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Project Number: CSUCP-148
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Park/NPS Unit: Mesa Verde National Park
Title of Project: Data Development and Field Surveys for Special Status Plants in Mesa Verde National Park, Montezuma County, Colorado - 2014

Administered through the: Colorado Plateau Cooperative Ecosystem Studies Unit Cooperative Agreement Number H1200-09-0005

CESU Partner: Colorado State University, Colorado Natural Heritage Program

PROJECT CONTACTS:

Principal Investigator: Jill Handwerk, Botany Team Leader, Colorado Natural Heritage Program, Colorado State University, 1475 Campus Delivery, Fort Collins, CO 80523-1474, Tel.: 970-491-5857, Fax.: 970-491-3349, Email: Jill.Handwerk@colostate.edu

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NPS Certified ATR: George L. San Miguel, Natural Resource Manager, Mesa Verde National Park, PO Box 8, Mesa Verde CO 81330, Tel.: 970-529-5069, Email: george_san_miguel@nps.gov

FUNDING INFORMATION:

Amount Funded: \$21,500

NPS Account Numbers (amounts in parentheses): PPIMMEVE6G PPMRSNR1Z.NI0000 (\$21,500)

Fund Source (e.g., ONPS, FLREA, CRPP, CESU, etc.): ONPS

NPS Funding

Is this funded using a reimbursable account number? If yes, IMR contracting needs a copy of the Interagency Agreement.

PROJECT DATES:

Start Date: (Tentative date) May 1, 2014

NOTE: This Task Agreement will become effective on the date of final signature or the effective date of the Award document, whichever is later.

End Date: (please make end date the last day of the month if possible) May 31, 2015

NPS Administrative Contacts

Interim CESU Coordinator: Todd Chaudhry, National Park Service/CPCESU, NAU P.O. Box 5765, Flagstaff, AZ 86011, 928-523-6638, Fax: 928-523-2014, todd_chaudhry@nps.gov

Intermountain Region Administrative Contact: Kelly Adams, Grants and Agreements Specialist, National Park Service, 12795 West Alameda Pkwy, Lakewood, CO 80228. Phone: 303-969-2303 Fax: 303-969-2992 Email: kelly_adams@nps.gov

FEDERAL FINANCIAL REPORTS AND DRAWDOWN SCHEDULE:

Federal Financial Reports (Check as required for project based on spending plan, period of performance, risk, cooperator history, etc.)

Quarterly Semi-annually Annually Final

PROJECT SCHEDULE AND TECHNICAL REPORT DEADLINES:

List all technical reports and products in sequential order as required in the scope (more lines and milestones can be added as needed):

Project Start Date – May 1, 2014

Technical progress reports – Quarterly Semi-annually Annually
(Check as needed from PI to monitor progress of specific project. Content should be addressed in the scope.)

Investigator’s Annual Reports (IAR) – March 31, 2015

Database, Collections/Specimens, Archives, and Maps provided to the NPS ATR or Technical Expert – May 15, 2015

Draft Final Report – January 15, 2015

Final Report – April 30, 2015

Project End Date – May 31, 2015

Final SF425 FFR must be submitted within 90 days of project end date

PAYMENTS

2 CFR PART 215.22: Cash advance (drawdown) to recipient organization shall be limited to the minimum amounts needed and be timed to be in accordance with the actual immediate cash requirements of the recipient organization in carrying out the purpose of the approved program or project. The timing and amount of cash advances shall be as close as is administratively feasible to the actual disbursements by the recipient organization for direct program or project costs and the proportionate share of any allowable indirect costs.

2 CFR PART 215.25 (8)(e)(1): Incur pre-award costs 90 calendar days prior to award or more than 90 calendar days with the prior approval of the Federal awarding agency. All pre-award costs are incurred at the recipient’s risk. (i.e. the Federal awarding agency is under no obligation to reimburse such costs if for any reason the recipient does not receive an award or if the award is less than anticipated and inadequate to cover such costs.)

