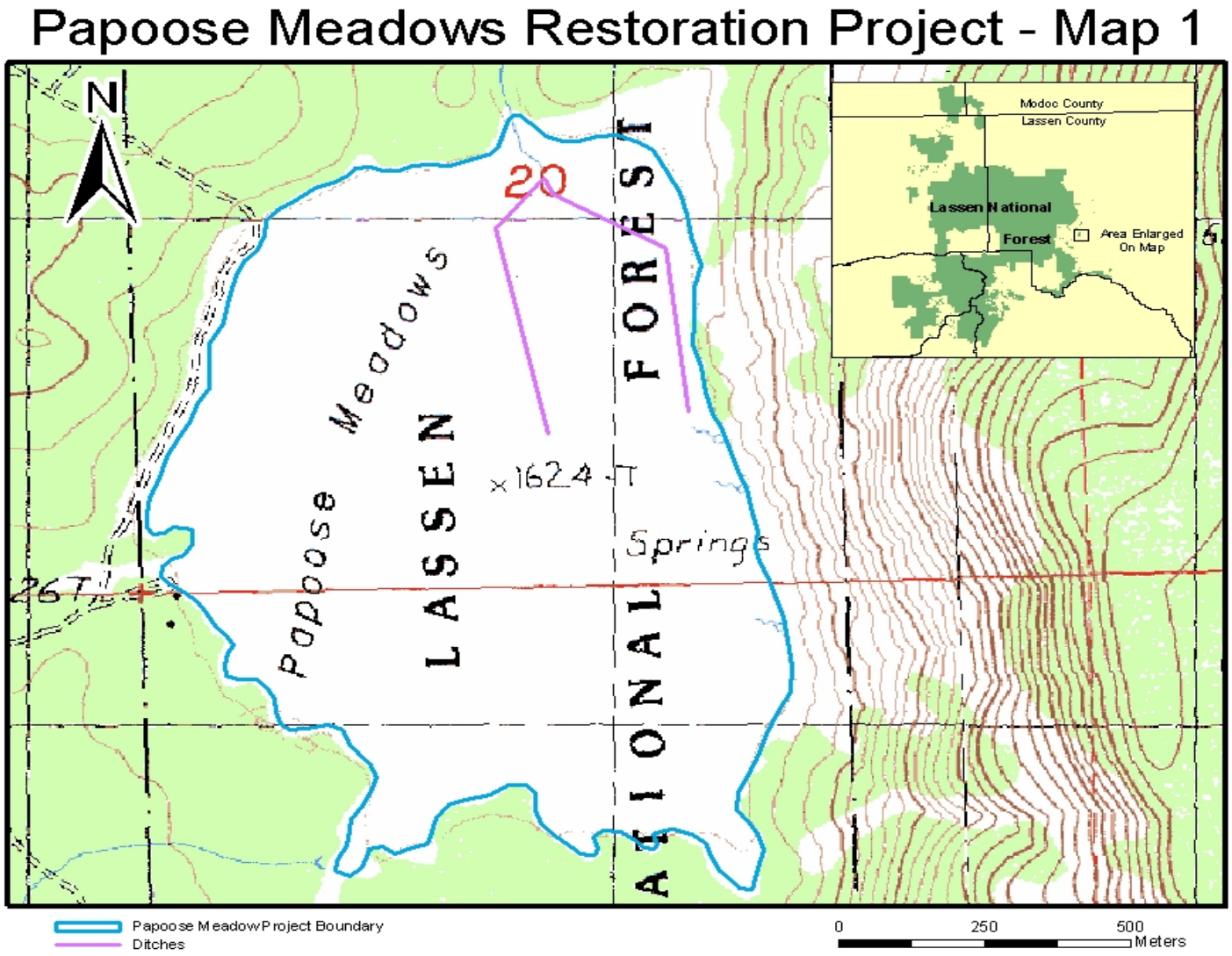

Figure 1: 1941 historic photo of Papoose Meadows showing wetland area.

