BOTANICAL SURVEY OF WINTER PARK RESORT, ARAPAHO NATIONAL FOREST, GRAND COUNTY, COLORADO

Colorado Natural Heritage Program
College of Natural Resources, 8002 Campus Delivery
Colorado State University
Fort Collins, Colorado 80523-8002

Natural Heritage Program COLORADO

Colorado State University
Knowledge to Go Places

BOTANICAL SURVEY OF WINTER PARK RESORT, ARAPAHO NATIONAL FOREST, GRAND COUNTY, COLORADO

Prepared for:

Doug Laraby, Winter Park Resort
P.O. Box 36
Winter Park, CO 80482

and

U.S. Forest Service
Arapaho-Roosevelt National Forests and Pawnee National Grassland, Supervisor's Office
240 West Prospect
Fort Collins, CO 80526

Prepared by:

David G. Anderson and Jill E. Handwerk
January 26, 2005

Colorado Natural Heritage Program (CNHP)
College of Natural Resources
8002 Campus Delivery
Colorado State University
Fort Collins, Colorado 80523-8002

Cover photograph: *Botrychium* c.f. *echo* at Prospector Chairlift, Winter Park Resort.

Photo taken by: David G. Anderson

TABLE OF CONTENTS

INTRODUCTION

Winter Park Resort is located in southeastern Grand County, Colorado, approximately three air miles southwest of the town of Winter Park, to the west of Highway 40 and north of Berthoud Pass. The permit boundary includes east- and northeast-facing slopes west of the Fraser River, and the valley of Vasquez Creek. The area within the permit boundary ranges in elevation from approximately 9,000 feet near the headquarters area, to over 12,000 feet on the alpine summits of Parsenn Peak above Vasquez Creek.

The vegetation of Winter Park Resort is primarily coniferous forests of the subalpine zone, with areas of alpine vegetation on the highest peaks. Subalpine fir and Engelmann spruce are common in higher and moister sites, while lodgepole pine becomes more prevalent at lower elevations and in warmer, drier sites. At Winter Park Resort, high elevation forests dominated by subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*) are fairly open and support a lush understory of whortleberry with sickletop lousewort (*Pedicularis racemosa*), pussytoes (*Antennaria* spp.), yarrow (*Achillea lanulosa*), and goldenrod (*Solidago simplex* var. *nana*). At lower elevations the trees are larger and the canopy is more closed. In some areas the forests are very dense, with closed canopies leaving less light available to support the development of understory vegetation. However, moist sites support a diverse array of forest floor species, including stiff clubmoss (*Lycopodium annotinum*) and heartleaf twayblade (*Listera cordata* ssp. *nephrophylla*).

In response to recently proposed activities in the analysis area, the Colorado Natural Heritage Program (CNHP) was contracted to conduct a botanical survey of specific project areas on the Arapaho- Roosevelt National Forest within the permit boundary of Winter Park Resort. CNHP botanists also spent one day searching for peatlands (fens) elsewhere in Grand County that are similar to that known from Discovery Park at Winter Park Resort (please see Appendix A for a description of montane fens). Two other contractors were also involved in conducting botanical surveys in 2004 of other proposed project areas at Winter Park Resort. This report summarizes the results of the surveys conducted by CNHP. These surveys were conducted on August 9 through August 11, 2004 (Table 1).

Table 1. Field Calendar for Botanical Surveys at Winter Park Resort conducted by CNHP.

Date	**Activity**
August 9, 2004	Intensive search for rare plant target species along proposed chairlift alignment site above Area G, followed by search of the lower portion of Area G.
August 10, 2004	Search proposed affected area adjacent to the Summit Express chairlift, timed surveys for moonworts on ski runs.
August 11, 2004	Visit to fen site in Discovery Park, followed by extensive surveys to attempt to identify other similar fens in Grand County.

During this botanical survey, six items were addressed based on proposed project areas and general rare plant survey needs for Winter Park Resort and the Arapaho-Roosevelt National Forest. Target species lists are included in the Methods section of this report. Methods and results are discussed separately for each of these items throughout this report. They are as follows:

Botanical Survey of Parsenn Peak

A new chairlift is proposed to service the area proposed for glading (removal of trees to facilitate recreational access) in Area G (see next section). The areas potentially affected by this chairlift alignment were surveyed by other contractors except for the upper reach above treeline near Parsenn Peak (Figures 1 and 2). CNHP surveyed this area on August 9, 2004.

Botanical Survey of Backside Parsenn Peak Improvement Area (Area G)

Areas on the north-facing slopes above Vasquez Creek are proposed for glading. The lower slopes of Area G were not previously surveyed for target plant species and natural communities by other contractors so they were surveyed by CNHP on August 9, 2004 (Figures 1 and 3).

Botanical Survey of the Area Affected by Proposed Summit Express Chairlift Replacement

Replacement and upgrading of the Summit Express Chairlift will require widening the existing cleared area by approximately 15 feet on each side by cutting all trees. The areas that would be affected by this project were surveyed on August 9, 2004 for the presence of target species and natural communities (Figure 1 and 4).

Timed Moonwort (*Botrychium* ssp.) Surveys

Due to concern for their viability rangewide and on lands within the U.S. Forest Service System, surveys for moonworts were conducted throughout Winter Park Resort. Timed moonwort surveys were conducted within the Summit Express Chairlift Replacement project footprint and at numerous ski slopes throughout Winter Park Resort. Please see the Methods section of this report for a description of the timed surveys.

Documentation of Selected Noxious Weeds

Selected noxious weeds were mapped when they were encountered throughout Winter Park Resort. These data are provided to promote effective eradication and

management of these species and prevent their spread into uninfested areas. Weed occurrences were mapped on August 9 and August 10, 2004. Please see the Methods section of this report for the list of target species and survey methods.

Fraser Valley Peatland Survey

The proposed Fraser Pipeline and Pond project would result in the creation of a six-acre holding pond in the Discovery Park area to hold water from the Fraser River for snowmaking activities. The creation of this pond would result in the destruction of a fen. Because fens require thousands of years to develop and are irreplaceable, Steve Popovich with the U.S. Forest Service requested that efforts be made to identify other similar fens in the Fraser Valley. It was thought by the U.S. Forest Service that if other similar fens were found, the loss of the fen in Discovery Park would not result in the loss of the only known peatland in the area. Therefore, after assessment of the Discovery Park fen, an extensive survey of the Fraser River Valley was conducted on August 11, 2004 to attempt to identify other similar fens. Due to the limited scope of this survey it was not comprehensive and more survey work is needed.