CESU REQUIRED PRODUCTS (may be different from those products required by the ATR – See Statement of Work for Products required by the NPS unit):

The Principal Investigator will prepare a brief report abstract suitable for public distribution and two hard copies and an electronic version (in PDF file format) of the final report and mail all to Judy Bischoff, National Park

Service, CPCEUS, NAU P.O. Box 5765, Flagstaff, AZ 86011. Please be sure to include the project number (e.g.; **NAU-###**, **UMT-###**, **UAZDS-###**) and the P number on the cover page of the final report.

PROJECT ABSTRACT:

At 52,000-acres, Mesa Verde National Park is located in the southwestern corner of Colorado, and is characterized by winding canyons and by mesas dominated by old-growth pinyon-juniper. These habitats support several of Colorado's rarest plant species, including *Hackelia gracilentia* and *Aletes macdougallii* ssp. *breviradiatus*. Surveys are needed to determine current viability and long-term trends of existing populations of this species, and to look at the effects of impacts from management and human use to these populations and their potential habitat. Despite rare plant surveys conducted in 2012 & 2013 by CNHP and MEVE staff, many occurrences of *Hackelia gracilentia* remain along the steep canyonsides in MEVE that have not been visited in the last twenty years. Additional surveys are needed to accurately map *Hackelia gracilentia* in these areas, and to update population data for these historical occurrences. Furthermore, extensive suitable habitat for both species remains unsurveyed in MEVE. In 2014, we will conduct surveys to update any remaining historical occurrences and survey potential habitat for these species on NPS lands. For *Aletes macdougallii* ssp. *breviradiatus* we recommend surveying west-facing aspects of Wickiup, Soda, and School Section canyons (time permitting). *Hackelia gracilentia* would be surveyed in May and June while *Aletes* surveys can take place throughout the growing season. Time permitting we will spend one day at Yucca House National Monument (YUHO) to look for additional rare species including *Penstemon breviculus*.

Mesa Verde National Park, known primarily for its outstanding archeological sites, contains a rich diversity of natural resources, including globally rare plant species. Most notably, the Park contains the largest documented population of Schmoll's milkvetch (*Astragalus schmolliae*). This species is among the rarest of Colorado's endemic plant species. Its global distribution is constrained almost entirely to Chapin Mesa within Mesa Verde National Park (MEVE) and the Ute Mountain Ute Tribal Park, with small outlying populations on neighboring Park Mesa, east of Chapin Mesa in Mesa Verde National Park, and from the West Chapin Spur. The entire population is thought to contain approximately 294,499 individuals (Anderson 2004). It is considered critically globally imperiled (G1) by the Colorado Natural Heritage Program, and has recently been added to the list of candidates for listing under the Endangered Species Act in a twelve-month finding for a listing petition (U.S. Fish and Wildlife Service 2010).

The Colorado Natural Heritage Program has been monitoring *A. schmolliae* at MEVE intermittently since 2001. The two primary components of this monitoring are demography plots and belt transects. Demography plots were established in 2003 at four locations on Chapin Mesa. Results from re-sampling demography plots indicate an overall pattern of decline (2003, 2011, 2012, and 2013) in number of individuals in two plots, and an increase in one. A total of 43 belt transects were established and sampled in 2001 on Chapin Mesa. The following year, the Long Mesa Fire burned 17 of the transects, which allowed us to examine the effects of fire on the population. Our sampling data from 2003, 2011, and 2012 indicate an overall decline in density. However, in 2013 density levels were extremely high, and for the first time in our sampling history were above 2001 levels. In a comparison of number of individuals in burned vs. unburned transects, burned transects contained more individuals than unburned in both 2012 and 2013 ($p=0.03052$, $p=0.01859$, respectively). Data from 2014 will inform whether or not density levels are part of a positive population trend for the Chapin Mesa population. As part of this agreement with MEVE, we will complete the four following objectives: 1) re-sample two demography plots 2) re-sample 43 belt transects 3) create a regression and/or general linear model using belt transect data with fire, precipitation, and year as variables 4) provide a written report and photos resulting from study to MEVE staff. We assert that collecting data from these plots and transects for a sixth year will

allow us to continue building a long-term data set for *A. schmolliae* density and population status on Chapin Mesa.

