Colorado Natural Heritage Program

2005/2006 Project Abstracts

Natural Heritage Program
COLORADO

Colorado State University
Knowledge to Go Places

Colorado Natural Heritage Program
Warner College of Natural Resources
Colorado State University
254 General Services Building
Fort Collins, Colorado 80523-4061

Telephone (970) 491-1309
Fax (970) 491-3349

www.cnhp.colostate.edu

CNHP is a nonprofit organization, and is a sponsored program of the Warner College of Natural Resources, Department of Fishery and Wildlife Biology at Colorado State University. Sponsored programs of the University are externally funded through grants and contracts.

Cover photo: CNHP field crew documenting vegetative communities at the Great Sand Dunes National Park.

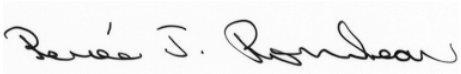
From the Director:

Coloradans are using more energy than ever before and headlines such as "Fort Collins Greenhouse Emissions Outpaces Population Growth" are becoming more common. At the same time that energy development and consumption increase, the citizens of Colorado continue to consider open space, the environment, and air and water quality as important issues of concern. We are often in direct conflict with ourselves over what is important. The Colorado Natural Heritage Program (CNHP) is working harder than ever to help the citizens of Colorado make wise decisions over where energy development can occur with the least impact to lands with high conservation value. We understand that some energy development projects will directly conflict with areas of concern, but the more advance information that we can provide to the energy industry, the fewer conflicts we expect to see. EnCana Corporation has begun natural gas development of the North Parachute Ranch, and has seen fit to incorporate all of CNHP's data into the planning process. With CNHP's data in hand, they plan to avoid disturbing the locations where the rarest plants and the most sensitive wildlife reside. They have become the stewards of some of Colorado's rarest plants, and are taking every precaution to protect these plants. Although our staff would prefer that no drilling take place in rare plant habitat, we also agree that a compromise is necessary in order for us to have warm houses and our accustomed amenities.

I hope that by reviewing this year's report, you will see that CNHP has been extremely busy in gathering and maintaining biodiversity data that are useful to all of the citizens of Colorado. Some of our findings from this year's projects include discovering that Mountain Plovers and Black-tailed Prairie Dogs occupy more habitat than were recently believed. A state-rare silky pocket mouse subspecies that we trapped in Canyons of the Ancients had not been seen in Colorado for over 20 years! While inventory and data collection helped us realize that some species were more abundant than we realized, other species were added to our tracking list. Two new G1 plants were described in Western Colorado, Gypsum Valley cat-eye (*Cryptantha gypsophila*) and cushion bladderpod (*Physaria pulvinata*).

CNHP worked on over 40 projects last year, with each project adding information to our State's most comprehensive biodiversity database (BIOTICS). We now maintain over 16,000 mapped locations of vulnerable species and plant communities, and 1,800 Potential Conservation Areas and Network of Conservation Areas that are used by land managers to help make wise land use decisions.

I invite all of you to stop by and visit with CNHP! You will be glad you did: our staff is exceptionally dedicated, hard working, and friendly!



Renée J. Rondeau
February 17, 2006

Colorado Natural Heritage Program
2005/2006 Project Abstracts

Table of Contents

NatureServe and the Colorado Natural Heritage Program

NatureServe is a membership organization that governs the Colorado Natural Heritage Program (CNHP) and a network of similar programs operating in all 50 U.S. states, in 11 Canadian provinces and territories, and in many countries and territories of Latin America and the Caribbean.

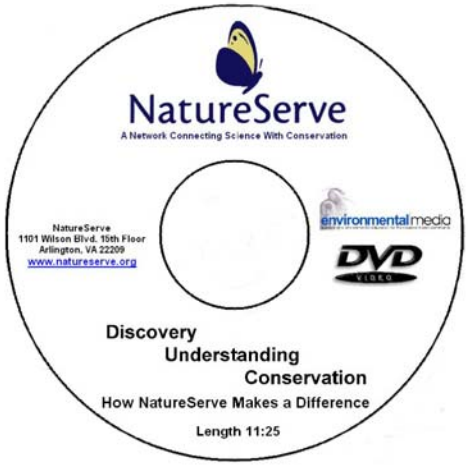
NatureServe coordinates the network of natural heritage programs in collection and management of detailed local information on plants, animals, and ecosystems, and development of information products, data management tools, and conservation services to help meet local, national, and global conservation needs. The objective scientific information about species and ecosystems developed by the NatureServe network is used by all sectors of society—conservation groups, government agencies, corporations, academia, and the public—to make informed decisions about managing our biological resources.

NatureServe Explorer is an online encyclopedia of plants, animals, and ecosystems of the U.S. and Canada. This valuable resource is available through the NatureServe website.

www.natureserve.org/explorer

In 2005, NatureServe created a DVD presentation on how NatureServe and the Natural Heritage Programs document and contribute to the conservation of biodiversity. *Discovery, Understanding, Conservation: How NatureServe Makes a Difference* includes interviews with Dr. E.O. Wilson and Bruce Babbitt. Natural Heritage Program directors Renée Rondeau (CNHP) and Linda Pearsall (North Carolina NHP) discuss contributions their programs have made. The DVD provides a glimpse of NatureServe and Natural Heritage Program work in the Blue Ridge Mountains of North and South Carolina, the San Luis Valley of Colorado, and the Amazonian lowlands of Peru. Download or view a copy of the presentation on our website.

www.cnhp.colostate.edu



2005/2006 Projects

With over 40 projects simultaneously occurring in one year, CNHP has the opportunity to work in all of Colorado's habitats including high and low elevations, wet and dry habitats, and all four corners of the state. Along with the varied terrain, we also work with a variety of subjects that include all major taxonomic groups and ecological communities. The common thread that ties all of these projects together is our commitment to providing quality conservation science.

Throughout all of our projects we aim to answer one or more of the following questions:

1. **What species and ecological communities exist in Colorado?**
2. **Which are at greatest risk of extinction?**
3. **What are their biological and ecological characteristics?**
4. **Where are they found?**
5. **What is their condition at those locations?**
6. **What processes or activities are sustaining or threatening them?**
7. **Where are the most important sites to protect?**
8. **What actions are needed for the protection of those sites?**

These basic questions are important to carrying out biodiversity conservation efforts, and are at the core of all Natural Heritage Programs. As you read through these abstracts you will see this foundation in all of our projects.

Giant helleborine (*Epipactis gigantea*), a state imperiled tall orchid growing on a hillside seep in Archuleta County.

Primary Funders (in alphabetical order)

Colorado Department of Natural Resources

Survey of Critical Wetland Resources in Grand County
Survey of Critical Wetland Resources in Fremont County
Vegetation Index of Biotic Integrity for Colorado Wetlands: Phase 1

Colorado Department of Transportation

Colorado Department of Transportation Conservation Easement Monitoring

Colorado Division of Wildlife

Boreal Toad Monitoring and Survey
Northern Leopard Frog Statewide Status Assessment
Colorado Small Mammal Survey
Montane Mollusk and Crustacean Survey of Western Colorado
Vegetation Index of Biotic Integrity for Colorado Wetlands: Phase 1
Survey of Critical Wetland Resources in Archuleta County
Survey of Critical Wetland Resources in Grand County
Survey of Critical Wetland Resources in Fremont County
Black-tailed Prairie Dog Complex Modeling

Colorado State Board of Land Commissioners

Lowry Range Biological Survey and Conservation Plan

Crestone/Baca Land Trust

Baca Grande Biological Assessment

Denver Water

Pawnee Montane Skipper Post-fire Habitat Assessment Survey

engineering-environmental Management

Preliminary Vegetation Classification for Fossil Butte National Monument

Grand County

Survey of Critical Biological Resources of Grand County
Fraser Valley Parkway Boreal Toad Habitat Inventory

Great Outdoors Colorado

Survey of Critical Biological Resources of Grand County

National Park Service

Vegetation and Mapping of Great Sand Dunes National Park and Preserve
Vegetation and Mapping of Bents's Old Fort and Sand Creek Massacre National Historic Sites
NPS Databases: Species of Mgmt. Concern, Invasive Animals, Endangered Species Act, and NPSpecies

NatureServe

Ecological Integrity Scorecards and EPA Performance Measures for Wetland Mitigation
CNHP Data Distribution and Environmental Review Projects
Conservation Status Updates and Community Characterization Abstracts

The Nature Conservancy

Central Shortgrass Prairie Ecoregional Assessment
Ecological Systems Viability Specifications for Colorado
General Support from The Nature Conservancy
An Aquatics Classification for the Headwaters of the Platte, Republican, Arkansas, and Canadian Drainages Contributing Watersheds
San Juan Biodiversity Planning

U.S. Bureau of Land Management

Rare Plant Survey of San Juan Public Lands
BLM Data Processing and Statewide Dataset
Ecological Systems Viability Specifications for Colorado
Survey of Critical Wetland Resources in Grand County
Survey of Critical Wetland Resources in Fremont County
San Juan Biodiversity Planning

U.S. Department of Defense

Buckley Air Force Base Wildlife Management Plan
Central Shortgrass Prairie Ecoregional Assessment
Monitoring Vegetation at Pueblo Chemical Depot: 1998-2005
U.S. Air Force Academy Noxious Weed Monitoring
Preble's Meadow Jumping Mouse Populations at the U.S. Air Force Academy
Front Range EcoRegional Partnership Project
Ecological Monitoring Program Assessment for Fort Carson and Pinon Canyon Maneuver Site

U.S. Environmental Protection Agency

Survey of Critical Wetland Resources in Grand County
Survey of Critical Wetland Resources in Fremont County
Vegetation Index of Biotic Integrity for Colorado Wetlands: Phase 1
Colorado Floristic Quality Assessment
Ecological Integrity Scorecards and EPA Performance Measures for Wetland Mitigation

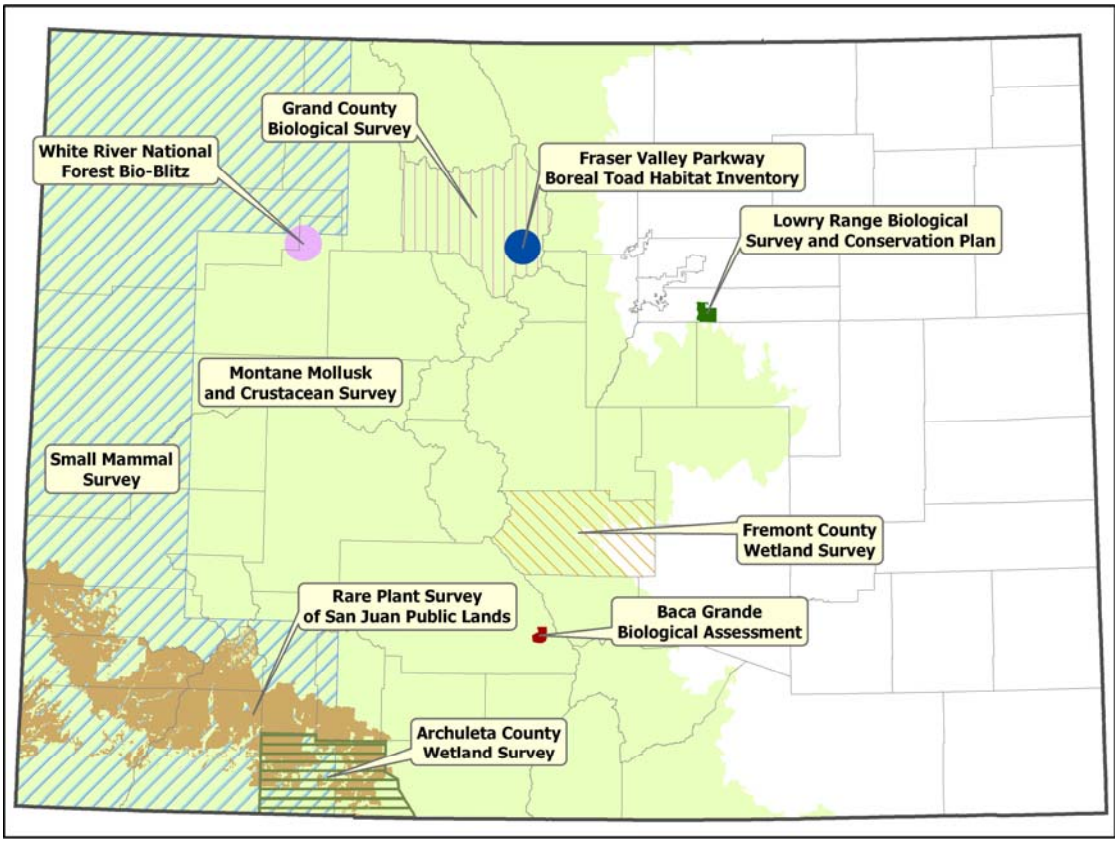
U.S. Fish and Wildlife Service

Pawnee Montane Skipper Post-fire Habitat Assessment Survey
Threatened and Endangered Plant Species Data Development and Element Distribution Modeling
Pagosa Skyrocket Conservation Planning and Inventory

U.S. Forest Service

Rare Plant Survey of San Juan Public Lands
U.S. Forest Service Region 2 Data Processing and Statewide Dataset
U.S. Forest Service Region 2 Technical Conservation Assessments
White River National Forest Bio-blitz in the Flat Tops Wilderness
Ecological Systems Viability Specifications for Colorado
Pawnee Montane Skipper Post-fire Habitat Assessment Survey

Inventory



Lowry Range Biological Survey and Conservation Plan
John Sovell, Lee Grunau, Renée Rondeau, Michael Menefee, and Georgia Doyle

The Lowry Range, managed for the State of Colorado by the Colorado State Board of Land Commissioners (SBLC), is an approximately 26,000-acre property located at the southeastern edge of greater metropolitan Denver. The SBLC would like to maintain significant portions of the Range in its current natural state, but is also interested in developing a portion to meet their mandate to generate revenue for Colorado schools. CNHP is working with the SBLC to identify significant biological resources on the Range, and to evaluate potential conservation easement and development scenarios within a framework of biodiversity conservation. This project is being conducted in two phases – inventory (completed in 2005) and conservation planning (scheduled for completion in 2006).