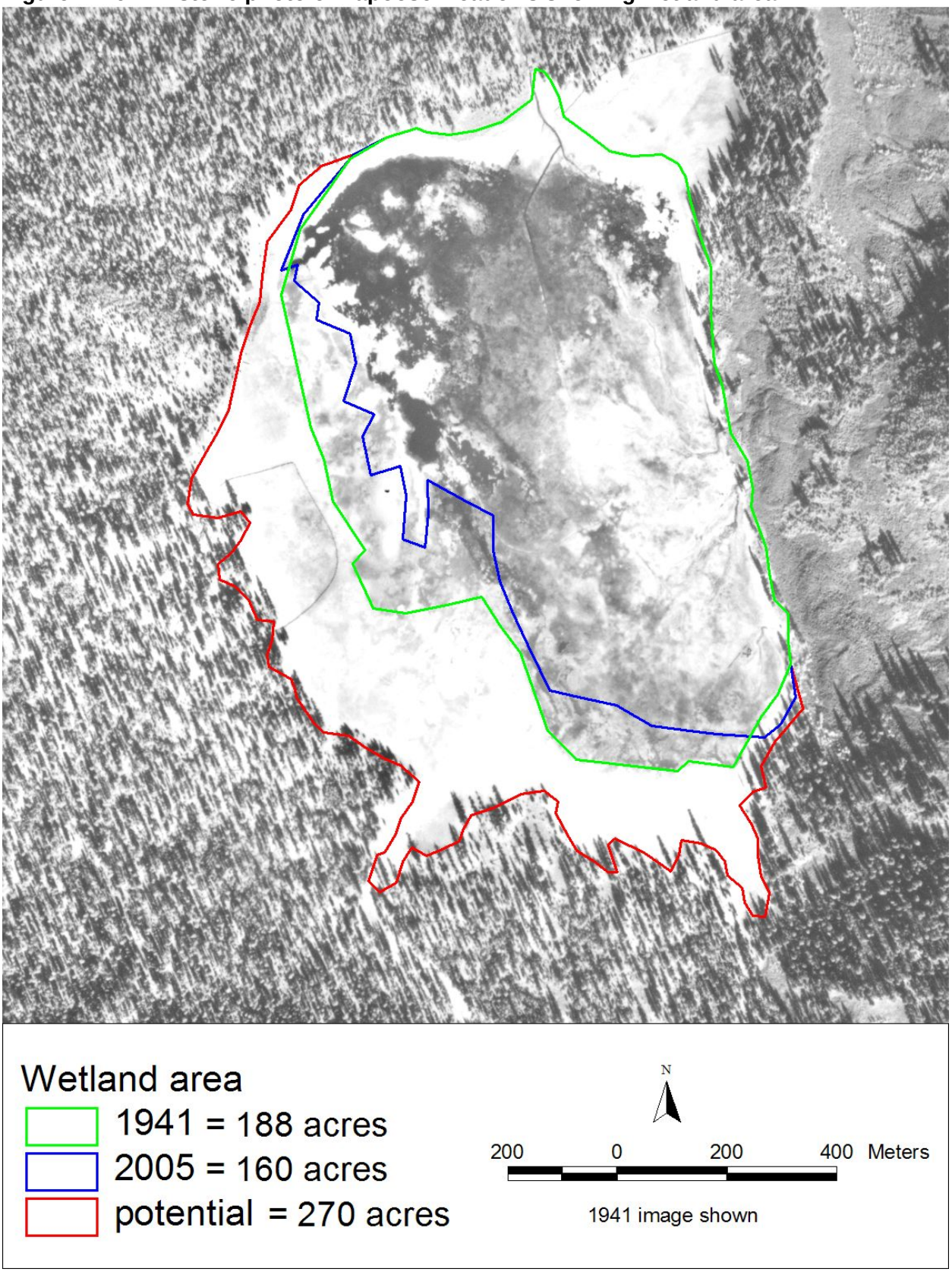

Figure 2: Papoose Meadows, showing current wetland area.