SCOPE OF WORK:

Objectives

CNHP will conduct field surveys within MEVE for *Hackelia gracilentia* and *Aletes macdougallii* ssp. *breviradiatus*, thereby updating existing historical records, and search for new occurrences of these species. In order to locate new occurrences, CNHP staff will compile existing information to identify potential habitat and perform field surveys targeting these habitats. CNHP botanists will use their technical expertise, field survey skills, and knowledge of the target species to survey the rugged canyons of MEVE. When encountered, species location records will be updated to reflect current population size and conditions at each site. Photographs will be taken and additional information on habitat and threats will be recorded as needed. The data resulting from the 2014 field surveys will be incorporated into the CNHP BIOTICS database and provided to MEVE staff in a geospatial format, thus providing Park biologists and operations staff the ability to view rare plant data in a consistent, repeatable format, following NatureServe methodology. Staff members of MEVE will provide input on the project, priorities of targeted plant species, and expertise in the natural resource management issues of the study area. Survey data will be recorded for any additional rare plant species encountered during surveys.

Objectives for the Schmoll's milkvetch population study portion of the project are 1) re-sample two demography plots, 2) re-sample 43 belt transects, 3) create a regression model using belt transect data with fire and precipitation as parameters, and 4) provide a written report and photos resulting from the study to MEVE staff. Time permitting we will spend one day at Yucca House National Monument (YUHO) to look for additional rare species including *Penstemon breviculus*.

The resulting up-to-date data set will enable the Park to manage existing and potential threats to its rare plant species and to coordinate rare plant stewardship with general park operations such as fire management and weed control. This data will also be available to interested researchers by request, from CNHP.

Methods

Field surveys will be conducted at phenologically appropriate times for *Hackelia gracilentia* and *Aletes macdougallii* ssp. *breviradiatus* in the spring and summer of 2014. Revisits to the sites of historical occurrences will be attempted using existing locational data obtained from MEVE staff and the CNHP data base. Additional suitable habitat for on-the-ground surveys will be identified by using maps, aerial photographs, soil surveys, geological maps, and satellite imagery (as available). Areas targeted by MEVE staff for intensive survey efforts will be prioritized based on their likelihood of supporting occurrences of the target species, with an emphasis on revisiting historical occurrences. GPS units will be used to track the routes traveled and to record the locations of the target species when found. Protocol developed by NatureServe for the Natural Heritage Programs will be followed to develop new or update existing element occurrence records for inclusion in the CNHP database.

Additional field work for this project will be conducted at phenologically appropriate times for *A. schmolliae* (late May or early June, 2013 unless local conditions require starting sooner). Methods for sampling the demography plots follow those described in Anderson 2004. The following two plots will be re-sampled: Sun Temple and West Chapin Spur. Plots are 10m x 10m and divided into four quadrants. Each quadrant measures 5m x 5m. Each *A. schmolliae* individual within the entire plot is marked with a pin flag. Individuals are assigned a life history stage (Seedling, Non-Reproductive, and Reproductive). Reproductive effort and vigor is assessed nondestructively using the methods of Floyd et al. (1999) on all marked adults at all plots. Reproductive effort is assessed by counting flowers, fruits, and aborted flowers on each marked adult. Vigor is assessed by counting the number of stems per plant. Data will be compiled into tables and bar charts. Due to the

limited nature of the sample size and the inability to fund a study of marked individuals, no models or regression analysis will be conducted for the demography plots. Rather, results will be summarized with bar charts and tables to provide a snapshot of demography trends.