Results of the field survey confirm that numerous species of conservation priority inhabit the range, and that the ecological systems are in fair to good condition. The most significant finding from the inventory was the northern pocket gopher *macrotis* subspecies – a critically imperiled subspecies. This small mammal may require

preservation of its population on the Range to prevent its extinction. The Range also supports a fair sized complex of black-tailed prairie dogs and associated species, including ferruginous hawk, prairie falcon, burrowing owl, and swift fox. Work in 2006 will focus on identifying conservation targets for the Range, evaluating targets for viability and stresses, and recommending basic conservation and management strategies.

Swift fox at culvert den at the Lowry Range.

Colorado Small Mammal Survey
Jeremy Siemers

In 2001, The Colorado Division of Wildlife (CDOW) contracted with CNHP to develop a protocol for a statewide small mammal survey. The primary objective of this 10-year project is to expand knowledge of the distribution of lesser-known mammals in the orders Insectivora, Chiroptera, and Rodentia. CNHP biologists, in consultation with CDOW, developed a list of priority species for inventory. In addition, to better evaluate the presence of small mammals in habitats throughout Colorado, CNHP biologists identified major ecological systems within each area to survey.

CNHP surveyed western Colorado during the 2005 field season. Efforts focused on the Wyoming pocket gopher (*Thomomys clusius*), Stephen's woodrat (*Neotoma stephensi*) pocket mice (*Perognathus* spp.), shrews, and bats. We documented new occurrences of two species of rare bat: the spotted bat (*Euderma maculatum*) and the pallid bat (*Antrozous pallidus*). We also recorded additional records of the state rare sagebrush vole (*Lemmiscus curtatus*) and a new occurrence of a state historic pocket mouse subspecies (*Perognathus flavus hopiensis*). Additional survey work will continue in southwestern Colorado in 2006.

Jeremy Siemers with spotted bat.

Montane Mollusk and Crustacean Survey of Western Colorado
John Sovell


High elevation lakes, like Twin Lakes on the Flat Tops Wilderness, have unique species of pea-clams.

The Colorado Division of Wildlife funded this three-year inventory project, completed in 2005, to identify current distributions and abundance of mollusk and crustacean species in western Colorado. This information will be useful in defining conservation issues and developing conservation plans for these little-known taxa.

Based on our sampling, it appears that higher elevation lakes often have unique species of pea-clams (*Pisidium* sp.) not found in streams and creeks or lower elevation sites. We also found that reservoirs tended to have lower abundances and species richness relative to natural lakes. It may be that the extreme fluctuations of water levels common in regulated lakes affect mollusk populations or our ability to detect them. A more detailed study may be warranted to investigate these potential impacts. One surprising outcome of the sampling was the lack of some species of freshwater snails, such as those of the genera *Ferrissia* and *Promenetus.* We believe the large amount of collecting conducted during this project provides a useful synoptic set of material for future research and management decisions. Specimens were deposited at the University of Colorado.

Baca Grande Biological Assessment
John Sovell and Joe Stevens

The privately owned Baca Grande is an approximately 11,000-acre parcel of property located south of Crestone, Colorado. By virtue of its location – surrounded on three sides by the Great Sand Dunes National Park and Preserve, the Baca National Wildlife Refuge (NWR), and the Rio Grande National Forest – development on the Baca Grande has the potential to influence the ecology of these wild lands. This is especially true of the Baca NWR, whose wetlands are dependent upon six drainages, four of which flow across the Baca Grande before entering the refuge.


Emergent wetland on the Baca Grande.

The Baca Grande is a development consisting of second homes, retirement homes, and primary family residences located at the base of the Sangre de Cristo Mountains. The Baca Grande Property Owners Association (POA) regulates lot development, assuring that development specifications concerning setbacks from riparian areas, and sewage and septic systems are met. The Crestone/Baca Land Trust funded this project to conduct a biological assessment on the Baca Grande, to evaluate the area for the occurrence of important biological resources, to note current or potential problems relating to continued viability of the biological resources, and to supply these scientific data to the land trust and POA. This information will help inform their decisions on conservation and regulation of development within the Baca Grande.

Highlights of the field work conducted during summer 2005 include newly documented locations for the globally vulnerable northern pocket gopher *agrestis* subspecies (*Thomomys talpoides agrestis*), and narrowleaf cottonwood – Rocky Mountain juniper riparian woodland (*Populus angustifolia-Juniperus scopulorum*).

Fraser Valley Parkway Boreal Toad Habitat Inventory
Chris Gaughan and Lee Grunau

CNHP conducted an inventory for the state endangered boreal toad (*Bufo boreas*) within and adjacent to the proposed Fraser Valley Parkway project area during the spring and summer breeding season of 2005. The inventory was funded by Grand County. The objectives of the project were to quantify the amount and quality of habitat, find potential breeding sites, and evaluate historic or current activity of boreal toads along the proposed roadway. A total of five visits to the impacted areas were made between May 20 and July 18, 2005. Our results suggest that there is currently no occupied habitat within the surveyed areas. However, GIS analysis found that occupied boreal toad breeding sites are known to occur within a practical dispersal distance, and within the Pole Creek drainage, which will be crossed by the road if the proposed alignment is implemented. In addition to the inventory, the analysis included quantification of potential breeding and summer habitat and discussion of other landscape qualities, such as apparent hibernacula, upland habitat, and suitable water levels, as they pertain to the areas where impacts are most likely to occur. Direct (e.g., road building) and indirect (e.g., associated housing development) impacts on both short and long-term time scales were included in the discussion, along with options for offsetting potential adverse impacts.


Chris Gaughan surveying Crooked Creek in the Fraser Valley.

Rare Plant Survey of San Juan Public Lands
Peggy Lyon and Julia Hanson


Gypsum Valley cat-eye and lichens in Big Gypsum Valley, San Miguel County.

This survey was a continuation of several years of rare plant survey on San Juan Public Lands. Funding for the project was provided by San Juan National Forest and the San Juan Resource Area of the Bureau of Land Management. The primary emphases for field work in 2005 were to revisit and update all records for agency sensitive species older than 2000; survey areas missed on previous surveys; and assess the viability of two newly described species.

Seventy-five targeted inventory areas were surveyed. Seventy new and updated occurrences of rare plants were documented. Sixteen new Potential Conservation Areas (PCAs) were delineated and six existing PCAs revised with new information. Species lists were prepared for 55 sites.

Highlights of the field season included surveys of sites for two newly described species, Gypsum Valley cat-eye (*Cryptantha gypsophila*) and cushion bladderpod (*Physaria pulvinata*). Gypsum outcrops in Big Gypsum Valley were found to support three globally rare lichen species and a state rare grass, in addition to Gypsum Valley cat-eye. One of the most imperiled plants in the state, the Pagosa skyrocket (*Ipomopsis polyantha*) was found for the first time on public lands.

White River National Forest Bio-Blitz in the Flat Tops Wilderness
Peggy Lyon

CNHP was pleased to be invited to be part of an interdisciplinary team to conduct field research in the Flat Tops Wilderness in 2005. Funding for this project was provided by the White River National Forest. Members of the group included ecologists, wildlife biologists and even an arachnologist. Five days of camping and hiking were highlighted by freezing in the rain, beautiful scenery and great company. We prepared a complete list of plant species encountered, although no rare species were found. We are looking forward to more field work in the White River National Forest in 2006.

Survey of Critical Biological Resources in Grand County
Denise Culver and Jennifer Jones

Jennifer Jones and CNHP volunteers Rich Scully and Mary Jane Howell keying out plants near Granby in Grand County.

CNHP has been systematically conducting county-based surveys for rare and imperiled species and significant plant communities since 1992. During the 2005 field season, we surveyed Grand County with support from a Great Outdoors Colorado Planning Grant and Grand County Department of Natural Resources. Grand County is a place of tremendous beauty and diverse recreational interests. The economy over the years has steadily changed from agriculture to tourism. In recognition of their valuable natural resources, Grand County is taking a proactive planning approach to ensure the protection and conservation of these exceptional natural resources for years to come.

The survey prioritized field efforts on rare, sensitive, and unique plants and plant communities. CNHP documented expansions of the known range for the federally listed Endangered plants Osterhout's milkvetch (*Astragalus osterhoutii*) and Penland's beardtongue (*Penstemon penlandii*), as well as other rare plants. Two county records resulted from the field surveys – dropleaf buckwheat (*Eriogonum exilifolium*), a globally imperiled plant, and three-tip sagebrush (*Artemisia tripartita*), previously not documented on the West Slope.

One of the most valuable outcomes of the project was the active involvement of the advisory council formed by CNHP as part of the project. The enthusiastic involvement of the council was a major factor in accessing private properties. The importance of community-based conservation cannot be overstated. Field surveys are the first step in the protection of biological resources. The advisory council will ensure that the data will be incorporated into ongoing, community-based open space planning. Project data provide the advisory council and Grand County with baseline information needed to make wise land use decisions, maximizing the consideration of biological diversity in the planning process.

Survey of Critical Wetland Resources in Grand County
Jennifer Jones and Denise Culver

CNHP conducted a survey of critical wetland resources in Grand County in conjunction with the Grand County Survey of Critical Biological Resources. With funds awarded by the Colorado Department of Natural Resources via a grant from the Environmental Protection Agency, and by the Bureau of Land Management and Colorado Division of Wildlife, over 90 wetlands and riparian areas were visited in 2005.


Second Creek, a tributary of the Fraser River in Grand County.

CNHP focused survey efforts on the Colorado River and its tributaries to document native riparian habitat condition. Preliminary results indicate that there are remaining stretches of the Colorado River that are in good condition. These sites will become instrumental in the County's Master Plan to guide development away from the most biologically significant riparian areas. Other wetland types documented include an extreme rich (high pH and conductivity) fen; the first documented on the West Slope, several intermediate (neutral pH) fens, and glacial kettle ponds.

Thirty-seven wetland and riparian sites of biodiversity significance are profiled in the report as Potential Conservation Areas (PCAs). These PCAs represent the best examples of the wetland and riparian communities observed on the private and public lands visited. Of the 37 PCAs, three are nearly irreplaceable in terms of biodiversity significance (B2) and 20 are of high biodiversity significance (B3). In addition, 24 wetland and riparian areas on BLM lands were surveyed for Proper Functioning Condition.

Survey of Critical Wetland Resources in Archuleta County
Karin Freeman, Maggie March, and Denise Culver

In cooperation with the Colorado Division of Wildlife (CDOW), CNHP conducted a survey of critical wetlands in Archuleta County. Protection of the San Juan River watershed is a priority for CDOW, Archuleta County, the Southwest Land Alliance, and CNHP due to the increasing pressures from rapid development, water diversions, and mineral extraction. The final product of this survey provides land managers with a proactive tool to guide development away from biologically sensitive wetlands. The

wetland survey compliments the *Upper San Juan Basin Biological Assessment*, completed by CNHP in 2003.

With the assistance of Archuleta County, the Southern Ute Indian Tribe, Natural Resources Conservation Service, Forest Service, and the Southwest Land Alliance, CNHP documented a 99% success rate in obtaining permission to access private lands. This success is a testament to the commitment of Archuleta County's residents to protect and conserve this valuable resource.

Within a fen on the San Juan National Forest, Karin Freeman tests water pH in a stand of cottongrass (*Eriophorum angustifolium*).

Thirty-six sites of biodiversity significance were documented. Of these, four are nearly irreplaceable in terms of biodiversity significance (B2) and 21 are of high biodiversity significance (B3). Highlights of the survey include the discovery of several intermediate fens, including a floating peat-mat fen, which supports a globally imperiled mud sedge (*Carex limosa*) community and a newly discovered population of the state-rare purple marshlocks (*Comarum palustre*). In addition, new populations of the state-rare knotsheath sedge (*Carex retrorsa*), and new occurrences of the globally imperiled narrowleaf cottonwood/bluestem willow riparian community (*Populus angustifolia/Salix irrorata*) were documented.

Survey of Critical Wetland Resources in Fremont County
Stephanie Neid

Playa wetland on Waugh Mountain State Trust Land in northwestern Fremont County.