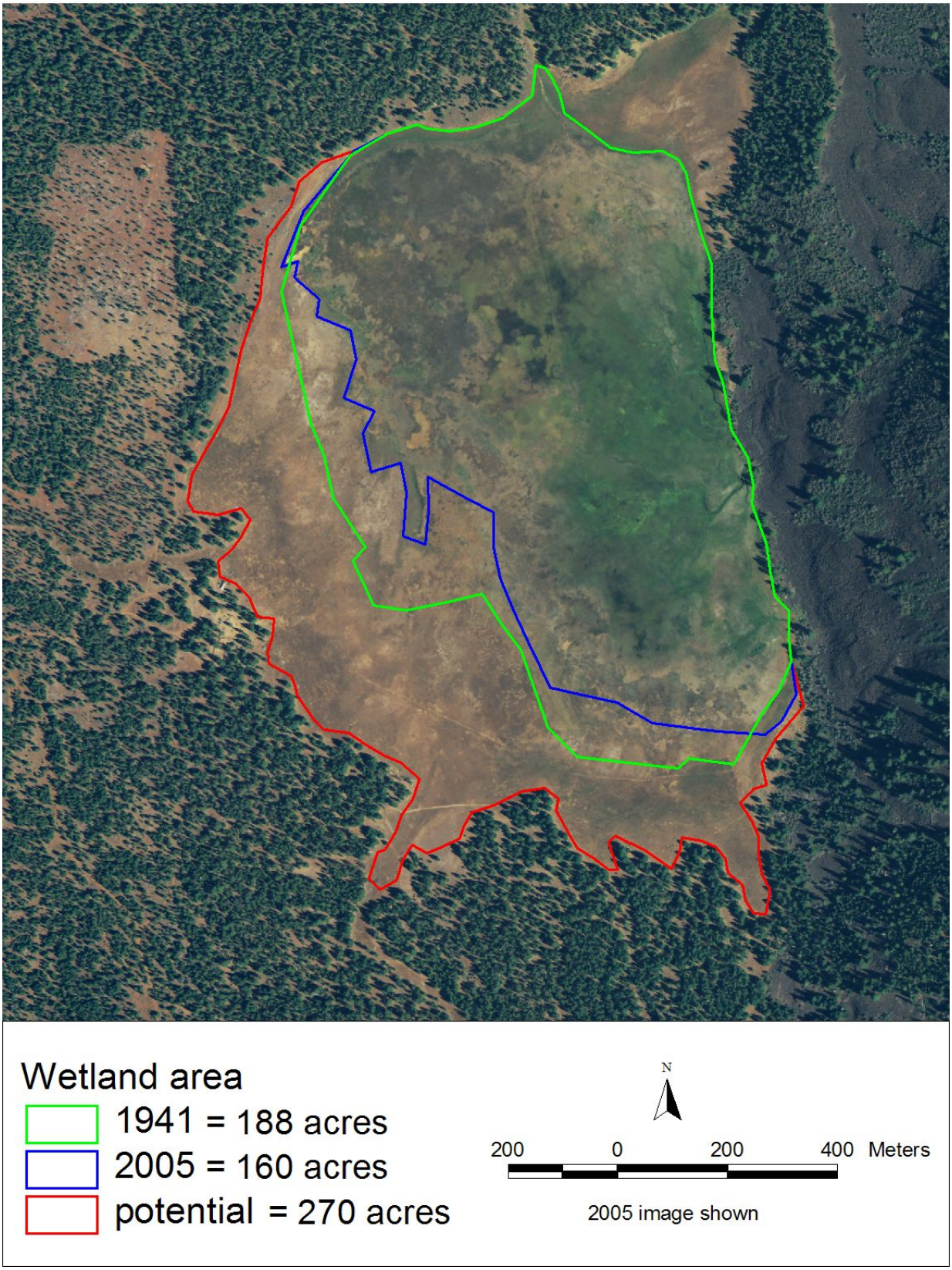

Figure 3: Papoose Meadows at the confluence of both ditches.

Figure 4: Eastern ditch going north toward Papoose Creek, depth ~45 inches.

Figure 5: Eastern ditch looking southeast, depth ~45 inches.

Figure 6: Eastern ditch running parallel to lava, depth ~45-68 inches.

Figure 7: Ditch running north from spring, Depth ~65 inches.