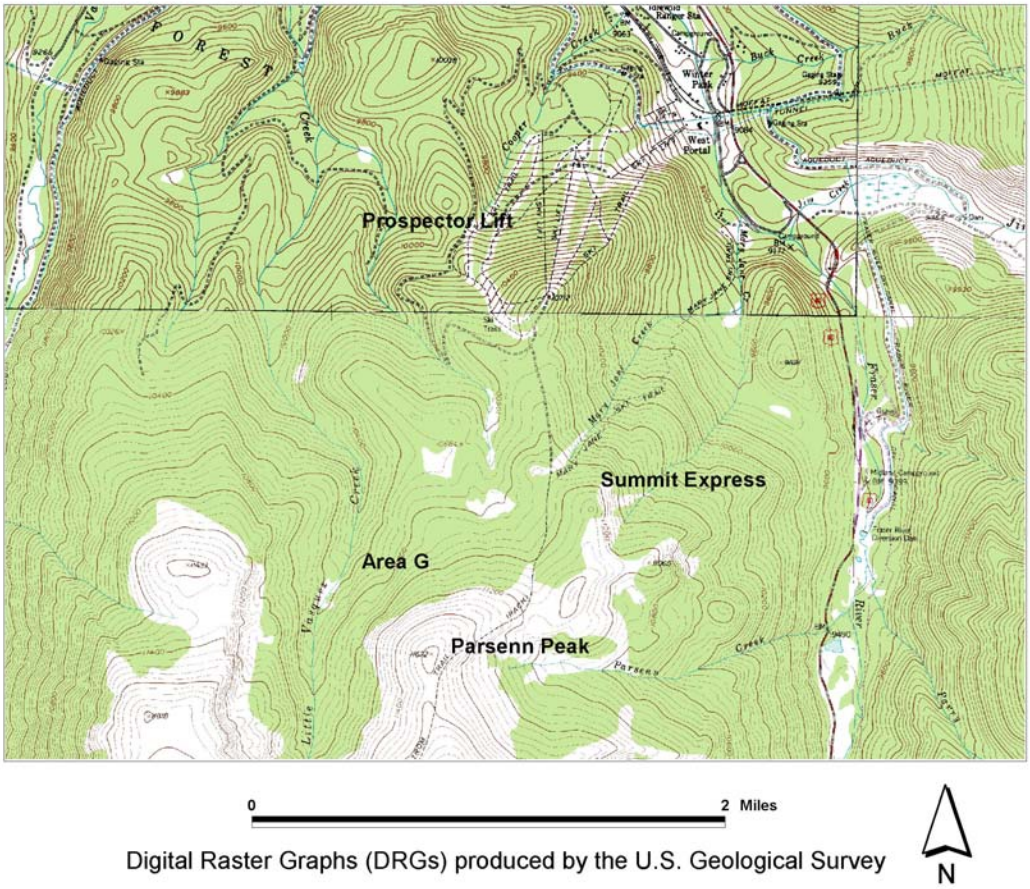

Figure 1. Three project footprint areas targeted by the Colorado Natural Heritage Program at Winter Park Resort.

Figure 2. Alpine vegetation near treeline in the project footprint area for construction of a chairlift to service Area G (Backside Parsenn Peak).

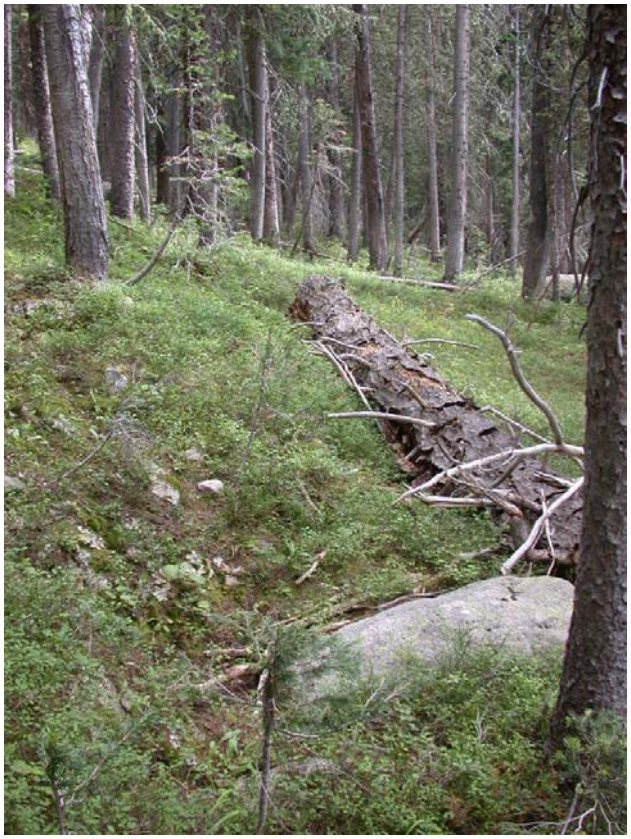

Figure 3. Typical vegetation in the lower portion of Area G, showing the diverse population structure of the forest and lush mesic understory.

Figure 4. The existing Summit Express chairlift.

NATURAL HERITAGE METHODOLOGY

Just as ancient artifacts and historic buildings represent our cultural heritage, a diversity of plant and animal species and their habitats represent our "natural heritage." Colorado's natural heritage encompasses a wide variety of ecosystems from tallgrass prairie and shortgrass high plains to alpine cirques and rugged peaks, from canyon lands and sagebrush deserts to dense subalpine spruce-fir forests and wide-open tundra.

These widely diversified habitats are determined by water availability, temperature extremes, altitude, geologic history, and land use history. The species that inhabit each of these ecosystems have adapted to the specific set of conditions found there. Because human influence today touches every part of the Colorado environment, we are responsible for understanding our impacts and carefully planning our actions to ensure our natural heritage persists for future generations.

Some generalist species, like house finches, have flourished over the last century, having adapted to habitats altered by humans. However, many other species are specialized to survive in vulnerable Colorado habitats; among them are Bell's twinpod (a wildflower), the Arkansas darter (a fish), and the Pawnee montane skipper (a butterfly). These species have special requirements for survival that may be threatened by incompatible land management practices and competition from non-native species. Many of these species have become imperiled not only in Colorado, but also throughout their range of distribution. Some species exist in less than five populations in the entire world. The decline of these specialized species often indicates disruptions that could permanently alter entire ecosystems. Thus, recognition and protection of rare and imperiled species is crucial to preserving Colorado's diverse natural heritage.

Colorado is inhabited by some 800 vertebrate species and subspecies, and tens of thousands of invertebrate species. In addition, the state has approximately 4,300 species of plants and more than 450 recognized plant associations that represent upland and wetland ecosystems. It is this rich natural heritage that has provided the basis for Colorado's diverse economy. Some components of this heritage have always been rare, while others have become imperiled with human-induced changes in the landscape. This decline in biological diversity is a global trend resulting from human population growth, land development, and subsequent habitat loss. Globally, the loss in species diversity has become so rapid and severe that Wilson (1988) has compared the phenomenon to the great natural catastrophes at the end of the Paleozoic and Mesozoic eras.