A total of 43 belt transects covering 4,067 meters will be sampled. These were originally sampled in 2001 (Anderson 2004). Subsequent sampling years were 2003, 2011, 2012, and 2013. Each transect is oriented in an east-west direction, traversing Chapin Mesa. The transects are 10 meters wide and spaced 500 meters apart following UTM northing lines projected in NAD 27 Datum, Zone 12T. Each belt transect is broken into 100m x 10m segments. Within each segment, a census of the *A. schmolliae* individuals will be recorded. To avoid deviating from the UTM northing line, CNHP staff will use a Trimble or Garmin GPS in tandem with a compass. Data will be recorded in a field notebook and then entered electronically into existing long-term data set at the CNHP main office. Data analysis will be conducted to investigate the difference between burned and unburned transects. Statistical tests will include non-parameteric, two-sample Wilcoxon rank sum test tests ($\alpha=0.05$, alternative hypothesis=two-sided, test type=exact), as well as regression models to investigate the effect of precipitation and fire on density. Regression models will be built with the assistance of the CSU Statistics Lab.

COOPERATIVE AGREEMENTS OR TASK AGREEMENTS INVOLVING COOPERATORS WORKING ON-SITE

Background

In cooperative agreements or task agreements with universities where the university utilizes interns, student employees, research associates (RAs) or cooperators on-site (hereafter called “cooperator personnel”), these cooperator personnel sometimes work on government sites in close proximity to federal employees. It is illegal (without specific statutory authority) for federal employees to directly supervise the cooperator personnel or any university employees or for the students or other university employees to supervise federal employees. When cooperator personnel are working on an NPS site, it is important that there is a clear distinction between students and federal employees.

Office Environment and Vehicles

- The office space of the cooperator personnel and NPS personnel should be clearly labeled (Name and NPS or University affiliation on office or cubicle space).
- Cooperator personnel should be listed separately from NPS personnel in telephone lists, other identification or organizational rosters, and publication credits.
- Cooperator personnel should not receive “all-employee” e-mail or other communications intended for NPS personnel (unless it relates directly to the work the cooperator is doing for the NPS). When the e-mail does relate to the work being done, a copy of the same e-mail message should be sent to the University or cooperator’s supervisor.
- Cooperator personnel may use NPS e-mail systems when the communication relates directly to the work the cooperator is doing for the NPS. The e-mail addresses of the cooperator personnel must include a label associated with their NPS e-mail address that identifies the cooperator’s status (i.e., “Linda Webb, Cooperator” would be the label associated with the e-mail address, linda_webb@contractor.nps.gov). Doing so clearly identifies this individual each time they send an e-mail message using the NPS system, and it identifies their status as a research associate, student intern or student employee in the e-mail directory.

- Unless stipulated in the agreement, cooperator personnel should not drive government vehicles.
- Unless stipulated in the agreement, cooperator personnel should not ride as a passenger in a government vehicle. When this is planned as part of the agreement, an appropriate amount of liability insurance should be negotiated.
- Prior written approval by the Park Superintendent or Center Manager must be obtained in order for a task to allow cooperator personnel to drive or ride in government vehicles.

Supervision and Scheduling

- Each task must specify the university's/cooperator's supervisor for the cooperator personnel.
- Unless stipulated in the agreement, NPS staff should not set hours for cooperator personnel, specify where the work should be done, or conduct performance appraisals. National Park Service staff may give performance feedback to the cooperator personnel supervisor.
- Cooperator personnel should report leave, scheduling, and other related issues to the university or cooperator's supervisor, not to NPS employees. The supervisor of the cooperator personnel should then communicate with the NPS. National Park Service employees cannot directly supervise cooperator personnel on a day-to-day basis. Work should be given to the cooperator personnel (via the cooperator's supervisor) on a "task basis." Cooperators should work without NPS supervision to accomplish each task, although technical consultations and cooperation is permissible.
- The Cooperator will be responsible for any disciplinary action needed to correct student employee conduct or performance problems. The NPS agreements technical representative will inform the university/cooperator's supervisor of any conduct or performance problems.
- The Cooperator will remove student employees from their positions if they fail to improve performance or address conduct issues.
- The NPS will review and provide feedback to students or interns regarding work assignments.
- The NPS will inform the cooperator of conduct or performance problems with cooperator personnel so that the university can counsel employees and correct the performance problems.
- The NPS will recommend to the cooperator dismissal of cooperator personnel based on conduct or performance issues.
- The Cooperator will hire students, interns or RAs to work on NPS tasks identified in the agreement. Hiring will be conducted in consultation with the NPS Agreements Technical Representative (ATR).
- The Cooperator will: pay students, interns or RAs for hours they have worked in support of the agreement.