Attachments:

- Support Letter from Dr. David Cooper, Colorado State University, Fort Collins
- *Curriculum Vita,* Dr. David Cooper, Senior research Scientist, Colorado State University

Colorado State University
Department of Forest, Rangeland and Watershed Stewardship
Fort Collins, Colorado 80523
Tel: 970 491-5430
Fax: 970-491-6307

14 May 2007

Allison Sanger
Botanist, Lassen National Forest,
Susanville, California

RE: Papoose Meadow

Dear Allison,

I am very interested in working with you and Lassen National Forest to develop, implement and monitor a restoration plan for Papoose Meadow. This is an extraordinary site, certainly the largest marsh complex we have seen in the mountains of California, and an important site to restore. The ditches that were dug to drain the site could be filled resulting in the restoration of more than 100 acres of high quality wetland.

The proposal you will submit for this work contains ideas and a work plan that I developed in cooperation with you, and it represents an excellent approach for restoration. The budget within the proposal is suitable for our work to assist you.

Sincerely,

David J. Cooper

David J. Cooper, Ph.D.
Senior Research Scientist
Room 209 Forestry Building
DavidC@cnr.colostate.edu

DAVID JONATHAN COOPER
(*Curriculum Vitae – April 2007)*

EDUCATION

Ph.D. University of Colorado, May 1983. Biology.
B.A. University of Colorado, May 1975. Environmental Biology

EXPERTISE

Wetland and riparian ecosystems studies, wetland restoration, wetland flora and vegetation, wetland hydrology-vegetation interactions

CURRENT POSITIONS

2003-present. Senior Research Scientist, Department of Forest, Rangeland and Watershed Stewardship, Colorado State University, Fort Collins, Colorado 80523. Phone: (970) 491-5430 *DavidC@cnr.colostate.edu*

1996-present. Advising Faculty, Graduate Degree Program in Ecology, Colorado State University, Fort Collins, Colorado 80523.

CURRENT AND RECENT RESEARCH PROJECTS

2007. Design and implement long-term wetland monitoring program for US National Parks in the Sierra Nevada, California. Funded by National Park Service.

2006. Analysis of hydrologic regime and vegetation in Tuolumne Meadow wetlands in Yosemite National Park, California. Funded by Yosemite National Park.

2006. Wetland analysis and restoration planning for Rodeo Lagoon, Golden Gate National Recreation Area, Sausalito, CA. Funded by National Park Service and Golden Gate Conservation Fund.

2006. Restoration plan development for the Flagg Ranch floodplain of the Snake River, Grand Teton National Park, WY. Funded by National Park Service.

2006. Develop protocol and implement long-term monitoring program for Rocky Mt. National Park, Colorado. US National Park Service, Inventory & Monitoring Program, $130,000.

2005. Analysis, development and implementation of a restoration plan for Halstead Meadows, Sequoia National Park, California. Funded by Sequoia National park.

2005. Regional Assessment of Fen Distribution, Condition, and Restoration Needs, San Juan Mountains. Funded by US EPA.

2005. Characterization and classification of bofedales (peatlands) in the northern Andes, Cajamarca, Peru. Baseline study of alpine ecosystems funded by Yanacocha and Newmont Mining Co..

2005. Developing Concepts for Riparian Habitat and Stream Restoration in western National Parks, Canyon de Chelly National Monument. Funded by US National Park Service.

2004. Effects of Flaming Gorge Dam on riparian forests in Dinosaur National Monument. Funded by US Bureau of Reclamation.

2005. Developing a restoration plan for Yosemite Valley, Yosemite National Park, California. Funded by Yosemite National Park.

2004. Influence of livestock grazing on the sustainability of wetlands in the South Sierra Nevada range, California. Funded by Inyo National Forest.

2004. Effects of ground water pumping on wetlands in Crane Flat, Yosemite National Park, California. Yosemite National Park.

2003. Biodiversity in the fens of Yellowstone National Park. Funded by the Canon Foundation, Yellowstone Park Foundation, and Yellowstone National Park.

2003. Characterization and classification of fens in the Sierra Nevada and Cascade Ranges of California. U.S. Forest Service, Region 5.

2001. Willow persistence in Yellowstone National Park: interactive effects of climate, hydrology and herbivory. Funded by National Park Service.