The need to address this loss in biological diversity has been recognized for decades in the scientific community. However, many conservation efforts made in this country were not based upon preserving biological diversity; instead, they primarily focused on preserving game animals, striking scenery, and locally favorite open spaces. To address the absence of a methodical, scientifically based approach to preserving biological diversity Dr. Robert Jenkins of The Nature Conservancy pioneered the Natural Heritage Methodology in the early 1970s.

Recognizing that rare and imperiled species are more likely to become extinct than common ones, the Natural Heritage Methodology ranks species according to their rarity or degree of imperilment. The ranking system is scientifically based upon the number of known locations of the species as well as their biology and known threats. By ranking the relative rarity or imperilment of a species, the quality of its populations, and

the importance of associated conservation sites, the methodology can facilitate the prioritization of conservation efforts so the most rare and imperiled species may be preserved first. As the scientific community realized that plant associations are equally important as individual species, this methodology has been applied to ranking and preserving rare plant associations, as well as the best examples of common associations.

The Natural Heritage Methodology is used by Natural Heritage Programs throughout North, Central, and South America, forming an international database network. The 85 Natural Heritage Network data centers are located in each of the 50 U.S. states, five provinces of Canada, and 13 countries in South and Central America and the Caribbean. This network enables scientists to monitor the status of species from a state, national, and global perspective. Information collected by the Natural Heritage Programs can provide a means to protect species before the need for legal endangerment status arises. It can also enable conservationists and natural resource managers to make informed, objective decisions in prioritizing and focusing conservation efforts.

What is Biological Diversity?

Protecting biological diversity has become an important management issue for many natural resource professionals. Biological diversity at its most basic level includes the full range of species on Earth, from single-celled organisms such as bacteria and protists through the multicellular kingdoms of plants and animals. At finer levels of organization, biological diversity includes the genetic variation within species, both among geographically separated populations and among individuals within a single population. On a wider scale, diversity includes variations in the biological associations in which species live, the ecosystems in which associations exist, and the interactions between these levels. All levels are necessary for the continued survival of species and plant associations, and many are important for the well being of humans.

The biological diversity of an area can be described at four levels:

Genetic Diversity — the genetic variation within a population and among populations of a plant or animal species. The genetic makeup of a species varies between populations within its geographic range. Loss of a population results in a loss of genetic diversity for that species and a reduction of total biological diversity for the region. Once lost, this unique genetic information cannot be reclaimed.

Species Diversity — the total number and abundance of plant and animal species and subspecies in an area.

Community Diversity — the variety of plant associations or associations within an area that represent the range of species relationships and inter-dependence. These associations may be diagnostic or even restricted to an area. Although the terms plant association and community have been described by numerous ecologists, no general consensus of their meaning has developed. The terms are similar, somewhat overlapping, and are often used more or less interchangeably. The U.S. National Vegetation Classification

(USNVC) (Anderson et al. 1998), the accepted national standard for vegetation, defines a community as an "assemblage of species that co-occur in defined areas at certain times and that have the potential to interact with one another" (The Nature Conservancy 1999), and a plant association as a type of plant community with "definite floristic composition, uniform habitat conditions, and uniform physiognomy" (Flahault and Schroter 1910). The term plant "association" is hereafter used in lieu of "community" except when referring to a broader definition of community (e.g. natural community). Identifying and protecting representative examples of plant associations ensures conservation of multiple number of species, biotic interactions, and ecological process. Using associations as a "coarse-filter" enables conservation efforts to work toward protecting a more complete spectrum of biological diversity.

Landscape Diversity — the type, condition, pattern, and connectedness of natural communities. A landscape consisting of a mosaic of natural communities may contain one multifaceted ecosystem, such as a wetland ecosystem. A landscape also may contain several distinct ecosystems, such as a riparian corridor meandering through shortgrass prairie. Fragmentation of landscapes, loss of connections and migratory corridors, and loss of natural communities all result in a loss of biological diversity for a region. Humans and the results of their activities are integral parts of most landscapes.

The conservation of biological diversity should include all levels of diversity: genetic, species, community or association, and landscape. Each level is dependent on the other levels and inextricably linked. In addition, and all too often omitted, humans are also closely linked to all levels of this hierarchy. We at the Colorado Natural Heritage Program believe that a healthy natural environment and a healthy human environment go hand in hand, and that recognition of the most imperiled species is an important step in comprehensive conservation planning.

Colorado Natural Heritage Program (CNHP)

CNHP is the state's primary comprehensive biological diversity data center, gathering information and field observations to help develop statewide conservation priorities. After operating in the Colorado Division of Parks and Outdoor Recreation for 14 years, the Program was relocated to the University of Colorado Museum in 1992, and then to the College of Natural Resources at Colorado State University in 1994, where it has operated since.

The multi-disciplinary team of scientists, planners, and information managers at CNHP gathers comprehensive information on the rare, threatened, and endangered species and significant plant associations of Colorado. Life history, status, and locational data are incorporated into a continually updated data system. Sources include published and unpublished literature, museum and herbaria labels, and field surveys conducted by knowledgeable naturalists, experts, agency personnel, and our own staff of botanists, ecologists, and zoologists.

The Biological and Conservation Data System (BCD) was the original database developed by The Nature Conservancy to be used by all Natural Heritage Programs to house data about imperiled species. The database includes taxonomic group, global and

state rarity rank, federal and state legal status, observation source, observation date, county, township, range, watershed, and other relevant facts and observations. Recently, NatureServe, the parent organization to all Heritage programs, has updated BCD utilizing current technology and database capabilities. The new database, BIOTICS (Biodiversity Tracking and Conservation System), is currently being implemented throughout the Natural Heritage Network. The Colorado Natural Heritage Program began using BIOTICS for digitizing and mapping occurrences of rare plants, animals, and plant associations and tracking their distribution and life history information. These rare species and plant associations are referred to as "elements of natural diversity" or simply "elements."

Concentrating on site-specific data for each element enables CNHP to evaluate the significance of each location for the conservation of biological diversity in Colorado and in the nation. By using species imperilment ranks and quality ratings for each location, priorities can be established to guide conservation action. A continually updated locational database and priority-setting system such as that maintained by CNHP provides an effective, proactive land-planning tool.

To assist in biological diversity conservation efforts, CNHP scientists strive to answer questions like the following:

- What species and ecological associations exist in the area of interest?
- Which are at greatest risk of extinction or are otherwise significant from a conservation perspective?
- What are their biological and ecological characteristics, and where are these priority species or associations found?
- What is the species' condition at these locations, and what processes or activities are sustaining or threatening them?
- Where are the most important sites to protect?
- Who owns or manages those places deemed most important to protect, and what is threatening those places?
- What actions are needed for the protection of those sites and the significant elements of biological diversity they contain?
- How can we measure our progress toward conservation goals?