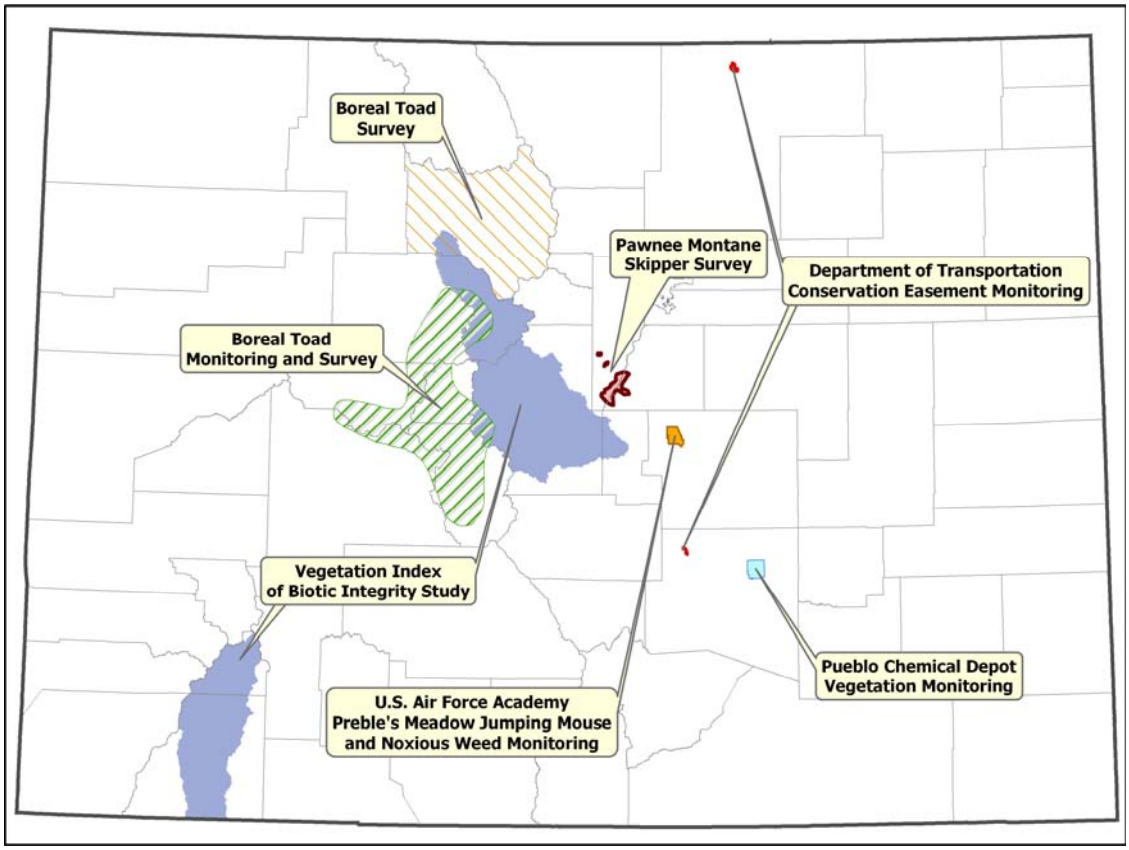
In 2004, CNHP was awarded funds from the Colorado Department of Natural Resources via a grant from the Environmental Protection Agency, Region 8, to survey critical wetlands and riparian areas in Fremont County, Colorado. With additional assistance from the Bureau of Land Management (BLM) and the Colorado Division of Wildlife, 80% of the targeted inventory areas were evaluated during the summer of 2005. In total, 27 new occurrences of globally

vulnerable or globally imperiled wetland natural communities were assessed. These occurrences span the wide range of elevation in Fremont County from plains, barrens, and foothills to montane, subalpine, and alpine zones. Twenty-one known natural community occurrences documented in the mid- to late 1990's were re-visited and re-assessed; several on BLM lands showed positive ecological improvements as a result of land management changes. One new rare wetland plant population, of the globally imperiled pale blue-eyed grass (*Sisyrinchium pallidum*) was discovered during the 2005 field season.

The final report will document 18 Potential Conservation Areas (PCAs) that highlight biologically sensitive wetlands. These PCAs can guide planning efforts and identify unique areas of wetland biodiversity within Fremont County.

Beaver Creek State Wildlife Area in northeastern Fremont County.

Monitoring and Research



U.S. Air Force Academy Noxious Weed Monitoring
David G. Anderson

In 2002, CNHP botanists mapped the distribution of 14 species of noxious weeds at the U.S. Air Force Academy (USAFA) and the Farish Outdoor Recreation Area in El Paso County. A total of 3,936 occurrences of weeds were mapped in this project throughout approximately 19,000 acres within the two areas. This extensive dataset has great utility for the management of the targeted species. In 2003 and 2004, USAFA developed a management plan for noxious weeds, which included a monitoring component to measure the effectiveness of weed management activities.

In 2005, CNHP established monitoring plots at the USAFA in infestations of 13 species of noxious weeds. The targeted species are those most in need of weed management actions due to their status as noxious weeds in Colorado, invasiveness, distribution, potential to negatively impact natural resources, and potential to require costly future management actions.

A 50 meter transect with a $1m^2$ quadrat frame in an infestation of hoary cress (*Cardaria draba*) along Monument Creek. This transect was established in 2005 at the USAFA.

A combination of quadrats, belt transects, photoplots, and photopoints were used to establish baseline conditions in 2005. These plots will be resampled in 2006 and 2007. Data from these plots will have practical benefits to the management of noxious weeds at the USAFA. Inferences will be possible regarding the effects of management practices and annual climatic variation on the population trends of noxious weed species at the USAFA.

Boreal Toad Monitoring and Survey
Brad Lambert, Chris Gaughan, and Georgia Doyle

CNHP formed a partnership with the Colorado Division of Wildlife (CDOW) in 1999 to monitor known breeding sites and to survey locations throughout Colorado for new populations of the state endangered boreal toad (*Bufo boreas*). The data collected have been used by the Boreal Toad Recovery Team to assess the status of the boreal toad in Colorado, and by the U.S. Fish and Wildlife Service to assess the status for potential federal listing as an endangered species. CNHP has continued this work yearly through 2005 and expects to continue this project through 2008.

In 2005, CNHP monitored 22 known breeding sites in Chaffee, Eagle, Pitkin and Summit counties. In addition, 108 sites throughout Colorado were surveyed for boreal toads. No new breeding sites were located, but new non-breeding sites were located on Snowmass Creek in Pitkin County and Williams Fork in Grand County.

CNHP also continued a mark-recapture study in the Cottonwood Creek drainage in Chaffee County. The study was set up in 1999 to look at demographic variables in a large metapopulation of boreal toads. A total of 1,250 toads were tagged between 1999 and 2005, including the 88 new toads tagged in 2005. Of the previously tagged toads, 201 were recaptured in 2005. CNHP is currently analyzing these mark-recapture data to increase understanding of estimated population size, site fidelity, and movement between breeding sites. We are collaborating with researchers from the USGS to publish a paper on site fidelity in male toads in an upcoming issue of *Ecology*.

Northern Leopard Frog Statewide Status Assessment
Brad Lambert

In 2005, CNHP received funding through the Colorado Wildlife Conservation Grant Program, administered by the Colorado Division of Wildlife, to compile a statewide status report on the northern leopard frog (*Rana pipiens*) and to conduct surveys for this rare frog in Grand County. In Colorado, the northern leopard frog is listed as a species of special concern by the CDOW and is a CNHP watchlisted species.


Northern leopard frog at Muddy Creek near Kremmling.

Targeted surveys were conducted in Grand County for the northern leopard frog in the summer of 2005. Northern leopard frogs were only found at several historical locations around the Kremmling area. It appears that outside the Kremmling area the leopard frog is rare, even though there is an abundance of suitable habitat in Grand County.

At present, CNHP is compiling northern leopard frog data from various agencies around the state to input into a point observation database. CNHP will use the data to produce a baseline statewide assessment of the northern leopard frog. This assessment will include an examination of current and historic distributions in the state and available trend data. A large component of this assessment will be identifying data gaps for future inventory efforts. A statewide assessment for the northern leopard frog is needed as a planning and management tool for the CDOW and other state and federal agencies in Colorado.

Pawnee Montane Skipper Post-fire Habitat Assessment Survey
John Sovell

The Hayman and Schoonover forest fires burned across a large amount of Pawnee montane skipper butterfly (*Hesperia leonardus montana*) habitat during the summer of 2002. The U.S. Forest Service, the U.S. Fish and Wildlife Service, and Denver Water funded a three-year post-fire monitoring study, expanded to a fourth year in 2005, within the range of this federally listed Threatened species. The purpose of the monitoring was to estimate the fire's effect on skipper occupancy rates in burned habitat.

Understanding occupancy rates of the Pawnee montane skipper butterfly and their recolonization of the Hayman Fire area is important to understanding the conservation status of this butterfly. Monitoring shows that unburned plots support significantly more Pawnee skippers and that populations on low severity burn areas are recovering. In 2005,

A burned landscape within the north-central portion of the Hayman Fire area. Photo taken summer 2005.

skippers were observed on one moderate-to-high severity burn plot and it appears that fire-induced changes to the landscape are slowing Pawnee montane skipper reoccupation of these plots. Lack of response by *Hesperia* skippers on intensely burned areas appears not to be due to loss of host and nectar plant populations, as these plants have recovered significantly over all burn conditions since the fires. It is more likely that the reduction of live tree counts to near zero on moderate-to-high severity burn areas creates habitat unsuitable for *Hesperia* skippers. Whether fire has created unsuitable habitat, or reoccupation occurs at a temporal scale longer than current monitoring, could be determined through further monitoring.

Preble's Meadow Jumping Mouse Populations at the U.S. Air Force Academy
Rob Schorr, Bobby Weidmann, and Katie Neuhaus

CNHP has been working with the U.S. Air Force Academy (USAFA) since 1997 to understand the distribution, movement patterns, and population parameters of Preble's meadow jumping mice (PMJM). Currently in its 8th year, this long-term study has provided invaluable estimates of PMJM movement, survival, and abundance. Over the course of this project we have determined that PMJM move much further along riparian corridors than previous telemetry studies suggested. The mark-recapture efforts have found that individuals will move up to 3 miles along Monument Creek. Additionally, we have found that population abundance (mice/kilometer of stream) has been stable for the past couple of years (approximately 22 – 26 mice/kilometer).

Monument Creek at the USAFA.

CNHP zoologists trapped four sets of transects along Monument Creek twice during the 2005 season. Trapping events took place over five nights in early June and again in early September. In early June there were 113 captures of 37 PMJM, and in September there were 65 captures of 35 PMJM.

For the first time in eight years of trapping, a new species was captured along Monument Creek. Two olive-sided pocket mice (*Perognathus fasciatus*) were trapped within the sandy washes of the Monument Creek drainage. This is likely the subspecies of olive-sided pocket mouse that is found from the Wyoming border south to central Colorado.

Vegetation Index of Biotic Integrity for Colorado Wetlands: Phase 1
Joe Rocchio


High Creek Fen, South Park.

The U.S. Environmental Protection Agency and Colorado Division of Wildlife provided CNHP with funds for a multi-year project to develop a Vegetation Index of Biotic Integrity (VIBI) for Colorado wetlands in the Southern Rocky Mountains ecoregion. The project will develop a bioassessment monitoring tool by sampling various attributes of wetland vegetation across a human-induced disturbance gradient (e.g., pristine to heavily disturbed). Attributes that show a predictable response to increasing human disturbance are chosen as metrics to be incorporated into the VIBI. The VIBI value can be used for 1) monitoring and evaluating wetland protection, restoration, enhancement, and creation projects; 2) monitoring and evaluating the effectiveness of wetland management practices; 3) prioritizing wetland restoration and protection projects; and 4) identifying reference conditions for specific wetland types.

During the summer of 2004, 35 wetlands were sampled in Park and Summit counties. Presence/absence and cover were recorded for all plant species in 20 x 50 meter relevé-type plot. The level of disturbance was rated according to multiple categorical ranking forms. Data analysis is ongoing and the first iteration of the VIBI model will be completed in Spring 2006. Additional plot data will be collected in 2006 resulting in a second iteration of the VIBI model. During 2007, the VIBI model will be validated on an independent dataset and tested for geographic variability.

Colorado Floristic Quality Assessment
Joe Rocchio

The U.S. Environmental Protection Agency provided funding for development of a Floristic Quality Assessment (FQA) for Colorado. A FQA is a vegetative community index designed to assess the degree of "naturalness" of an area based on the presence of conservative plant species. Conservative plants are those that show strong affinity to

high-quality natural areas (areas representing "pre-settlement conditions"). The FQA index represents the amount of conservative plants remaining in an ecological community, and thus is reflective of the amount of human-induced disturbance impacting a site. The index is developed by assigning each plant species that occurs in Colorado a coefficient representing its conservatism ranging from 0 (not conservative) to 10 (highly conservative). This is accomplished through a panel of experts who are most familiar with the Colorado flora. This panel, the Colorado Floristic Quality Assessment Panel, is currently assigning each plant a coefficient. The Panel is expected to complete this process in the spring of 2006, at which point the FQA Database will be made available to the public.


Yellow lady's slipper (*Cypripedium parviflorum*), a state imperiled orchid, has a coefficient of conservatism of 9.

The FQA can be used for a variety of applications such as:

- Setting priorities for conservation, management, and acquisition actions;
- Facilitating comparison of quality between sites;
- Long-term monitoring of natural areas;
- Monitoring management and/or restoration activities of natural areas; and
- Wetland mitigation monitoring/performance criteria.

Ecological Integrity Scorecards and EPA Performance Measures for Wetland Mitigation

Joe Rocchio in partnership with NatureServe


Riparian Shrubland, Middle Fork Swan River, Summit County.

With funding from NatureServe and the U.S. Environmental Protection Agency, CNHP and NatureServe developed Ecological Integrity Scorecards (Scorecards) for Southern Rocky Mountain wetland types. Scorecards are a multi-metric index used in assessment of ecological condition. Practical and ecologically meaningful biotic and abiotic metrics are selected to measure the integrity of key ecological attributes found in a wetland type. These indicators are rated according to their deviation

from their natural range of variability. The ratings are then aggregated into an overall score or rating for four major ecological categories: (1) Landscape Context; (2) Biotic Condition; (3) Abiotic Condition; and (4) Size. These scores or ratings can then be used to track changes or trajectory toward management goals and objectives.