RECENT PEER REVIEW PUBLICATIONS

Wolf, E. C., D.J. Cooper, N.T. Hobbs. **2007.** Beaver, streamflow and elk influence willow establishment and floodplain stability on Yellowstone's northern range. *Ecological Applications.* In press.

DeWine, J. and D.J. Cooper. **2007.** The effect of river regulation on native riparian forest in canyons of the upper Colorado River basin, USA. *Wetlands*. In Press. Patterson, L.S., D.J. Cooper. **2007.** On-site and off-site hydrologic regimes influence mountain fen restoration, Cascade Range, California. *Wetlands*, In press.

Northcott, K., D.C. Andersen, D.J. Cooper. **2007.** The influence of river regulation and land use on floodplain forest regeneration in the semi-arid Upper Colorado River Basin, USA. *Regulated Rivers*. In press.

Wohl, E., D.J. Cooper, L. Poff, F. Rahel, D. Staley, D. Winters. **2007.** Assessment of Stream Ecosystem Function and Sensitivity in the Bighorn National Forest, Wyoming. *Environmental Management.* In Press.

Andersen, D., D. J. Cooper, K. Northcott. **2007.** Dams, Floodplain Land Use, and Riparian Forest Conservation in the Semi-Arid Upper Colorado River Basin, USA *Environmental Management*. In Press.

Willard, B. E., D J. Cooper, B.C. Forbes. **2007.** Natural regeneration of alpine tundra vegetation after human trampling: a 42-year data set from Rocky Mountain National Park, Colorado, U.S.A. *Arctic, Antarctic and Alpine Research* 39: .

Lemly, J. R. E. Andrus, D.J. Cooper. **2007**. *Sphagnum lindbergii* Schimp. in Lindb. and other new records of *Sphagnum* in geothermal fens, Yellowstone National Park, Wyoming, USA. *Evansia* 24 in press.

Bilyeu, D. M., D. J. Cooper and N. T. Hobbs**. 2007.** Reassessing the browse-point diameter method for estimating herbivore utilization rates in woody deciduous plant communities. *Journal of Applied Ecology* **44:** 168-175.

Westbrook, C., D. J. COOPER, B. Baker. **2006.** Beaver dams and floods in controlling hydrologic processes of a mountain valley. *Water Resources Research* 42: W06404, doi:10.1029/2005WR004560

Birken, A. and D. COOPER. **2006.** Processes of *Tamarix* invasion and floodplain development during the 20th century along the lower Green River. *Ecological Applications* **16**: 1103-1120.

COOPER D.J., J. Dickens, N. T. Hobbs, L. Christensen, L. A. Landrum. **2006.** Hydrologic, geomorphic and climate controls on willow establishment in a montane ecosystem. *Hydrological Processes* **20**: 1845-1864.

COOPER, D., J. Sanderson, D. Stannard, D. Groeneveld. **2006.** Effects of long-term water table drawdown on evapotranspiration and vegetation in an arid region phreatophyte community. *Journal of Hydrology* **325**: 21-34.

Woods, S. W. and D. J. COOPER. 2005. Hydrologic Factors Affecting Willow Seedling Establishment along a Subalpine Stream, Colorado, USA. *Arctic, Antarctic and Alpine Research* 37: 636-643.
Gage, E. A. & COOPER, D.J. 2005. Patterns and processes of Salix seed dispersal in a browsed environment. *Canadian Journal of Botany* 83: 678-687.
Williams, C.A. and D.J. COOPER. 2005. Mechanisms of riparian cottonwood decline along regulated rivers. *Ecosystems* 12: 382-395.
Chimner, R.A, and COOPER, D.J. 2004. Water sources utilized by native shrubs in an intermountain basin. *Plant and Soil* 260:225-236.
Gage, E. A. & COOPER, D. J. 2004. Constraints on willow seedling establishment in a Rocky Mountain montane riparian floodplain. *Wetlands* 24:908-911.
Arp, C.D. and COOPER, D. J. 2004. Analysis of sediment retention in western riverine wetlands: the Yampa River watershed, Colorado. *Environmental Management* 33:318-330.
COOPER, D.J., D.C. Andersen, R.A. Chimner. 2003. Multiple pathways for woody plant establishment on floodplains at local to regional scales. *Journal of Ecology* 91:182-196.
Chimner, R.A. and, D.J. COOPER. 2003. Carbon balances of pristine and hydrologically modified southern Rocky Mountain fens. *Canadian Journal of Botany* 81:477-491.
COOPER, D.J. 2003. In Memoriam: Beatrice E. Willard. *Arctic and Alpine Research* 35:125-127.
Chimner, R. A. and D.J. COOPER. 2003. Influence of water table levels on CO2 emissions in a Colorado subalpine fen: an in situ microcosm study. *Soil Biology and Biochemistry* 35:345-351.
Wurster, F.C., D.J. COOPER, and W.E. Sanford. 2003. Stream/aquifer interactions at Great Sand Dunes National Monument, Colorado: Influences on interdunal wetland disappearance. *Journal of Hydrology* 271:77-100.
COOPER, D.J., D. D'Amico and M.L. Scott. 2003. Physiological and morphological response patterns of *Populus deltoides* to alluvial groundwater pumping. *Environmental Management* 31:215-226.