CNHP has effective working relationships with several state and federal agencies, including the Colorado Department of Natural Resources, the Colorado Division of Wildlife, the Bureau of Land Management, and the U.S. Forest Service. Numerous local governments and private entities, such as consulting firms, educators, landowners, county commissioners, and non-profit organizations, also work closely with CNHP. Use of the

data by many different individuals and organizations encourages a cooperative and proactive approach to conservation, thereby reducing the potential for conflict.

The Natural Heritage Ranking System

Key to the functioning of Natural Heritage Programs is the concept of setting priorities for gathering information and conducting inventories. The number of possible facts and observations that can be gathered about the natural world is essentially limitless. The financial and human resources available to gather such information are not. Because biological inventories tend to be under-funded, there is a premium on devising systems that are both effective in providing information that meets users' needs and efficient in gathering that information. The cornerstone of Natural Heritage inventories is the use of a ranking system to achieve these twin objectives of effectiveness and efficiency.

Ranking species and ecological associations according to their imperilment status provides guidance for where Natural Heritage Programs should focus their information-gathering activities. For species deemed secure, only general information needs to be maintained by Natural Heritage Programs. Fortunately, the more common and secure species constitute the majority of most groups of organisms. On the other hand, for those species that are by their nature rare, more detailed information is needed. Because of these species' rarity, gathering comprehensive and detailed population data can be less daunting than gathering similarly comprehensive information on more abundant species.

To determine the status of species within Colorado, CNHP gathers information on plants, animals, and plant associations. Each of these elements of natural diversity is assigned a rank that indicates its relative degree of imperilment on a five-point scale (for example, 1 = extremely rare/imperiled, 5 = abundant/secure). The primary criterion for ranking elements is the number of occurrences (in other words, the number of known distinct localities or populations). This factor is weighted more heavily than other factors because an element found in one place is more imperiled than something found in twenty-one places. Also of importance are the size of the geographic range, the number of individuals, the trends in both population and distribution, identifiable threats, and the number of protected occurrences.

Element imperilment ranks are assigned both in terms of the element's degree of imperilment within Colorado (its State-rank or S-rank) and the element's imperilment over its entire range (its Global-rank or G-rank). Taken together, these two ranks indicate the degree of imperilment of an element. For example, the lynx, which is thought to be secure in northern North America but is known from less than five current locations in Colorado, is ranked G5 S1 (globally-secure, but critically imperiled in this state). The Rocky Mountain Columbine, which is known only in Colorado from about 30 locations, is ranked a G3 S3 (vulnerable both in the state and globally, since it only occurs in Colorado and then in small numbers). Further, a tiger beetle that is only known from one location in the world at the Great Sand Dunes National Monument is ranked G1 S1 (critically imperiled both in the state and globally, because it exists in a single location). CNHP actively collects, maps, and electronically processes specific occurrence information for animal and plant species considered extremely imperiled to vulnerable in the state (S1 - S3). Several factors, such as rarity, evolutionary distinctiveness, and

endemism (specificity of habitat requirements), contribute to the conservation priority of each species. Certain species are "watchlisted," meaning that specific occurrence data are collected and periodically analyzed to determine whether more active tracking is warranted. A complete description of each of the Natural Heritage ranks is provided in Table 2.

This single rank system works readily for all species except those that are migratory. Those animals that migrate may spend only a portion of their life cycles within the state. In these cases, it is necessary to distinguish between breeding, non-breeding, and resident species. As noted in Table 3, ranks followed by a "B," for example S1B, indicate that the rank applies only to the status of breeding occurrences. Similarly, ranks followed by an "N," for example S4N, refer to non-breeding status, typically during migration and winter. Elements without this notation are believed to be year-round residents within the state.

Global imperilment ranks are based on the range-wide status of a species. State imperilment ranks are based on the status of a species in an individual state. State and Global ranks are denoted with an "S" or a "G" respectively, followed by a number or letter. These ranks should not be interpreted as legal designations.

Legal Designations for Rare Species

Natural Heritage imperilment ranks should not be interpreted as legal designations. Although most species protected under state or federal endangered species laws are extremely rare, not all rare species receive legal protection. Legal status is designated by either the U.S. Fish and Wildlife Service under the Endangered Species Act or by the Colorado Division of Wildlife under Colorado Statutes 33-2-105 Article 2. In addition, the U.S. Forest Service recognizes some species as “Sensitive,” as does the Bureau of Land Management. Table 4 defines the special status assigned by these agencies and provides a key to abbreviations used by CNHP.

Candidate species for listing as endangered or threatened under the Endangered Species Act are indicated with a “C." While obsolete federal legal status (C1 and C2) are no longer used, CNHP continues to maintain them in its Biological and Conservation Data system for reference.

Table 2. Definition of Natural Heritage Imperilment Ranks.

G/S1	Critically imperiled globally/state because of rarity (5 or fewer occurrences in the world/state; or 1,000 or fewer individuals), or because some factor of its biology makes it especially vulnerable to extinction.
G/S2	Imperiled globally/state because of rarity (6 to 20 occurrences, or 1,000 to 3,000 individuals), or because other factors demonstrably make it very vulnerable to extinction throughout its range.
G/S3	Vulnerable through its range or found locally in a restricted range (21 to 100 occurrences, or 3,000 to 10,000 individuals).
G/S4	Apparently secure globally/state, though it may be quite rare in parts of its range, especially at the periphery. Usually more than 100 occurrences and 10,000 individuals.
G/S5	Demonstrably secure globally/state, though it may be quite rare in parts of its range, especially at the periphery.
G/SX	Presumed extinct globally, or extirpated within the state.
G#?	Indicates uncertainty about an assigned global rank.
G/SU	Unable to assign rank due to lack of available information.
GQ	Indicates uncertainty about taxonomic status.
G/SH	Historically known, but usually not verified for an extended period of time.
G#T#	Trinomial rank (T) is used for subspecies or varieties. These taxa are ranked on the same criteria as G1-G5.
S#B	Refers to the breeding season imperilment of elements that are not residents.
S#N	Refers to the non-breeding season imperilment of elements that are not permanent residents. Where no consistent location can be discerned for migrants or non-breeding populations, a rank of SZN is used.
SZ	Migrant whose occurrences are too irregular, transitory, and/or dispersed to be reliably identified, mapped, and protected.
SA	Accidental in the state.
SR	Reported to occur in the state but unverified.
S?	Unranked. Some evidence that species may be imperiled, but awaiting formal rarity ranking.

Note: Where two numbers appear in a state or global rank (for example, S2S3), the actual rank of the element is uncertain, but falls within the stated range.