The Scorecards provide an assessment tool that currently does not exist for Colorado. Their framework is designed to help set performance standards and assess ecological integrity for wetland mitigation, as well as a variety of other monitoring applications such as:

- Setting priorities for conservation, management, and acquisition actions;
- Facilitating comparison of integrity between sites;
- Long-term monitoring of ecological integrity of natural areas;
- Monitoring management and/or restoration activities effect on ecological integrity; and
- Wetland mitigation monitoring/performance criteria.

CNHP is currently seeking funding to calibrate and validate the Scorecards against an independent measure of ecological integrity.

Department of Transportation Conservation Easement Monitoring
Jill Handwerk, Georgia Doyle, and Renée Rondeau


Georgia Doyle estimating vegetation height using the Robel pole visual obstruction method.

Monitoring was conducted at two recently established conservation easements in eastern Colorado. The easements are held by The Nature Conservancy and were funded by the Colorado Department of Transportation as part of CDOT's Shortgrass Prairie Initiative. The easements were established to protect rare plants growing on chalk barrens along the Arkansas River (a private ranch in Pueblo County) and McCown's Longspur, a shortgrass prairie endemic bird (a private ranch in Weld County). The purpose of the monitoring was to document baseline conditions at the easements and provide a method to assess their long-term viability.

At the ranch in Pueblo County, photo monitoring points were established for the three rare plant species, round-leaf four-o'clock (*Oxybaphus rotundifolius*), Pueblo goldenweed (*Oonopsis puebloensis*), and Barneby's feverfew (*Bolophyta tetraneuris*). Additionally, the viability of the occurrences was assessed qualitatively. Desirable nesting habitat for McCown's Longspur is shortgrass prairie with very short vegetation

and a high percentage of bare ground. Therefore, the monitoring in Weld County included microplot measurements to estimate the percentage of bare ground and a visual obstruction method to measure vegetation height. Additionally, photo monitoring points were established at multiple locations. Annual monitoring within the easements will allow variation over time to be documented and will be used be to help guide land management decisions.

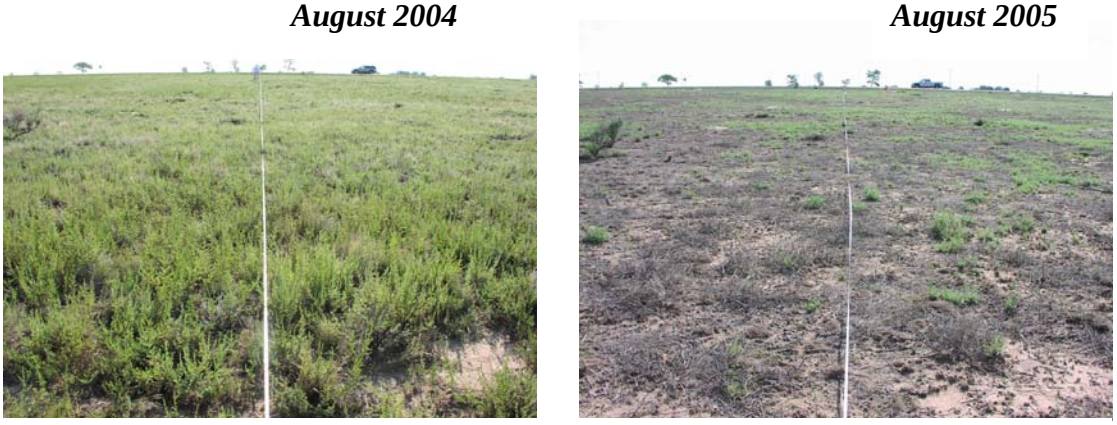
Monitoring Vegetation at Pueblo Chemical Depot: 1998-2005
Renée Rondeau

A unique situation at Pueblo Chemical Depot (PCD) has allowed CNHP to study the differences between areas that haven't been grazed by cattle since the 1940's and those areas that have been continuously grazed by cattle up until 1998.

In addition to observing the differences between these two treatments, we also set up permanent monitoring plots to assess how rapidly or slowly the prairie responds to the cessation of all cattle grazing on the areas that were grazed up until 1998. Over 40 permanent plots were sampled for changes in vegetation.

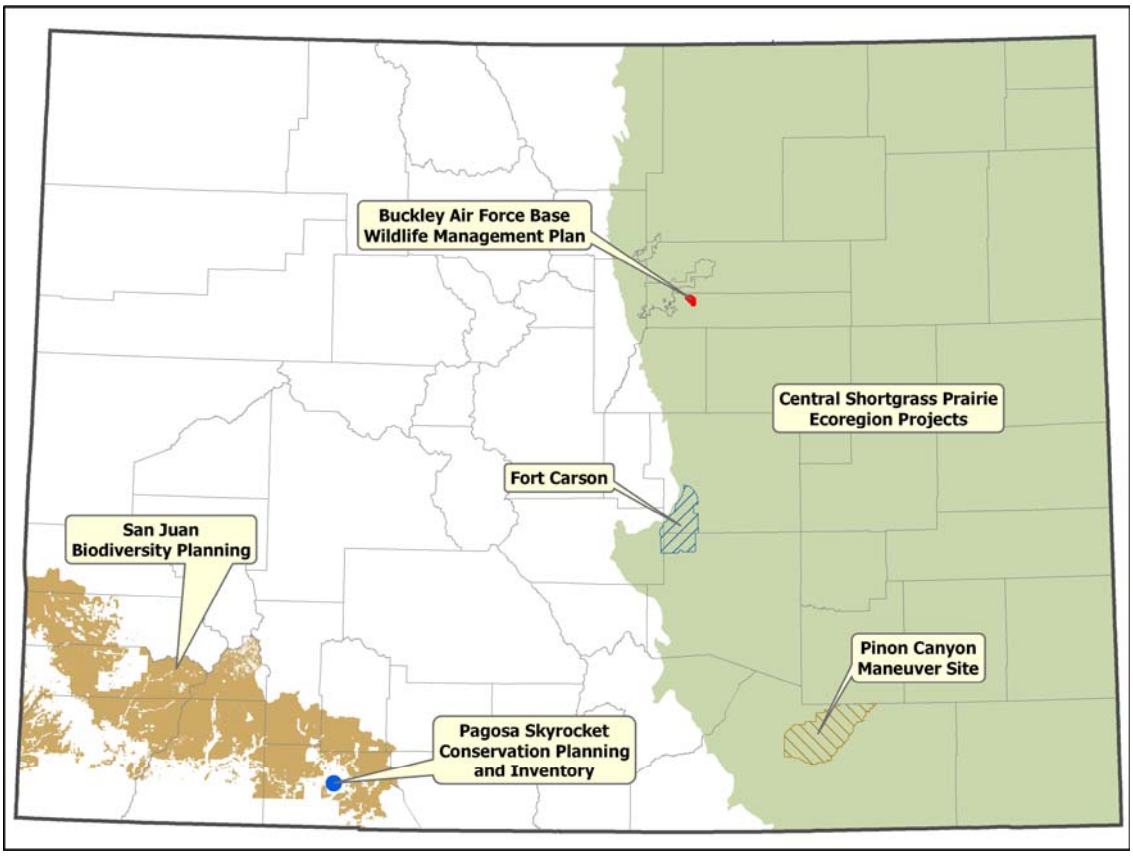
Differences in vegetation and the amount of bare ground have been documented for the shortgrass prairie, sandsage prairie, and greasewood shrublands within PCD. Eight years of monitoring permanent plots has given us new insight into how the biotic community changes with the removal of cattle grazing. This study occurred over the worst recorded drought and has added additional insight into the effects of drought. Up until 2004, weeds were always a minor component of all vegetation types, but in 2004 weeds filled in the patches of bare ground that were left after a major blue grama dieback. Ungrazed areas had an average of 60% more weeds than the previously grazed areas. In 2005 the weeds were mostly nonexistent. We believe that spring rain coupled with a lot of bare ground is a perfect recipe for annual weed invasion in this area.

August 2004 ***August 2005***



Shortgrass prairie plot showing drought-induced weed infestation and blue grama dieback.

Conservation Planning



Central Shortgrass Prairie Ecoregional Assessment
Renée Rondeau, Lee Grunau, David G. Anderson, John Sovell, Melissa Landon, Amy Lavender, Karin Decker, Michelle Fink and Chris Gaughan

CNHP is assisting The Nature Conservancy (TNC), the U.S. Department of Defense, and numerous other partners, in updating TNC's 1998 Central Shortgrass Prairie (CSP) Ecoregional Assessment. The CSP ecoregion covers portions of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, Texas, and Wyoming. CNHP's biology and planning staff are participating on an interdisciplinary planning team, and providing assistance with ecological analyses, identifying priority areas, developing a monitoring framework, and collecting data to catalyze conservation action and mitigate impacts to biodiversity in the Central Shortgrass Prairie. Work is largely complete on coordinating data exchanges with the other Natural Heritage Programs in the CSP, identifying species and developing ecological systems that will provide the focus for conservation strategies, and development of viability guidelines and conservation goals. Work in 2006 will focus on developing a portfolio of conservation sites and species management templates. The final assessment is scheduled for completion in the fall of 2006.

Black-tailed Prairie Dog Complex Modeling
Chris Gaughan, Michelle Fink, and Renée Rondeau


Black-tailed prairie dog.

CNHP and The Nature Conservancy, with funding from the Colorado Division of Wildlife, developed a model of black-tailed prairie dog (*Cynomys ludovicianus*) complexes for the Central Shortgrass Prairie (CSP) planning process. Data incorporated into the model included line transects from existing aerial surveys and polygons from field surveys. The model is based on the concept of landscape permeability, which models the relative ease with which an individual animal can travel through the landscape. Different components of the landscape, in this case land cover and degree of slope, were scored on a scale of relative permeability based on expert opinion and then combined to produce an overall permeability surface.

Prairie dog colonies function on their own, but to achieve the functionality of a complex they must meet a different ecological standard. Appropriate size and connectivity of colonies to support associated species are major factors. CNHP used the permeability layer to group colonies that have a high probability of functioning together as complexes. The estimated acreage of colonies within a complex was then added to rank the ecological importance of the complex. By this method nearly 30 important areas in the CSP are highlighted as having viable prairie dog complexes. Data from associated species such as mountain plover (*Charadrius montanus*) and burrowing owl (*Athene cunicularia*) can now be used to both verify model results and further refine where the complexes are functioning. This model may also direct the reintroduction of extirpated species such as the black-footed ferret (*Mustela nigripes*).

An Aquatics Classification of the Headwaters of the Platte, Republican, Arkansas, and Canadian Drainages
Michelle Fink, Renée Rondeau, and Lee Grunau

As part of a national assessment of freshwater aquatic systems, The Nature Conservancy and CNHP are collaborating on development of a classification of freshwater ecological systems from the eastern slope headwaters of the Rocky Mountains and into the central plains. This classification will help focus and establish conservation priorities that will ensure adequate protection of aquatic systems in the Southern Rocky Mountains, the Central Shortgrass Prairie, and surrounding ecoregions. The classification will document the distribution, natural variation, and relationships of freshwater systems. The resulting

classification will be used as a coarse filter for the conservation of the species, communities, and habitats that make up aquatic biodiversity in the area.

As a part of this project, the collaborators are working with Dave Theobald and colleagues at Colorado State University's Natural Resource Ecology Laboratory to refine and apply their FLoWs (Functional Linkage of Watersheds and Streams) tools to a project of this magnitude. The project is currently ongoing and should be completed by early 2006.

Pagosa Skyrocket Conservation Planning and Inventory
Peggy Lyon, Julia Hanson, and David G. Anderson


Julia Hanson collecting seed from Pagosa skyrocket.

Following a determination by the Colorado Rare Plant Technical Committee that the Pagosa skyrocket (*Ipomopsis polyantha*) was the species that most needed conservation action, CNHP, together with the U.S. Fish and Wildlife Service (USFWS) and The Nature Conservancy, organized a local working group in Pagosa Springs to plan strategies for protecting the species. Funding for this project was provided by the USFWS. Members of the group included representatives from the U.S. Forest Service, Bureau of Land Management, Pagosa Springs Parks Department, Archuleta County Roads, Colorado Department of Transportation, Colorado Native Plant Society, Pagosa Garden Club, CSU Extension Service, USFWS, Southern Ute Tribe, La Plata Electric and local botanists. The group planned and carried out an inventory of the species in June and began experimental transplanting of threatened individuals to safe sites. Results included the location of the first known occurrences of Pagosa skyrocket on public lands, and the discovery of one very large population on private land that is available as a seed source. More inventory and planning work is planned for 2005 and 2006.

San Juan Biodiversity Planning
Peggy Lyon, Renée Rondeau, and Karin Decker

CNHP contracted with The Nature Conservancy (TNC) to provide technical information to the Bureau of Land Management San Juan Resource Area that will help them in the revision of their management plan. The project established a conservation assessment of

the planning area based primarily on information and analyses from TNC and CNHP. The report highlights the relative value of biological resources within the planning area from a regional context perspective. The project also serves as a model for the types of information that could be provided for other planning efforts. TNC subcontracted with CNHP to provide technical expertise and updated information on ecological systems, communities, and species. Working closely with TNC personnel, we prepared a list of targeted species, and wrote descriptions of ecological systems and species with emphasis on their occurrence in the San Juan Resource Area Public Lands. This project is now beginning its second phase in 2006.