HONORS - AWARDS

2004 – National Park Service, Intermountain Regional Director's Award for research to support natural resource management.
2004 – National Park Service, Great Sand Dunes National Monument, Special Achievement Award.
2004 – National Park Service, Water Resources Division, Certification of Appreciation.
2004 – Office of Surface Mining, 2004 Abandoned Mine Reclamation People's choice award for restoration of the Snake River Gravel Pit, Grand Teton National Park, Wyoming.
1993 - Colorado Conservation Award. The Nature Conservancy.
1989 - Outstanding Achievement Award. EPA Region VIII.

CURRENT SCIENCE PANELS/COMMITTEES

U.S. Army Corps of Engineers, National Technical Committee for Hydrophytic Vegetation.
U.S. Army Corps of Engineers, Panel to develop a regional wetland delineation manual

for the western mountain and intermountain region of the US.
National Park Service, Rocky Mountain Network National Parks, Inventory and Monitoring Program, Science Advisory Panel
National Park Service, Sierra Network National Parks, Inventory and Monitoring Program, Science Advisor for Meadow Monitoring

RECENT EXPERT WITNESS ACTIVITIES AND TESTIMONY

2007. Expert for US Department of Justice and National Park Service. Effects of the Grand Ditch breach on wetlands of the Colorado River in Rocky Mt. National Park.

2006. Expert for State of Colorado and Rio Grande Water Conservation District. District Court, Water Division No. 3, Alamosa, CO on rules governing new withdrawals of ground water in the San Luis Valley Case No. 2004 CW 24. Decision won by State of Colorado. http://www.courts.state.co.us/supct/watercourts/wat-div3/water3index.htm

2003. The Nature Conservancy, Idaho, to evaluate their monitoring program for ground water and surface water protection, Silver Creek Preserve, Sun Valley, Idaho.

2001. EarthJustice Legal Defense Fund, Pikes Peak road erosion and wetland impacts.

2001. Snowmass Capitol Caucus, Snowmass, Colorado, determining the impacts of winter snowmaking water diversions, on floodplain ecosystems.

2001-2005. Friends of Mount Hood, Oregon a consortium of environmental groups analyzing the effects of Mount Hood Meadows ski area on wetlands on Mt. Hood.

1998-2005. EPA and Department of Justice providing analysis of impact to wetland from ski area and golf course development at Telluride Ski area, Colorado.

1993. Testimony before the US Senate subcommittee on Clean Water, Fisheries and Wildlife, Washington, D.C. regarding the functions and values of wetlands in the western US. This testimony was part of the last hearing on the reauthorization of the Clean Water Act. 15 September.

1991. Testimony before the US Senate subcommittee on Environmental Protection, Washington, D.C. on Federal Manual For Identification and Delineation of Jurisdictional Wetlands.

1991. State of Colorado, United States of America (DOJ), and Rio Grande Water Conservation District; On the application of American Water Development, Inc. (AWDI) for water rights in the San Luis Valley, Colorado. November 1991. Testify in Colorado water court.

1988. Holy Cross Wilderness Defense Fund. Testimony in US District Court, and Eagle County, Colorado hearings. 1988. Homestake II Water Project.