Table 3. Element Occurrence Ranks and their Definitions.

A	Excellent viability.
B	Good viability
C	Fair viability.
D	Poor viability.
H	Historic: known from historical record, but not verified for an extended period of time. In plants this is typically 20 years.
X	Extirpated (extinct within the state).
E	Extant: the occurrence does exist but not enough information is available to rank.

Table 4. Federal and State Agency Special Designations for Rare Species as they relate to plants.

Federal Status:	
1. U.S. Fish and Wildlife Service (58 Federal Register 51147, 1993) and (61 Federal Register 7598, 1996)	
LE	Listed Endangered: defined as a species, subspecies, or variety in danger of extinction throughout all or a significant portion of its range.
E (S/A)	Endangered: treated as endangered due to similarity of appearance with listed species.
LT	Listed Threatened: defined as a species, subspecies, or variety likely to become endangered in the foreseeable future throughout all or a significant portion of its range.
P	Proposed: taxa formally proposed for listing as Endangered or Threatened (a proposal has been published in the Federal Register, but not a final rule).
C	Candidate: taxa for which substantial biological information exists on file to support proposals to list them as endangered or threatened, but no proposal has been published yet in the Federal Register.
2. U.S. Forest Service (Forest Service Manual 2670.5) (noted by the Forest Service as "S")	
FS	Sensitive: those plant and animal species identified by the Regional Forester for which population viability is a concern as evidenced by: Significant current or predicted downward trends in population numbers or density. Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.
3. Bureau of Land Management (BLM Manual 6840.06D) (noted by BLM as "S")	
BLM	Sensitive: those species found on public lands designated by a State Director that could easily become endangered or extinct in a state. The protection provided for sensitive species is the same as that provided for C (candidate) species.

Element Occurrences and their Ranking

Actual locations of elements, whether they are single organisms, populations, or plant associations, are referred to as element occurrences. The element occurrence is

considered the most fundamental unit of conservation interest and is at the heart of the Natural Heritage Methodology. To prioritize element occurrences for a given species, an element occurrence rank (EO-Rank) is assigned according to the ecological quality of the occurrences whenever sufficient information is available. This ranking system is designed to indicate which occurrences are the healthiest and ecologically the most viable, thus focusing conservation efforts where they will be most successful. The EO-Rank is based on three factors:

Size – a measure of the area or abundance of the element's occurrence, relative to other known, and/or presumed viable, examples. Takes into account factors such as area of occupancy, population abundance, population density, population fluctuation, and minimum dynamic area (which is the area needed to ensure survival or re-establishment of an element after natural disturbance).

Condition/Quality – an integrated measure of the composition, structure, and biotic interactions that characterize the occurrence. This includes factors such as reproduction, age structure, biological composition (such as the presence of non-native versus native species), structure (for example, canopy, understory, and ground cover in a forest community), and biotic interactions (such as levels of competition, predation, and disease).

Landscape Context – an integrated measure of two factors: the dominant environmental regimes and processes that establish and maintain the element, and connectivity. Dominant environmental regimes and processes include herbivory, hydrologic and water chemistry regimes (surface and groundwater), geomorphic processes, climatic regimes (temperature and precipitation), fire regimes, and many kinds of natural disturbances. Connectivity includes such factors as a species having access to habitats and resources needed for life cycle completion, fragmentation of ecological associations and systems, and the ability of the species to respond to environmental change through dispersal, migration, or re-colonization.

Each of these factors is rated on a scale of A through D, with A representing an excellent grade and D representing a poor grade. These grades are then averaged to determine an appropriate EO-Rank for the occurrence. If not enough information is available to rank an element occurrence, an EO-Rank of E is assigned. EO-Ranks and their definitions are summarized in Table 3.

METHODS

Collect Available Information

CNHP's BIOTICS database was searched for records of biologically significant plant and animal species and plant communities within the analysis area. Geographic Information System (GIS) data layers were used to analyze spatial relationships between elements, land use, and other biotic and abiotic data. Colorado Natural Heritage Program data were searched for occurrences of plants and natural communities that are known from the study area.

Field Surveys and Documentation

CNHP botanists surveyed project footprint areas using a rapid ecological assessment (see section on Natural Heritage methodology). All project footprint areas to be surveyed by CNHP were searched for target plant species (Table 5) and plant communities (Table 6) during phenologically appropriate times. Total survey effort included approximately 60 hours on site by two CNHP botanists (Jill Handwerk and David G. Anderson). Photos were taken of all activities to document travel routes, target species, and project footprints. Please see Appendix B for descriptions of all photos taken at Winter Park Resort, which are included on the CD that accompanies this report.

All travel routes were marked using field GPS units. Two recreation-grade Garmin GPS units were used by the field crew (a Garmin 12 and a Garmin Vista), and data were gathered in NAD 27 CONUS Datum. The Garmin Vista GPS unit is Wide Area Augmentation System (WAAS) capable, and this feature was enabled during the project to enhance data accuracy and integrity. WAAS, a differential correction system developed by the Federal Aviation Administration, produces results of less than 3 meters of error 95% of the time. However, in mountainous terrain where there are no beacons nearby, WAAS is far less effective. Without differential correction or WAAS, recreation-grade GPS units are generally accurate to within 20 meters, but field trials performed by CNHP found that Garmin GPS units are accurate to within 5 meters most of the time. Electronic data from the GPS units were downloaded and converted to ArcView shapefiles.

The overall viability of each target plant population relative to others of the same element was estimated by rating the size, condition, and landscape context of the community. These factors are combined into an element occurrence rank, which is useful in refining conservation priorities. (*See the previous section on Natural Heritage Network for more about element occurrence ranking*). A qualitative assessment of species composition, structural diversity of vegetation, vegetation volume, soil and hydrological disturbance, and nearby and/or on-site land use was used to assess viability or integrity.

Table 5. Rare plant species targets for field surveys of project footprints at Winter Park Resort.

Species	**Notes**
Aralia nudicaulis	
Armeria maritima ssp. *sibirica*	
Astragalus leptaleus	
Botrychium lineare	
Botrychium species	any encountered (identification to species if readily possible; will distinguish *B. lineare* from others)
Carex diandra	
Carex leptalea	
Carex livida	
Comarum palustre	
Cypripedium fasciculatum	
Draba exunguiculata	
Draba grayana	
Drosera rotundifolia	
Eriogonum exilifolium	
Eriophorum altaicum var. *neogaeum*	
Eriophorum gracile	
Eutrema penlandii	
Festuca hallii	
Goodyera repens	
Ipomopsis aggregata ssp. *weberi*	
Kobresia simpliciuscula	
Listera borealis	
Listera convallarioides	
Lycopodium species	any encountered (identification to species if readily possible)
Malaxis monophyllos ssp. *brachypoda*	
Mimulus gemmiparus	
Parnassia kotzebuei	
Pyrola picta	
Ranunculus karelinii (R. gelidus ssp. *grayi)*	
Rubus arcticus ssp. *acaulis*	
Salix candida	
Salix serissima	
Sphagnum species	any encountered (identification to species if readily possible)
Utricularia minor	

Table 6. Potential plant community targets for Winter Park Resort. For plant communities ranked G4 or G5, only the best representative in a given county is tracked by CNHP.