Front Range EcoRegional Partnership Project
Fagan Johnson, Melissa Landon, and Susan Spackman Panjabi

There are eight Department of Defense (DOD) installations along the Front Range in Colorado (Fort Carson, Headquarters Air Force Space Command, Cheyenne Mountain Air Station, U.S. Air Force Academy, Peterson Air Force Base, Schriever Air Force Base, Buckley Air Force Base) and Wyoming (Francis E. Warren Air Force Base). In 2001, these DOD installations partnered with the U.S. Fish and Wildlife Service (USFWS) to form the Front Range EcoRegional Partnership.

CNHP is working on a 1-year project with the Front Range EcoRegional Partnership to: 1) develop an Invasive Species Strategic Plan in coordination with the Front Range DOD installations, counties, and states; and 2) develop and host an EcoRegional Partnership webpage in coordination with Front Range installations and the USFWS.

Ecological Monitoring Program Assessment for Fort Carson and Pinon Canyon Maneuver Site
Lee Grunau, Stephanie Neid, and Renée Rondeau

Fort Carson and Pinon Canyon Maneuver Site, two large U.S. Army installations situated on the eastern plains of Colorado, harbor a wealth of significant biological resources. These installations represent some of the largest contiguous examples of prairie ecosystems remaining in the Central Shortgrass Prairie ecoregion. These installations support occurrences of a number of species of conservation concern, including black-tailed prairie dogs, Mountain Plover, Burrowing Owl, Mexican Spotted Owl, and several critically imperiled rare plants.

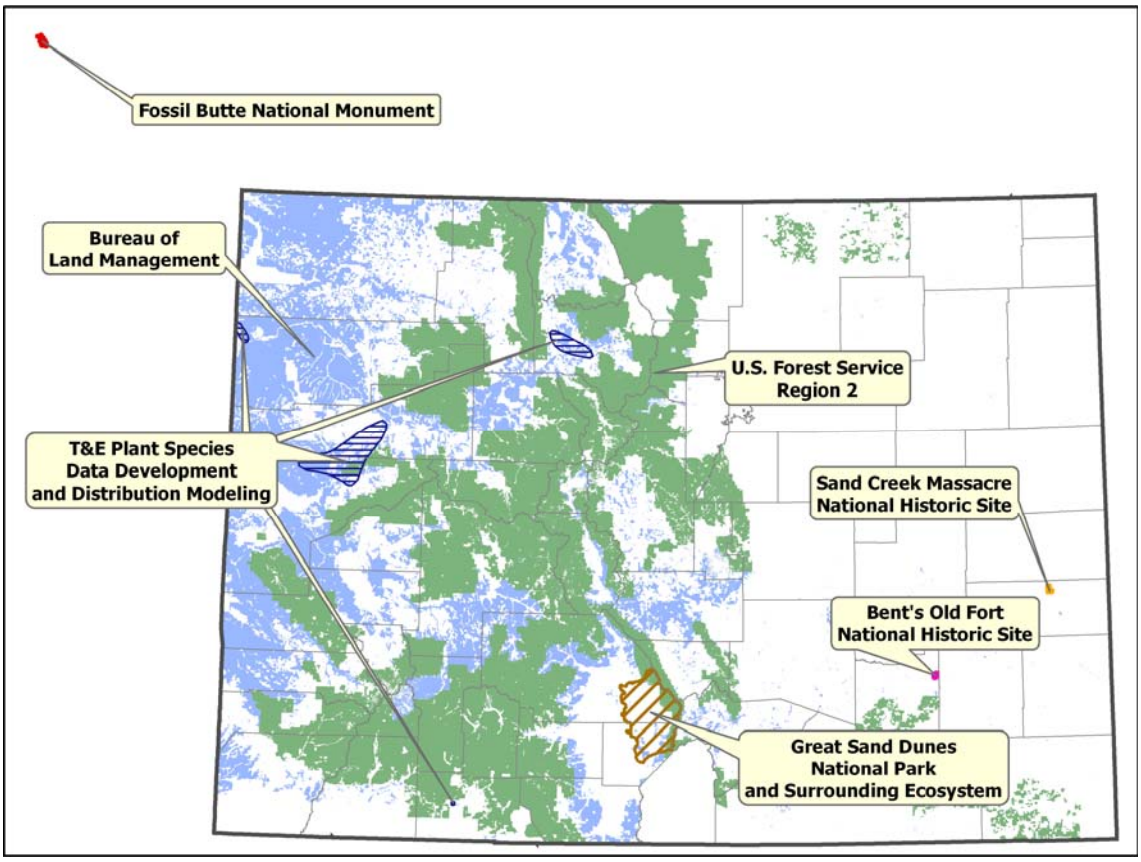
Existing ecological monitoring programs for Fort Carson and Pinon Canon Maneuver Site are currently split between two different departments. Overlapping responsibilities and conflicting goals make integration of these disparate programs difficult, and the functioning of the ecological monitoring programs is not as effective as it might be. The U.S. Fish and Wildlife Service and the Department of the Army are coordinating with CNHP to conduct an analysis of existing programs, and develop a coordinated and cohesive approach to integrated ecological monitoring for Fort Carson and the Pinon

Canyon Maneuver Site. CNHP will provide strategic guidance on how to design an ecological monitoring and management approach that will most effectively conserve the significant biological resources on these installations. The assessment is scheduled for completion June 2006.

Buckley Air Force Base Wildlife Management Plan
Lee Grunau and Rob Schorr

CNHP is coordinating with Buckley Air Force Base (AFB), the U.S. Fish and Wildlife Service (USFWS), and the Colorado Division of Wildlife (CDOW), to prepare a Wildlife Management Plan for Buckley. Project goals include development of management strategies that are based on a holistic ecosystem approach, enhance Buckley's role in ecosystem function at local and regional levels, contribute to conservation of wildlife resources within the constraints of the military mission, and minimize risk to human health and flight safety from wildlife. Significant planning issues include Bird Aircraft Strike Hazard (BASH), management of black-tailed prairie dogs and Burrowing Owls (especially within the flight zone), protection of migratory birds, and future development plans within and around the Base. CNHP has proposed management practices that balance the need for reduction of significant risks relative to BASH, with the need for species conservation in the context of encroaching urban development. The draft Wildlife Management Plan has been submitted to Buckley AFB for review. The final plan is scheduled for completion in 2006.

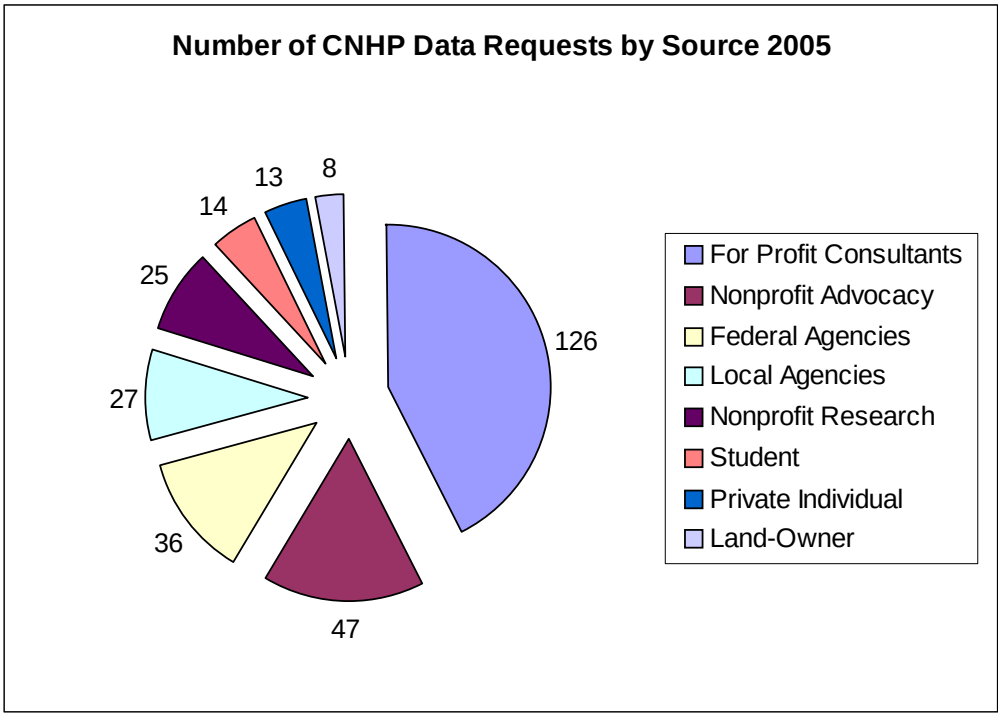
Vegetation Classification, Heritage Methodology, and Data Exchange



CNHP Data Distribution and Environmental Review Projects
Michael Menefee

CNHP maintains the most comprehensive spatial database of element occurrence locations for sensitive species and natural communities for the state of Colorado. CNHP also maintains an extensive library of publications available for distribution, with subjects ranging from county biological inventories to rare plant field guides. For a nominal fee, CNHP will conduct a spatial search of our Biodiversity Tracking and Conservation System (BIOTICS) database for documented records of rare species, natural communities and critical conservation sites near or in a given project site. CNHP furnishes our clients with life history and habitat information for all tracked species and communities, as well as their legal protection status with various federal and state agencies. CNHP also supplies conservation site reports, custom mapping, spatial data and supporting tabular data for a wide variety of environmental review projects each year. Our information serves as a vital resource for a variety of planning, natural science, and information technology professionals.

During 2005, CNHP handled about 300 data requests for a variety of projects in both the public and private sector. For example, CNHP provided critical data for a number of species assessments completed by federal and state agencies. In terms of total requests, for-profit consultants make up nearly half of all data requests (see chart), with governmental, advocacy and research requests making up the next largest sources for data inquiries.



Ecological Systems Viability Specifications for Colorado
Karin Decker and Renée Rondeau

Ecological systems are dynamic assemblages or complexes of plant and/or animal communities that 1) occur together on the landscape; 2) are tied together by similar ecological processes, underlying abiotic environmental factors, or gradients; and 3) form a readily identifiable unit on the ground. The ecological system is a practical analysis tool for both land managers and conservation professionals working at landscape scales. Viability specifications are useful for ranking relative health and quality of ecological systems and their constituent plant associations. Specifications are developed for each system that describe the size, condition, and landscape context that are necessary for the system to remain viable (i.e., persist for many years). The ranking process facilitates the identification of the best examples of each system.

With funding from a variety of partners (Bureau of Land Management, The Nature Conservancy, U.S. Forest Service, and others), CNHP was able to develop “field guide” versions of viability specifications for 38 ecological systems of Colorado, and make them

available on our website (http://www.cnhp.colostate.edu/projects/eco_systems/eco_systems.html). These specifications are applicable to occurrences of these systems throughout Colorado and will be used in identifying conservation targets for the ecoregion, as well as in the evaluation of Potential Conservation Areas.

U.S. Forest Service Region 2 Technical Conservation Assessments
David G. Anderson, Karin Decker, Susan Spackman Panjabi, Stephanie Neid, and Joe Rocchio


Pagosa bladderpod (*Lesquerella pruinosa*), a species for which a USFS assessment was prepared during 2005.

Between 2002 and 2005, CNHP botanists completed drafts of 42 technical conservation assessments for the Region 2 Forest Service Species Conservation Project. Writing each of these assessments involved a rigorous compilation of the existing knowledge for each species, which had not been done for most of these species prior to this project. The assessments are peer reviewed and published on the web at http://www.fs.fed.us/r2/projects/scp/index.shtml. This project has been an unprecedented opportunity to amass information on the targeted species, and has contributed greatly to our understanding of their distribution, abundance, habitat, rarity, threats, and research priorities. As a result, we changed conservation status ranks for several species including *Festuca hallii* (SH changed to S1), *Botrychium echo* (S2 to S3), *B. simplex* (S2 to S3), and *Thelypodiopsis juniperorum* (G1 to G2). Numerous new element occurrences have also been identified by our searches of herbaria and conversations with experts.

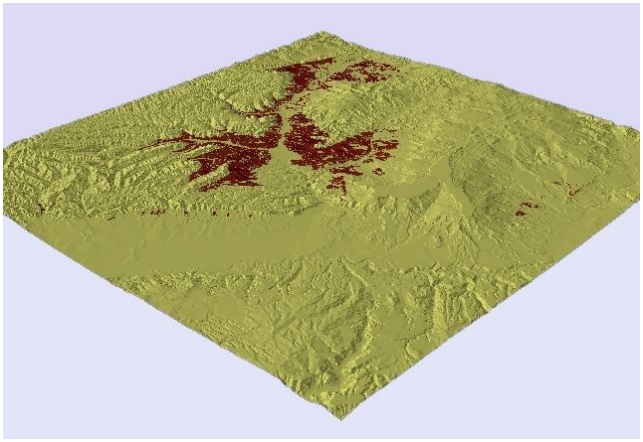
Twenty technical conservation assessments authored by CNHP are complete and available on the USFS website. By September 2006, CNHP will revise the remaining 22 draft assessments, making CNHP the single greatest contributor of species assessments in Region 2.

With the Wyoming Natural Diversity Database, CNHP is now involved in a pilot project to update technical conservation assessments. In this project we will develop a method for compiling additional information that has become available into addenda. In this way, the technical conservation assessments may continue to remain the most up-to-date source of information for the targeted species. It is hoped that this project will continue so that a subset of the published assessments can be updated each year.