Representation and Communication

- Cooperator personnel cannot in any way represent themselves to the public as NPS employees.
- Cooperator personnel are required to wear visible identification at all times.

Other Issues

- Cooperator personnel should not list an NPS affiliation on publications, but rather should list the cooperative agreement under which the work was performed.
- Cooperator personnel should not be invited to official NPS "social" events.
- Cooperator personnel will follow the local policy of the facility when federal facilities are closed due to early release for holidays, snow days, etc.

PRODUCTS:

Final Report

A final report summarizing work completed under this scope of work, will be provided in digital format, including digital photographs, to the NPS key official/ATR (CD-ROM/DVD) George L. San Miguel, Mesa Verde National Park Service, PO Box 8, Mesa Verde, CO 81330. Three hard copies (in color) of the final report will also be provided to the park. Two hard copies and an electronic version of the report on DVD will be sent to the Colorado Plateau Ecosystem Studies Unit.

Data Development

Element Occurrence Data: CNHP will provide the following Data to MEVE for all the plant species documented within the Park:

Level 1 Data consisting of attributed ArcGIS shapefiles and associated transcription reports for element occurrences which intersect MEVE lands.

Level 3 Data for all element occurrences (ArcGIS shapefiles only) for public display.

Under the existing Memorandum of Understanding between the National Park Service - Mesa Verde National Park and Colorado State University - Colorado Natural Heritage Program, these data will be provided as a pre-packaged ArcMap Hyperlink Project (ArcGIS .mxd) which links a GIS shape to its associated .pdf file containing tabular data for that particular element occurrence. All digital geospatial data will be documented using the Content Standard for Digital Geospatial Metadata (CSDGM), also referred to as the Federal Geographic Data Committee (FGDC) Metadata Standard.

Element Global Ranking Reports (EGRs) and Element State Ranking Reports (ESRs): CNHP will provide MEVE a digital .pdf file of the EGR for *Hackelia gracilenta* and the ESR for *Aletes macdougallii* ssp. *breviradiatus*.

In the winter of 2014, new data from the above field surveys will be incorporated into the CNHP database. Any additional data provided by MEVE staff will be incorporated into the CNHP element occurrence database, as time and funding allow. To ensure that the most complete dataset possible is provided, the target species Element Ranking Reports (EGR/ESR) will also be updated based on the information contained in BIOTICS (the CNHP database). The ranking reports will enhance decision-making and management efforts for the Park by providing a concise overview of *Hackelia gracilenta* and *Aletes macdougallii* ssp. *breviradiatus* population viability and threat information. The updated files will be delivered to the Park electronically as specified above.

Voucher Specimens and Curatorial Data

Any plant specimens of species not previously vouchered at MEVE or YUHO collected during surveys will be delivered to MEVE staff. The investigators will provide a spreadsheet of required specimen information for entry into the Automated National Catalog System software (ANCS+). Photographs and original data forms will be provided to the NPS in a format to be discussed and agreed upon after project initiation.

BUDGET: (*You may create your budget in a spreadsheet and attach it as a separate document when you submit your project coversheet and Justification for Use of Financial Assistance.*)

See separately attached budget table.