Global Scientific Name	Common Name	Global Rank	State Rank
BETULA NANA / MESIC FORBS - MESIC GRAMINOIDS SHRUBLAND	Subalpine Riparian Shrubland	G3G4	S3
CAREX RUPESTRIS - GEUM ROSSII HERBACEOUS VEGETATION	Alpine Meadows	G4	S4
DESCHAMPSIA CAESPITOSA - GEUM ROSSII HERBACEOUS VEGETATION	Mesic Alpine Meadows	G5	S5
KOBRESIA MYOSUROIDES - GEUM ROSSII HERBACEOUS VEGETATION	Alpine Meadows	G5	S5
PARONYCHIA PULVINATA - SILENE ACAULIS DWARF - SHRUBLAND	Alpine Fellfields	G5	S5
SALIX ARCTICA / GEUM ROSSII DWARF SHRUBLAND	Alpine Willow Scrub	G4	S4?
SALIX PLANIFOLIA / CAREX AQUATILIS SHRUBLAND	Subalpine Riparian Willow Carr	G5	S4
SALIX WOLFII / CAREX AQUATILIS SHRUBLAND	Subalpine Riparian Willow Carr	G4	S3

Botanical Survey of Parsenn Peak

This area was walked extensively for approximately three hours each by two botanists on August 9, 2004. The slopes were traversed walking slowly and the targeted plant species and natural communities were sought. All *Draba* species found were identified to species. A partial species list was made. GPS was used to mark the route traveled (Figure 5).

Botanical Survey of Backside Parsenn Peak Improvement Area (Area G)

This area was walked extensively for approximately four hours each by two botanists on August 9, 2004. The slopes were traversed walking slowly and the targeted plant species and natural communities were sought. Survey efforts were made on the western and eastern margins of Area G, but survey efforts were most intensive in the lower portion of Area G which had not been closely scrutinized by other crews. Locations of target species and other noteworthy plant species were documented using GPS and element occurrence record field forms were filled out for target species. A partial species list was made. GPS was also used to mark the route traveled (Figure 6).

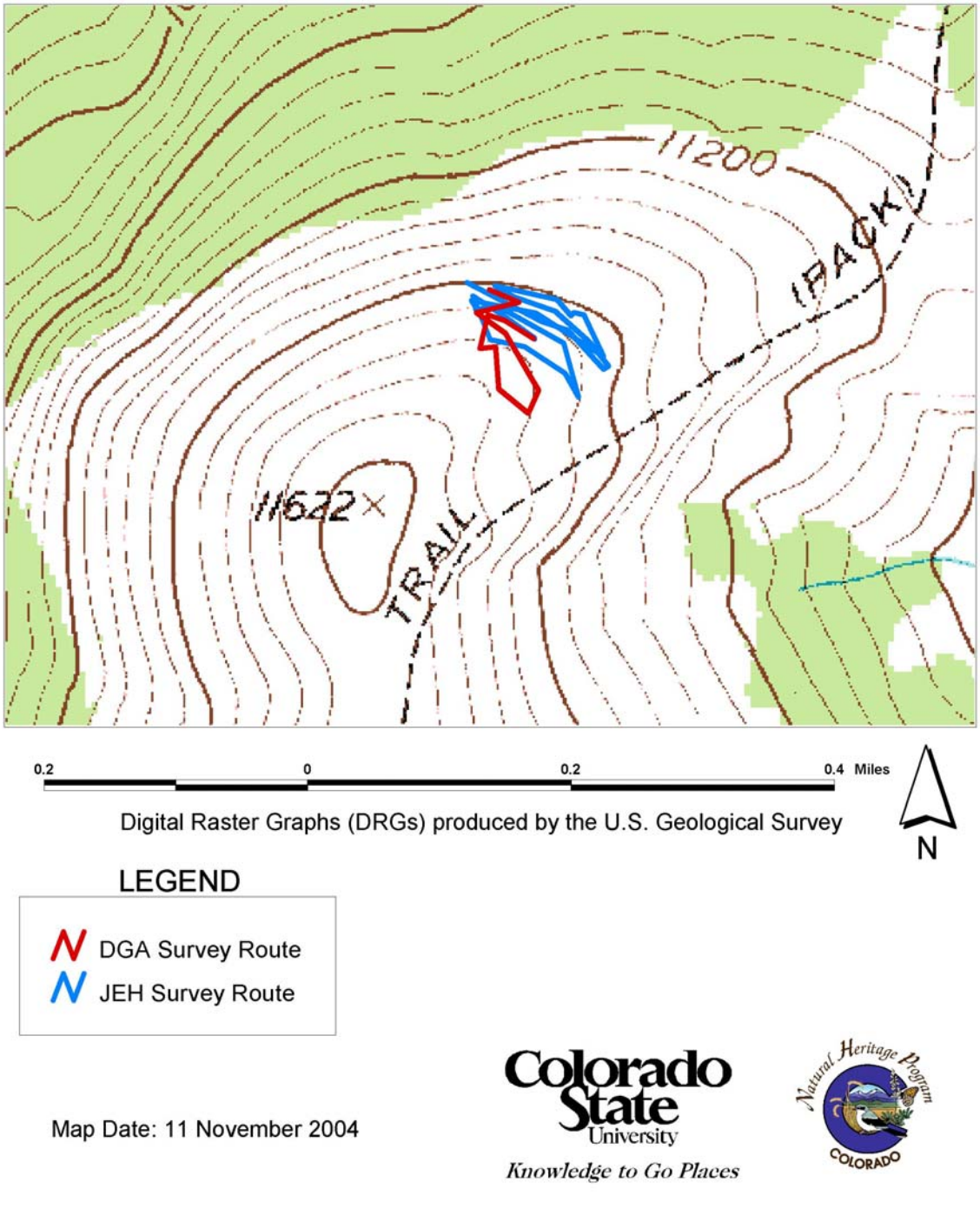

Figure 5. Survey routes within the alpine area of Parsenn Peak potentially affected by new chairlift installation.