Threatened and Endangered Plant Species Data Development and Element Distribution Modeling
Jill Handwerk, David G. Anderson, Amy Lavender, Karin Decker, and Peggy Lyon

CNHP, the Colorado Natural Areas Program (CNAP), and the U.S. Fish and Wildlife Service (USFWS) initiated a partnership in 2003 to manage biological and conservation data on federally listed Threatened, Endangered, and Candidate vascular plant species occurring in Colorado. In 2005, element occurrence data for five species (*Astragalus debequaeus, Astragalus osterhoutii* (listed Endangered); *Ipomopsis polyantha* (petitioned for listing), *Penstemon debilis* (candidate for listing), and *Penstemon grahamii* (candidate for listing)) were updated.

Element distribution models were generated for Debeque phacelia (*Phacelia submutica*) (a candidate for federal listing) and Debeque milkvetch (*Astragalus debequaeus*). Element Distribution Modeling is a process that uses a sample of known locations or element occurrences to build a model (estimate) of suitable environmental conditions (and, by implication, unsuitable conditions), and map that model across a study area.


Modeled potential distribution of Debeque phacelia.

Potential distribution maps were generated for both species using two different modeling approaches. Modeling indicated that there is a substantial amount of potential habitat for both species in Garfield, Mesa, and Delta counties beyond the currently known distribution. These models should now be tested by field surveys.

The data assimilated in this project were provided to the USFWS and CNAP. Additional USFWS Section 6 funding has been secured for a third year of this project. A complete dataset is required for use in models predicting species distribution, and to enable the monitoring of species population stability. The development of these data supports the management and conservation of these species by integrating all element occurrence data into a single comprehensive source.

Conservation Status Updates and Community Characterization Abstracts
Jill Handwerk, Stephanie Neid, and Georgia Doyle

NatureServe contracted with CNHP to update element global ranking forms for 16 imperiled (G1 and G2) plant species and to write global community characterization abstracts for 40 natural communities. These efforts help further the understanding of the

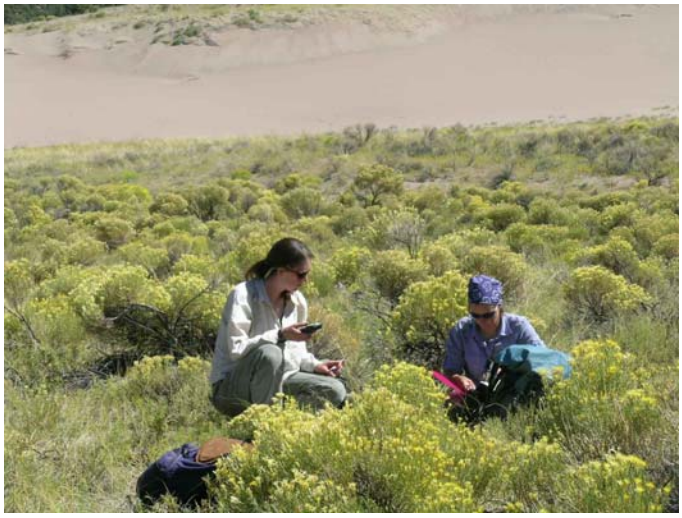
rarity and distribution of significant elements of biodiversity significance. The review of global ranks for the 16 imperiled plants, many of which are federally listed as Threatened and Endangered, showed that the status of the plants has not changed, that they are still globally imperiled. The descriptions of the 40 natural communities were written to comply with the national data standard for natural community classification.

Vegetation Classification and Mapping of Great Sand Dunes National Park and Preserve

Joe Stevens, Jodie Bell, and Katie Neuhaus

In September 2004, the Great Sand Dunes National Park and Preserve was created from the former Great Sand Dunes National Monument, and was expanded from about 39,000 acres protecting primarily the dune field to about 150,000 acres protecting the watershed crucial to the dune field. The new Park boundary includes alpine tundra and lakes, montane forests, meadows and creeks, foothill woodlands of pinyon pine, high desert shrublands, and vast areas of closed basin wetlands.

This project, funded by the National Park Service, is a multi-year effort to classify and map the vegetation of the new Great Sand Dunes National Park and Preserve and its surrounding ecosystem. The project area boundary encompasses 413,000 acres and was drawn from an ecological planning perspective.



CNHP field crew sampling rabbitbrush community on stabilized dunes near Medano Creek at the Great Sand Dunes National Park.

The mapping program uses the U.S. National Vegetation Classification (USNVC), which provides a uniform system of defining plant communities across the United States. Identification and description of the plant associations allows Park management and biological conservation efforts to be targeted more precisely and will contribute to the further development of the USNVC.

In 2005, CNHP collected the initial plot data that will be used to produce the classification and inform the photo-interpretation process used to create the map. Field crews collected 369 full plots and partial data from an additional 93 observation points. In 2006, field crews will collect additional plots needed to finalize the classification. Following field data collection, CNHP will use a variety of multivariate methods to analyze the plot data and assign them to new or existing plant associations. In the

summer of 2007, CNHP field crews will collect additional data for the accuracy assessment of the completed map. The final report is due in the spring of 2008. Partners on the project include the National Park Service, U.S. Fish and Wildlife Service, U.S. Forest Service, U.S. Bureau of Reclamation, U.S. Geological Service, The Nature Conservancy, NatureServe, Bureau of Land Management, and the Colorado State Board of Land Commissioners

Vegetation Classification and Mapping of Bent's Old Fort and Sand Creek Massacre National Historic Sites

Joe Stevens, Stephanie Neid, Georgia Doyle, Dina Clark, Jodie Bell, and Katie Neuhaus

Funded by the National Park Service, this one-year project is an effort to classify, describe, and map the vegetation of the Bent's Old Fort and Sand Creek Massacre National Historic Sites. It is part of a national program to gather baseline data for all national park units in order to meet specific information needs identified by each park unit.

Bent's Old Fort was first built in the 1830's on the banks of the Arkansas River as a trading post near what is now La Junta, CO. The Historic Site now occupies approximately 800 acres that have seen intensive human use since the early 1800's. The Sand Creek Massacre Historic Site was founded in 2005 to memorialize the events of November 29-30, 1864. This Historic Site currently occupies approximately 2400 acres of rolling plains of sand sage and shortgrass prairie traversed by the cottonwood gallery along Big Sandy Creek in Kiowa County.

Dina Clark in alkali sacaton (*Sporobolus airoides*) plot at the Sand Creek Massacre National Historic Site.

Data were collected from 24 plots at Bent's Old Fort and 31 plots at Sand Creek in late summer 2005 in order to classify the vegetation into plant associations. The vegetation classification, which will be produced using multivariate analysis in early 2006, will guide photo interpretation of aerial imagery to map the vegetation. Identification, characterization, and mapping of plant associations informs land management practices within these park units.

Preliminary Vegetation Classification for Fossil Butte National Monument
Karin Decker

In the fall of 2005 CNHP was contracted by engineering-environmental Management, Inc. (e^2M), to produce a preliminary vegetation classification for Fossil Butte National Monument in Wyoming as part of the National Park Service / U.S. Geological Survey National Vegetation Mapping Program. The mapping program uses the U.S. National Vegetation Classification Standard, which provides a uniform system of naming plant communities across the United States. This same standard is also used by CNHP, NatureServe, and other Natural Heritage Programs nationwide. CNHP and NatureServe staff analyzed data from 158 plots using a variety of multivariate methods, and assigned plots to new or existing plant associations based on the results of the analyses. Input from the classification will be used to guide the photo interpretation and mapping efforts for each park. This project is part of an ongoing effort to describe the plant associations of the Colorado Plateau region, where many types are not well documented or well described. Identification and characterization of these plant associations allows conservation efforts to be targeted more precisely.

National Park Service Databases
Chris Emmerich, Fagan Johnson, Simon Kingston, Melissa Landon, Alison Loar

ESA (Endangered Species Act) Database
CNHP is in the sixth year of an on-going partnership with the National Park Service (NPS) to maintain and enhance a nationwide ESA Database (formerly called the T&E or Threatened and Endangered species database). This project consists of two main tasks: 1) development and integration of several existing databases that contain information on the status and presence of T&E species in all NPS units; and 2) development of summary sheets describing the recovery plan requirements for listed T&E species.

Species of Management Concern (SOMC) and Invasive Animals (INVA) Databases
CNHP is in the second year of an on-going partnership with NPS to develop and maintain nationwide databases on Species of Management Concern (SOMC) and Invasive Animals (INVA) on NPS lands. This project consists of three main tasks: 1) develop two relational databases to house information on the presence, status, condition, source, and expenditures for SOMC and Invasive Animals by NPS unit; 2) continue to develop, update, maintain, and augment these two databases; and 3) provide support and training to NPS personnel towards utilizing the databases, summary sheets and related information more effectively.

NPSpecies Database
In 2005, CNHP began the first year of a new multi-year project in which CNHP assumed responsibility for an existing NPS biodiversity database system, NPSpecies, which stores, manages, and disseminates biological inventory and biodiversity information for all NPS units. This project encompasses five main tasks involving research, design, development, and implementation of: 1) tools to share biological inventory and biodiversity data in the

internet NPSpecies database; 2) a desktop NPSpecies application for data delivery to and from the internet NPSpecies application; 3) improvements to master reference datasets currently used in NPSpecies, including ITIS Taxonomic information, Parks information, Federal & State T&E Information, and NatureServe Rank Information; 4) tools to convert, manipulate, and upload data to the online NPSpecies database; and 5) tools and material to provide end-user training for NPSpecies.

Bureau of Land Management Data Processing and Statewide Dataset
Jodie Bell, Chris Gaughan, Jill Handwerk, Fagan Johnson, Melissa Landon, Amy Lavender, and Jeremy Siemers

In 2005, CNHP re-established a formalized partnership with Colorado BLM to manage biological and conservation data on Threatened, Endangered, and BLM Sensitive/Special Status Species, and other rare or imperiled species on BLM lands. BLM personnel and botanists across the state submit field inventory data to CNHP annually. Our scientists and information managers incorporate these raw data into CNHP's BIOTICS (Biodiversity Tracking and Conservation System) database. Element occurrences are digitized in GIS, and supporting data are uploaded into associated tabular databases. BIOTICS serves as BLM's primary database for species of conservation concern. We provide BLM personnel with a comprehensive dataset for all BLM, U.S. Forest Service, and National Park Service lands within Colorado once per year. This year's dataset includes a pre-packaged ArcGIS hyperlinked map document in which each Element Occurrence, Potential Conservation Area, and Network of Conservation Areas polygon is hyperlinked to its respective tabular report in PDF format. As part of this partnership, we will also provide data and expertise on revisions to the BLM Sensitive/Special Status Species list, comment on the potential impacts of BLM projects and management plans, and work with the BLM to continually improve data management and distribution methods and tools.

U.S. Forest Service Region 2 Data Processing and Statewide Dataset
Jodie Bell, Chris Gaughan, Jill Handwerk, Fagan Johnson, Melissa Landon, Amy Lavender, and Jeremy Siemers

CNHP is in the 13th year of an on-going partnership with Region 2 of the U.S. Forest Service (USFS) to manage biological and conservation data on Threatened, Endangered, Forest Service Sensitive, and other rare or imperiled species on USFS lands. Forest Service wildlife biologists and botanists across the state submit field inventory data to CNHP annually. Our scientists and information managers incorporate these raw data into CNHP's BIOTICS (Biodiversity Tracking and Conservation System) database. Element occurrences are digitized in GIS, and supporting data are uploaded into associated tabular databases. BIOTICS serves as the USFS's primary database for species of conservation concern. We provide each National Forest and Ranger District office with a comprehensive dataset for all USFS, Bureau of Land Management, and National Park Service lands within Colorado once per year. New this year, the dataset was provided as

a pre-packaged ArcGIS hyperlinked map document in which each Element Occurrence, Potential Conservation Area, and Network of Conservation Areas polygon is hyperlinked to its respective tabular report in PDF format. As part of this on-going partnership, we also provide data and expertise on revisions to the USFS Sensitive Species list, comment on the potential impacts of USFS projects and management plans, and work with the USFS to continually improve data management and distribution methods and tools.

General Support from The Nature Conservancy
Renée Rondeau

Natural Heritage Programs and Natural Heritage Methodology began in the office of The Nature Conservancy (TNC) in the 1970's. Development of the biological conservation database and its associated methodology was so successful that Natural Heritage Programs were established in every state. At first, all Natural Heritage Programs were part of TNC, but over time they realized that the best placement for these effective conservation programs was within state entities. Although the Colorado Natural Heritage Program has been part of Colorado State University since 1994, TNC has maintained close ties. The continuing support of The Nature Conservancy through our General Support agreement allows this conservation partnership to flourish. CNHP has been extremely active with TNC's ecoregional planning effort, measures of success, and local scale conservation planning. This year we are in the initial stages of providing the framework for a State of the State for Biodiversity. This biodiversity scorecard will be a living document that can measure the success of conservation action. As partners with TNC, we also assisted with the development of an aquatics classification (see Michelle Fink's abstract on aquatics classification for more detail).

Recent Journal Publications by Colorado Natural Heritage Program Staff

Gaughan, C.R. and S. DeStefano. 2005. Movement patterns of rural and suburban white-tailed deer in Massachusetts. *Urban Ecosystems* 8:189-200.

Muths, E, R.D. Scherer, P.S. Corn, and **B.A. Lambert**. 2006. Estimation of temporary emigration in male toads. *Ecology* (in press).

Neid, S.L. and D.D. Biesboer. 2005. Alleviation of salt-induced stress on seed emergence using soil additives in a greenhouse. *Plant and Soil* 268:303-307.

Siemers, J.L., **Y.R. Chen,** K.M. Canestorp, **J.R. Sovell**, and K.L. Cornelisse. 2006. Range expansion of the least shrew (*Cryptotis parva*) in Colorado. *Southwestern Naturalist* 51(2) (in press).