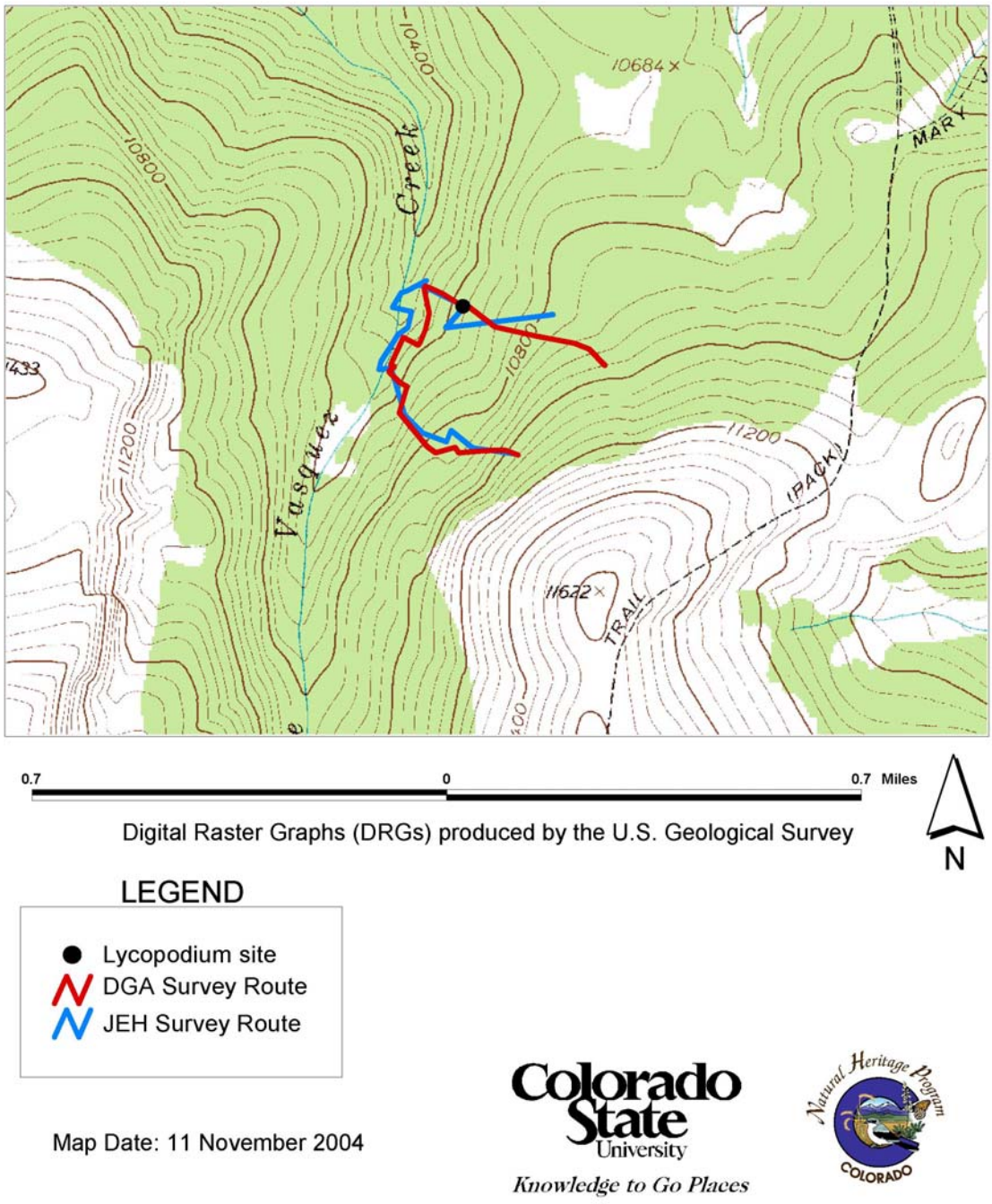

Figure 6. Survey routes within Area G, focusing on the lower portions of this area that remained unsurveyed.

Botanical Survey of the Area Affected by Proposed Summit Express Chairlift Replacement

The entire area to be impacted by the proposed replacement of the Summit Express Chairlift was surveyed for the presence of target species and natural communities (Figure 7). The area of potential impact had been flagged, indicating the edge of the proposed forest removal. The affected areas consisted of 15 foot-wide strips on either side of the existing cut area adjacent to the chairlift. One surveyor walked on each side in the affected area (David G. Anderson to the left of the fall line and Jill Handwerk to the right of the fall line). Because the affected area was very narrow, each surveyor was able to thoroughly search the area in a single pass. A short spur that will connect two ski runs was located about halfway down the slope and was also surveyed.

Timed Moonwort (*Botrychium* ssp.) Surveys

Timed moonwort surveys were conducted at 34 locations throughout Winter Park Resort (Figure 8). At each location, moonworts were sought for 10 minutes by two botanists. At the Summit Express Chairlift Replacement project area, each location was searched by one botanist; all other locations were searched by two botanists. During the visit to each location, the botanist(s) walked slowly in a bent-over position or on hands-and-knees. The area within a radius of approximately 10 meters was searched at each location, with each botanist covering about half of the area moving very slowly throughout the 10-minute duration. A GPS point was obtained at each location and the locational accuracy of the point was documented.

Documentation of Selected Noxious Weeds

Six noxious weed species were targeted within the Winter Park Resort (Table 7). At each weed population, its precise location was determined using GPS (Figure 9). Scientific name, observation date, observer names and affiliation, GPS point name, estimated accuracy, estimated number of individuals or ramets, estimated occupied acreage, phenology at time of observation, and presence of any rare plants was documented at each weed location.

Fraser Valley Peatland Survey

The proposed Fraser Pipeline and Pond project would result in the creation of a six-acre holding pond in the Discovery Park area to hold water from the Fraser River for snowmaking activities. The creation of this pond would result in the destruction of a fen. Because fens require thousands of years to develop and are irreplaceable, the U.S. Forest