Taylor, H.L., **R.J. Rondeau**, and **J. Sovell.** 2006. Alternative ontogenetic pathways to Color Pattern Class B in a newly discovered population of parthenogenetic *Aspidoscelis neotesselata* (Squamata: Teiidae). *Herpetological Review* 37(1):40-44.

Colorado Natural Heritage Program
Documents and Reports Available on the Web
www.cnhp.colostate.edu

2006 Documents and Reports

Asclepias unicalis Greene (wheel milkweed): A Technical Conservation Assessment – Decker, K. (in progress)

Baca Grande Biological Assessment – Sovell, J.R. (in progress)

Botrychium simplex Hitchcock (least moonwort): A Technical Conservation Assessment – Anderson, D.G. (in progress)

Buckley Air Force Base Wildlife Management Plan – Grunau, L. and R. Schorr (in progress)

Calochortus flexuosus S. Watson (winding mariposa lily): A Technical Conservation Assessment – Spackman Panjabi, S. and D.G. Anderson (in progress)

Distributional Survey of Rare Small Mammals (Orders Insectivora, Chiroptera and Rodentia) in Colorado: Year Two – Siemers, J.L. (in progress)

Ecological Integrity Assessment and EPA Performance Measures for Wetland Mitigation – Faber-Langendoen, D., J. Rocchio, M. Schafale, C. Nordman, M. Pyne, J. Teague, T. Foti, and P. Comer

Environmental Analysis and Potential Conservation Strategies for Lowry Range – Grunau, L., R. Rondeau, and J. Sovell (in progress)

Epipactis gigantea Dougl. ex Hook. (stream orchid): A Technical Conservation Assessment – Rocchio, J., M. March, and D.G. Anderson (in progress)

Eriogonum brandegeei Rydb. (Brandegee's wild buckwheat): A Technical Conservation Assessment – Anderson, D.G. (in progress)

Eriogonum exilifolium Reveal (dropleaf buckwheat): A Technical Conservation Assessment – Anderson D.G.

Eriophorum gracile W. D. J. Koch (slender cottongrass): A Technical Conservation Assessment – Decker, K., D. Culver, and D.G. Anderson

Eriophorum chamissonis C.A. Mey. (Chamisso's cottongrass): A Technical Conservation Assessment – Decker, K., D. Culver, and D.G. Anderson

Grasshopper Monitoring on Pueblo Chemical Depot (2000-2003) – Sovell, J.R. (in progress)

Kobresia simpliciuscula (Wahlenberg) Mackenzie (simple kobresia): A Technical Conservation Assessment – Decker, K., Culver, D. and D.G. Anderson (in progress)

Lowry Range Biological Survey – Sovell, J., L. Grunau, M. Menefee, G. Doyle, and R. Rondeau

Noxious Weed Monitoring at the US Air Force Academy - Year 1 Results – Anderson, D.G. and A. Lavender (in progress)

Pawnee Montane Skipper Post-fire Habitat Assessment Survey – Sovell, J. and B. Drummond

Penstemon harringtonii Penland (Harrington's beardtongue): A Technical Conservation Assessment – Spackman Panjabi, S. and D.G. Anderson (in progress)

Potentilla ambigens Greene (silky leaf cinquefoil): A Technical Conservation Assessment – Anderson, D.G. (in progress)

Ranunculus karelinii Czern. (ice cold buttercup): A Technical Conservation Assessment – Spackman Panjabi, S. and D.G. Anderson (in progress)

Rare Plant Survey of San Juan Public Lands – Lyon, P. and J. Hanson (in progress)

Salix arizonica Dorn (Arizona willow): A Technical Conservation Assessment – Decker, K. (in progress)

Salix myrtillifolia Anderss. (blueberry willow): A Technical Conservation Assessment – Neid, S., K. Decker, D. Anderson (in progress)

Salix serissima (Bailey) Fern. (Autumn willow): A Technical Conservation Assessment – Decker, K. (in progress)

Survey of Critical Wetlands and Riparian Areas in Archuleta County – Freeman, K., M. March, and D. Culver (in progress)

Survey of Critical Wetlands and Riparian Areas in Fremont County, Colorado – Neid, S. (in progress)

Survey of Critical Biological Resources in Grand County – Culver, D. and J. Jones (in progress)

Utricularia minor L. (lesser bladderwort): A Technical Conservation Assessment – Neid, S. (in progress)

Vegetation Classification and Mapping of Bent's Old Fort National Historic Site – Neid, S., D. Clark, G. Doyle, and J. Stevens (in progress)

Vegetation Classification and Mapping of Sand Creek Massacre National Historic Site – Neid, S., D. Clark, and J. Stevens (in progress)

Vegetation Index of Biotic Integrity for Southern Rocky Mountain Fens, Wet Meadows, and Riparian Shrublands: Phase 1 – Rocchio, J. (in progress)

2005 Documents and Reports

Astragalus proximus (Rydberg) Wooton & Standley (Aztec milkvetch): A Technical Conservation Assessment – Decker, K.

Astragalus wetherillii Jones (Wetherill's milkvetch): A Technical Conservation Assessment – Decker, K.

Botanical Survey of Winter Park Resort, Arapaho National Forest, Grand County, Colorado – Anderson, D.G. and J.E. Handwerk

Botrychium multifidum (Gmel.) Rupr. (leathery grapefern): A Technical Conservation Assessment – Anderson, D.G.

Bureau of Land Management San Luis Valley Forest Fuel Reduction Monitoring Project – Stevens, J.

Colorado Natural Heritage Program 2004 Abstracts – Rondeau, R., et al.

Ecological Systems of Colorado (Website) – CNHP

Fraser Valley Parkway Boreal Toad Habitat Inventory – Gaughan, C. and L. Grunau

Ipomopsis globularis (Brand) W.A. Weber (Hoosier Pass ipomopsis): A Technical Conservation Assessment – Spackman Panjabi, S. and D.G. Anderson

Modeling the potential distribution of *Phacelia scopulina* var. *submutica* (Debeque phacelia) and *Astragalus debequaeus* (Debeque milkvetch) in western Colorado – Decker, K., A. Lavender, J. Handwerk, and D.G. Anderson.

NSF-NatureServe Internet Data Delivery Workshop (Website) – Johnson, F. and M. Landon

Pawnee Montane Skipper Post-fire Habitat Assessment Survey – CNHP

Resolving Conflicts Of Mountain Plovers (*Charadrius montanus*) Breeding On Agricultural Lands In Colorado – Dreitz, V.

The Second Annual Rare Plant Symposium – CNHP, et al.

Survey of Critical Biological Resources, Larimer County, Colorado – Doyle, G., S. Neid, and R. Rondeau

Survey of Critical Wetlands and Riparian Areas in Dolores County – March, M., D. Culver, P. Lyon, J. Hanson, and S. Eastin

Survey of Rare Plants, San Juan Public Lands in Dolores and Montezuma Counties, Colorado – Lyon, P. and J. Hanson

Vegetation Monitoring at Pueblo Chemical Depot, 1998-2003: 2003 Update – Rondeau, R.

2004 Documents and Reports

Assessment of Critical Biological Resources, La Plata County, Colorado – Lyon, P., J. Huggins, J. Lucht, D. Culver, M. March, and J. Hanson

Astragalus anisus M.E. Jones (Gunnison milkvetch): A Technical Conservation Assessment – Decker, K. and D.G. Anderson

Biological Inventory of the Colorado Canyons National Conservation Area – Stevens, J.

Black-Tailed Prairie Dog Surveys of BLM Lands in Eastern Colorado – Assal, T.J. and J.R. Sovell

Botanical Survey of Strawberry Lake, Arapaho National Forest, Grand County, Colorado – Rocchio, J. and J. Stevens

Botrychium echo W.H. Wagner (reflected grapefern): A Technical Conservation Assessment – Anderson, D.G. and D. Cariveau

Botrychium hesperium (western moonwort): A Technical Conservation Assessment – Anderson, D.G. and D. Cariveau

Canyon of the Ancients National Monument Amphibian and Reptile Inventory – Lambert, B.

CDOT Noxious Weed Mapping Project, Final Report by the Colorado Natural Heritage Program, July 2000 to June 2004 – Johnson, F.

Cirsium perplexans (Rydb.) Petrak (Rocky Mountain thistle): A Technical Conservation Assessment – Spackman Panjabi, S. and D.G. Anderson

Colorado Natural Heritage Program 2003 Project Abstracts – Rondeau, R., et al.

Conservation and Management Plan for Colorado Butterfly Plant and Preble's Meadow Jumping Mouse on F.E. Warren Air Force Base – Grunau, L., R. Schorr, and J. Handwerk

Eriogonum coloradense Small (Colorado buckwheat): A Technical Conservation Assessment – Anderson, D.G.

Gilia sedifolia Brandeg. (stonecrop gilia): A Technical Conservation Assessment – Anderson, D.G.

Great Sand Dunes National Monument and Preserve 2003 Vascular Plant Inventory – Spackman Panjabi, S., K. Decker, G. Doyle, and D.G. Anderson

Ipomopsis polyantha (Rydberg) V. Grant (Pagosa ipomopsis): A Technical Conservation Assessment – Anderson, D.G.

Montane Mollusk and Crustacean Survey of Western Colorado, 2003 Annual Report – Sovell, J.R. and R. Guralnick

Natural Heritage Inventory of Rare Plants, Animals and Plant Communities on Peterson Air Force Base, Colorado Springs, Colorado, Update to Final Report 1997 – Schorr, R. and R. Abbott

Neoparrya lithophila Mathias (Bill's neoparrya): A Technical Conservation Assessment – Anderson, D.G.

Population Parameters and Fat Composition of Small Mammals on Pueblo Chemical Depot (2000-2003) – Sovell, J.R., B.A. Wunder, P.M. Lukacs, J.P. Gionfriddo, and J.L. Siemers

Population Status Survey of Schmoll's Milkvetch (*Astragalus schmolliae* C.L. Porter) – Anderson, D.G.

Potentilla rupincola Osterhout (rock cinquefoil): A Technical Conservation Assessment – Anderson, D.G.

Survey and Assessment of the "Alamosa Marshes" area, San Luis Valley, CO – Rocchio, J.

Survey of Critical Wetlands, Bureau of Land Management Lands, South Park, Park County, Colorado 2003-2004 – Culver, D.

Survey of Critical Wetlands and Riparian Areas in La Plata County, Colorado – March, M., P. Lyon, D. Culver, and J. Huggins

Survey of Critical Wetlands and Riparian Areas in Southern Alamosa and Costilla Counties, San Luis Valley, Colorado – Rocchio, J.

Thelypodiopsis juniperorum (Payson) Rydberg (juniper tumblemustard): A Technical Conservation Assessment – Anderson, D.G.

Visiting Insect Diversity and Visitation Rates for Seven Globally - Imperiled Plant Species In Colorado's Middle Arkansas Valley – Spackman Panjabi, S.

Wetland Classification of Blanca Wetlands, San Luis Valley, Colorado – Rocchio, J.

2003 Documents and Reports

Assessment of Riparian and Wetland Areas within the Buffalo-Stillwater-Gilsonite Allotment Analysis Area, Arapaho National Forest, Grand County, Colorado – Rocchio, J., Doyle, G., and R. Rondeau

Black-Tailed Prairie Dog Surveys in Crowley, Otero, Pueblo and Eastern Huerfano Counties, Colorado – Sovell, J.

Botrychium campestre (Iowa moonwort): A Technical Conservation Assessment – Anderson, D.G. and D. Cariveau

Distributional Survey of Rare Small Mammals (Orders Insectivora, Chiroptera and Rodentia) in Colorado: Year One – Siemers, J.L., R.A. Schorr, and A.C. Rinker

Field Guide to the Wetland and Riparian Plant Associations of Colorado – Carsey, K., G. Kittel, K. Decker, D.J. Cooper, and D. Culver

Florissant Fossil Beds National Monument Vascular Plant Inventory – Spackman Panjabi, S. and S. Anderson

Meadow Jumping Mice (*Zapus hudsonius preblei*) on the U.S. Air Force Academy El Paso County, Colorado: Populations, Movement and Habitat from 2000-2002 – Schorr, R.

Noxious Weed Survey of Peterson Air Force Base – Anderson, D.G., A. Lavender, and R. Abbott

Noxious Weed Survey of the U.S. Air Force Academy and Farish Outdoor Recreation Area – Anderson, D.G., A. Lavender, and R. Abbott

Potential Habitat for Mountain Plovers on Colorado Springs Utilities Property – Margulies, M. and J.R. Sovell

San Juan County Biological Assessment – Lyon P., D. Culver, M. March, and L. Hall

Statewide Wetlands Classification and Characterization, Final Report, April 2003 – Carsey, K., G. Kittel, K. Decker, D.J. Cooper, and D. Culver

Survey of Critical Wetlands and Riparian Areas in Gunnison County – Rocchio, J., G. Doyle, and R. Rondeau

Survey of Critical Biological Resources of Pueblo County, Colorado – Spackman Panjabi, S., J. Sovell, G. Doyle, D. Culver, and L. Grunau

Survey of Selected Seeps and Springs within the Bureau of Land Management's Gunnison Field Office Management Area (Gunnison and Saguache Counties, CO) – Doyle, G.

Surveys for Boreal Toads (*Bufo boreas boreas*) in and near the Northern Portion of the Powderhorn Wilderness, Gunnison and Hinsdale Counties, Colorado: Summer 2002 – Gionfriddo, J.P. and B. Lambert

Upper San Juan Basin Biological Assessment – Sovell, J., P. Lyon, and L. Grunau

Vegetation Monitoring at Pueblo Chemical Depot: 1998-2002 – Rondeau, R.

2002 Documents and Reports

A Survey of Colorado's Caves for Bats – Siemers, J.

Colorado Rare Plant Field Guide 2002 Update – Spackman, S. and D. Anderson

Great Sand Dunes National Monument and Preserve Vascular Plant Inventory (2002 report) – Spackman Panjabi, S. and K. Decker

Monument Creek Watershed Landscape Assessment – Armstrong, J. and J. Stevens

Pueblo Chemical Depot Grasshopper Monitoring: 2002 Results – Sovell, J.R. and S. Schneider

Rare Plant Survey, San Juan National Forest – Lyon, P. and M. Denslow

Survey of Critical Wetlands and Riparian Areas in Mesa County – Rocchio, J., G. Doyle, P. Lyon, and D. Culver

Survey of Seeps and Springs within the Bureau of Land Management's Grand Junction Field Office Management Area (Mesa County, CO) – Doyle, G., J. Rocchio, and D. Culver

2001 Documents and Reports

Conservation Assessment for Mountain Plover (*Charadrius montanus*) in South Park, Colorado – Grunau, L. and M. Wunder

Ecological System Viability Specifications for Southern Rocky Mountain Ecoregion, 1st edition – Rondeau, R.

Gunnison Gorge National Conservation Area Survey of Impacts on Rare Plants – Lyon, P. and M. Denslow

Inventory and Status Report of American Ground Nut (*Apios americana* Medicus) in Colorado – Anderson, D.G. and S. Spackman

Meadow Jumping Mice (*Zapus hudsonius preblei*) on the U.S. Air Force Academy, El Paso County, Colorado – Schorr, R.

Park County Inventory of Critical Biological Resources – Spackman, S., D. Culver, and J. Sanderson

Pueblo Chemical Depot Grasshopper Monitoring: 2001 Results – Sovell, J.R., and S. Schneider

Statewide Wetlands Classification and Characterization: Wetland Plant Associations of Colorado. Preliminary Report 1999-2001 – Carsey, K., D. Cooper, K. Decker, D. Culver, and G. Kittel

Survey of Critical Biological Resources, El Paso County, Colorado – Doyle, G., J. Armstrong, J. Gionfriddo, D.G. Anderson, J. Stevens, and R. Schorr

Survey of Critical Biological Resources, Garfield County, Colorado, Volume I – Lyon, P., J. Sovell, and J. Rocchio

Survey of Critical Biological Resources of Garfield County, Colorado, Volume II: Survey of Critical Wetlands and Riparian Areas in Garfield County – Rocchio, J., J. Sovell, and P. Lyon

Survey of Critical Wetland Wetlands and Riparian Areas in El Paso and Pueblo Counties, Colorado – Doyle, G., D.G. Anderson, and D. Culver

Survey of Seeps and Springs within the Bureau of Land Management's Grand Junction Field Office Management Area (Garfield County, CO) – Rocchio, J., J. Sovell, and P. Lyon

Visiting insect diversity and visitation rates for two globally-imperiled plant species in Colorado's Mosquito Range – Spackman, S., G. Doyle, and D. Anderson

Weed and Rare Plant Assessments on Selected BLM ACECs – Anderson, D., P. Lyon, S. Spackman, and J. Handwerk

2000 Documents and Reports

Assessment of Riparian Vegetation and Wildlife Habitat Structure, North Fork of the Gunnison River Tributaries and Lower Gunnison River Tributaries – Damm, M., J. Stevens, and S. Boyle

Biological Inventory of Rio Grande and Conejos Counties, Colorado – Kettler, S., J. Rocchio, R. Schorr, J. Burt

Biological Inventory of Rio Grande and Conejos Counties, Colorado, Volume II: A Natural Heritage Inventory and Assessment of Wetlands and Riparian Areas in Rio Grande and Conejos Counties – Rocchio, J., D. Culver, and R. Schorr

Biological Survey of Eagle County, Colorado. 2000 Final Report – Fayette, K., M. Wunder, and S. Schneider

Comprehensive Statewide Wetlands Classification and Characterization – Hupalo, R., D. Culver, and G. Doyle

Internet-based Biodiversity Database Workshop: an assessment of needs and tools, April 24 - 27, 2000 (Website) – Baker, B., P. Mehlhop, and P. Srimani

Natural Heritage Inventory of Buckley Air National Guard Base, Arapahoe County, Colorado – Fayette, K., R. Schorr, D. Anderson, and E. Mohr

Natural Heritage Inventory of Monte Vista National Wildlife Refuge, Rio Grande County, Colorado – Stevens, J. and J. Bell

Natural Heritage Inventory of Schriever Air Force Base, El Paso County, Colorado – Fayette, K., D. Anderson, E. Mohr, and J. Gionfriddo

Pueblo Chemical Depot Grasshopper Monitoring: 2000 Results – Sovell, J.

Staunton State Park Biological Inventory – Spackman, S., D. Anderson, J. Siemers, P. Pineda, and J. Handwerk

Wheat Ridge Open Space Areas Biological Inventory – Anderson, D. and J. Stevens

1999 Documents and Reports

A Biological Inventory and Conservation Recommendations for the Great Sand Dunes and San Luis Lakes, Colorado – Pineda, P., R.J. Rondeau, and A. Ochs

A Classification of Riparian Plant Associations of the Rio Grande and Closed Basin Watersheds, Colorado – Kittel, G., E. VanWie, M. Damm, R. Rondeau, S. Kettler, and J. Sanderson

A Classification of Riparian Wetland Plant Associations of Colorado – Kittel, G., E. VanWie, M. Damm, R. Rondeau, S. Kettler, A. McMullen, and J. Sanderson.

A Natural Heritage Assessment of Wetlands and Riparian Areas in the Uncompahgre River Basin Eastern Montrose and Ouray Counties, Volume II – Stephens, T., D. Culver, J. Zoerner, and P. Lyon

Biological Survey of Mineral County, Colorado – Rondeau, R.

Biological Survey of the Pikes Peak Area – Fayette, K.

Colorado Rare Plant Field Guide (Website) – Spackman, S., J. Coles, C. Dawson, M. Minton, A. Kratz, C. Spurrier, C. Johnson, and M. Barry

Conservation and Management Plan for Preble's Meadow Jumping Mouse on the U.S. Air Force Academy – Grunau, L., R. Schorr, D. Green, B. Rosenlund, C. Pague, and J. Armstrong

Conservation Status Handbook, Volume 3, No. 2 – Klein, M., et al.

Inventory of Critical Biological Resources in the Upper Arkansas Watershed 1999 Final Report – CNHP

Management Alternatives for Natural Communities and Imperiled Invertebrates at Horsetooth Mountain Park, Larimer County, Colorado. – Kettler, S. and P. Pineda

Pueblo Chemical Depot Grasshopper Monitoring: 1999 Results – Sovell, J.

Roaring Fork Watershed Biological Inventory, for Pitkin County, the Aspen Wilderness Workshop, and the Roaring Fork Valley Audubon Society – Spackman, S., J. Siemers, K. Murrel, and M. Sherman.

Significant Natural Heritage Resources of the Caribou Ranch Open Space and their Preservation – Pineda, P., S. Kettler, and M. Wunder

The Uncompahgre River Basin Volume I: A Natural Heritage Assessment – Lyon, M., T. Stephens, J. Siemers, D. Culver, P. Pineda, and J. Zoerner

1998 Documents and Reports

A Classification of the Riparian Vegetation of the South Platte and Republican River Basins, Colorado – Kittel, G., E. VanWie, and M. Damm

Natural Heritage Biological Survey of Delta County, Colorado – Lyon, P. and E. Williams

Saguache County, Closed Basin Biological Inventory Volume I: A Natural Heritage Assessment – Rondeau, R.J., D. Sarr, M.B. Wunder, P.M. Pineda, and G.M. Kittel

Saguache County, Closed Basin Biological Inventory Volume II: A Natural Heritage Assessment of Wetlands and Riparian Areas in the Closed Basin, Colorado Final Report – Sarr, D. and J. Sanderson

1997 Documents and Reports

Field Survey and Protection Recommendations for the Globally Imperiled Parachute Penstemon, *Penstemon debilis* O'Kane and Anderson – Spackman, S., K. Fayette, K. Carsey, and R. Rondeau

Literature Review of Fire Ecology and Effects United States Air Force Academy Colorado Springs, Colorado – Culver, D.

Natural Heritage Resources and Conservation Significance of the Laramie Foothills, Larimer County, Colorado – Kettler, S. and T.P. Scheurman

Summit County Conservation Inventory Volume I: A Natural Heritage Assessment – Spackman, S., K. Fayette, D. Culver, K. Murrell, and M. Sherman

1996 Documents and Reports

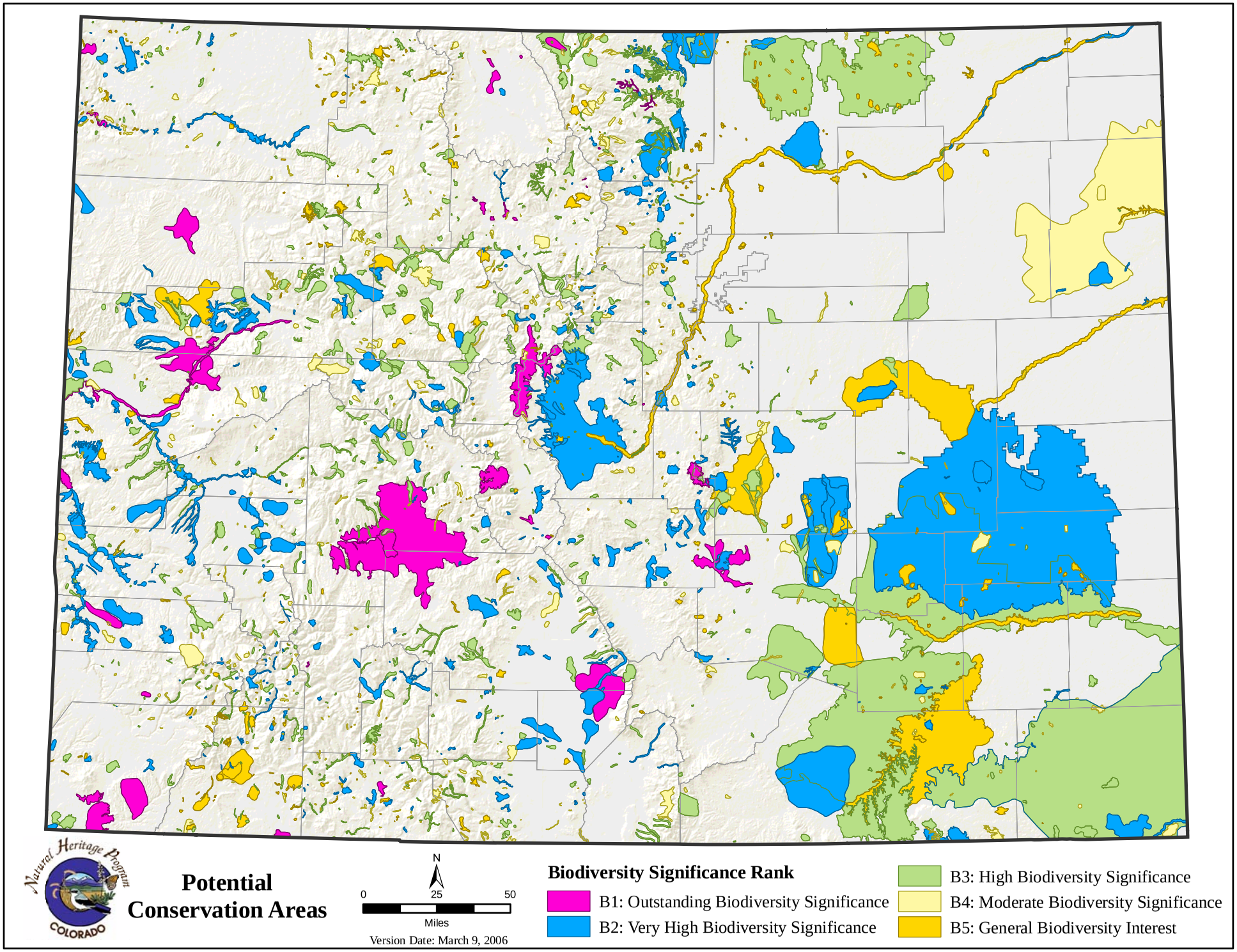
Extreme Rich Fens of South Park, Colorado: Their Distribution, Identification, and Natural Heritage Significance – Sanderson, J. and M. March

Significant Plant, Animal, and Wetland Resources of Larimer County and their Conservation – Kettler, S., J. Sanderson, S. Spackman, K. Fayette, C. Pague, D. Clark, and A. Hicks

1995 Documents and Reports

Effects of Fire on Threatened and Endangered Plants: An Annotated Bibliography, U.S. Department of the Interior – Section by A. Hessl and S. Spackman

Fourteeners Initiative Rare Plant Survey Report – Spackman, S., M. Duff, and S. Floyd


Natural Heritage Program
COLORADO
Potential
Conservation Areas
N
0
25
50
Miles
Version Date: March 9, 2006
Biodiversity Significance Rank
B1: Outstanding Biodiversity Significance
B2: Very High Biodiversity Significance
B3: High Biodiversity Significance
B4: Moderate Biodiversity Significance
B5: General Biodiversity Interest