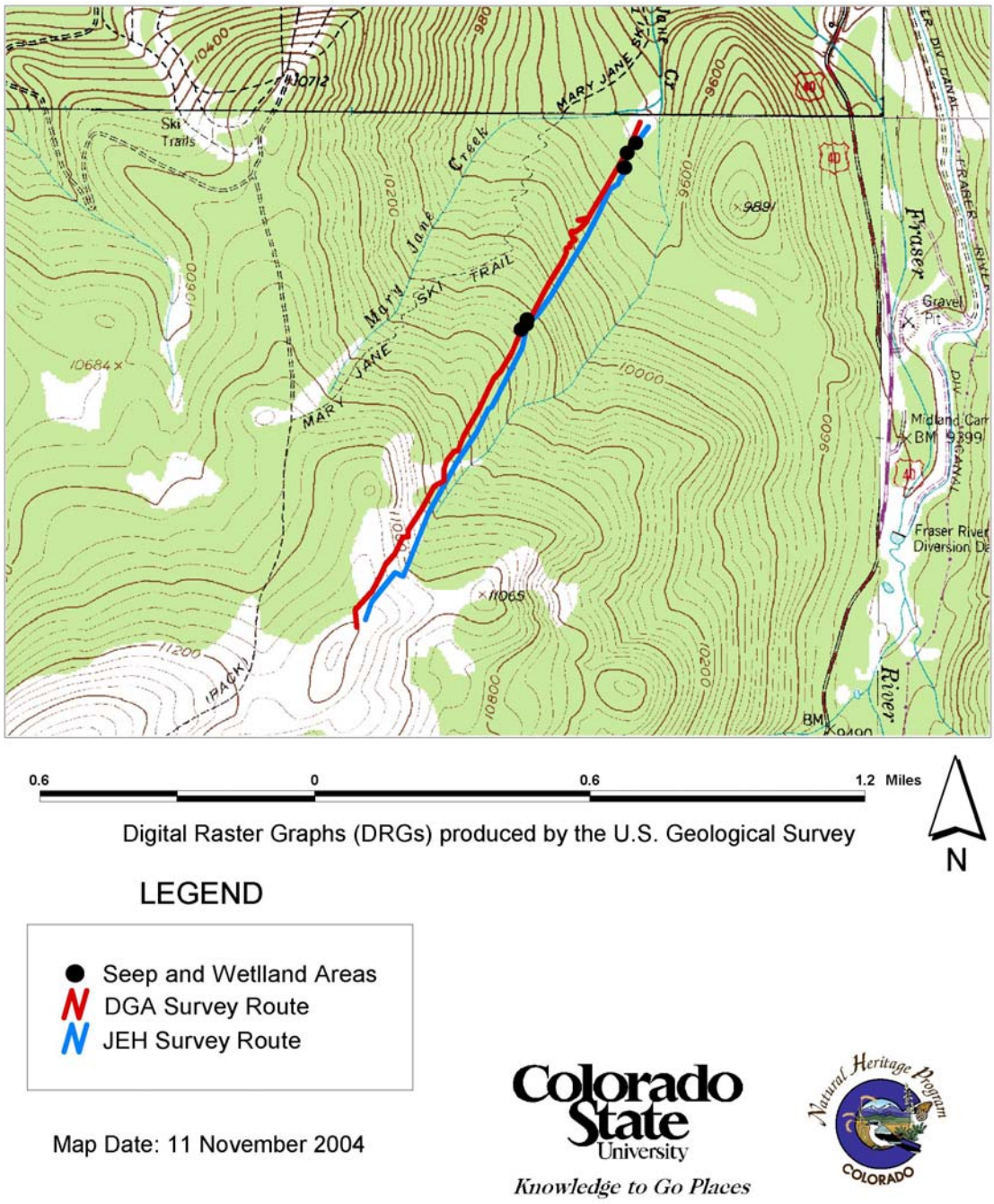

Figure 7. Survey routes within the project footprint of the Summit Express Chairlift replacement.

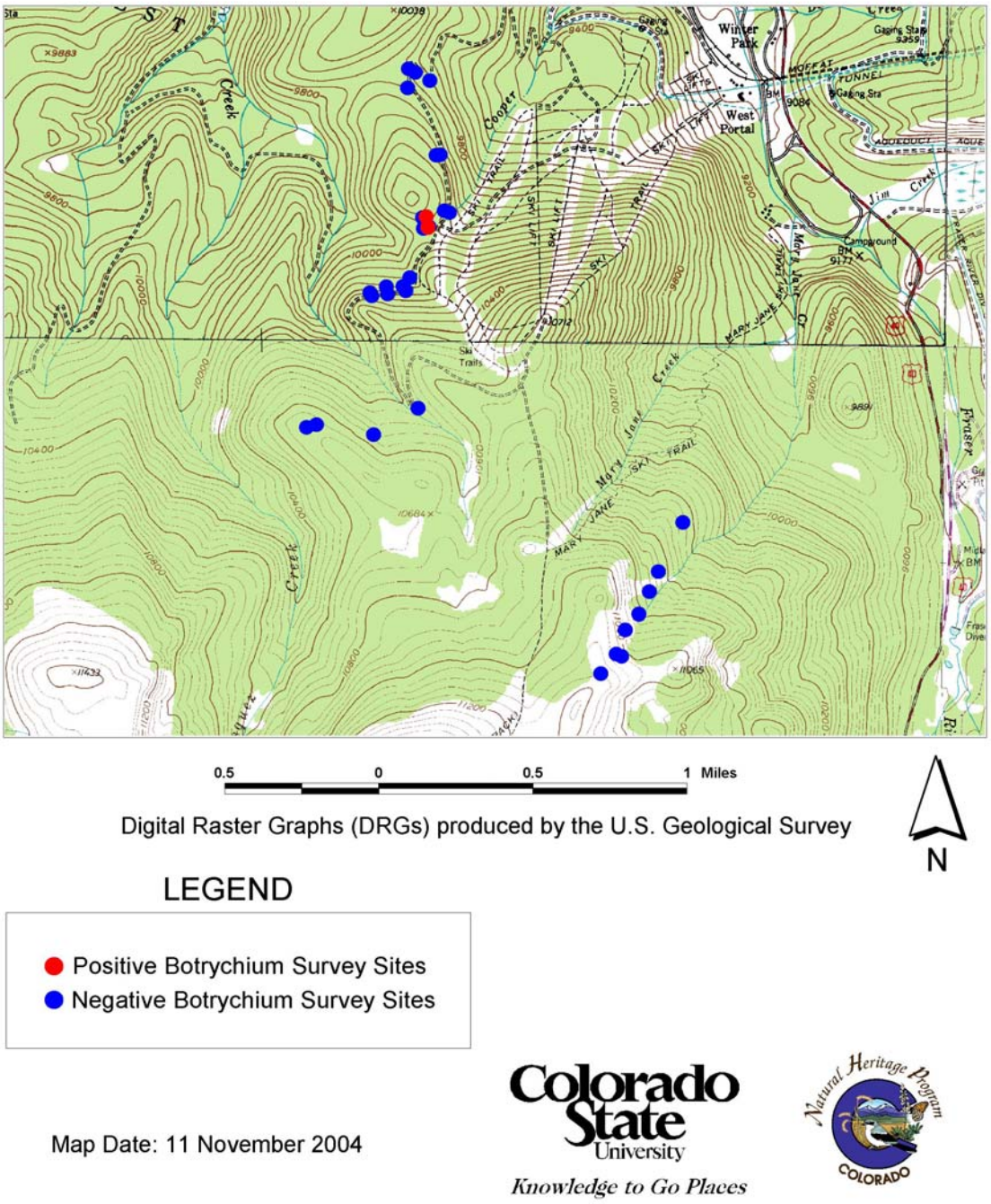

Figure 8. Locations of timed moonwort (*Botrychium* spp.) surveys at Winter Park Resort.

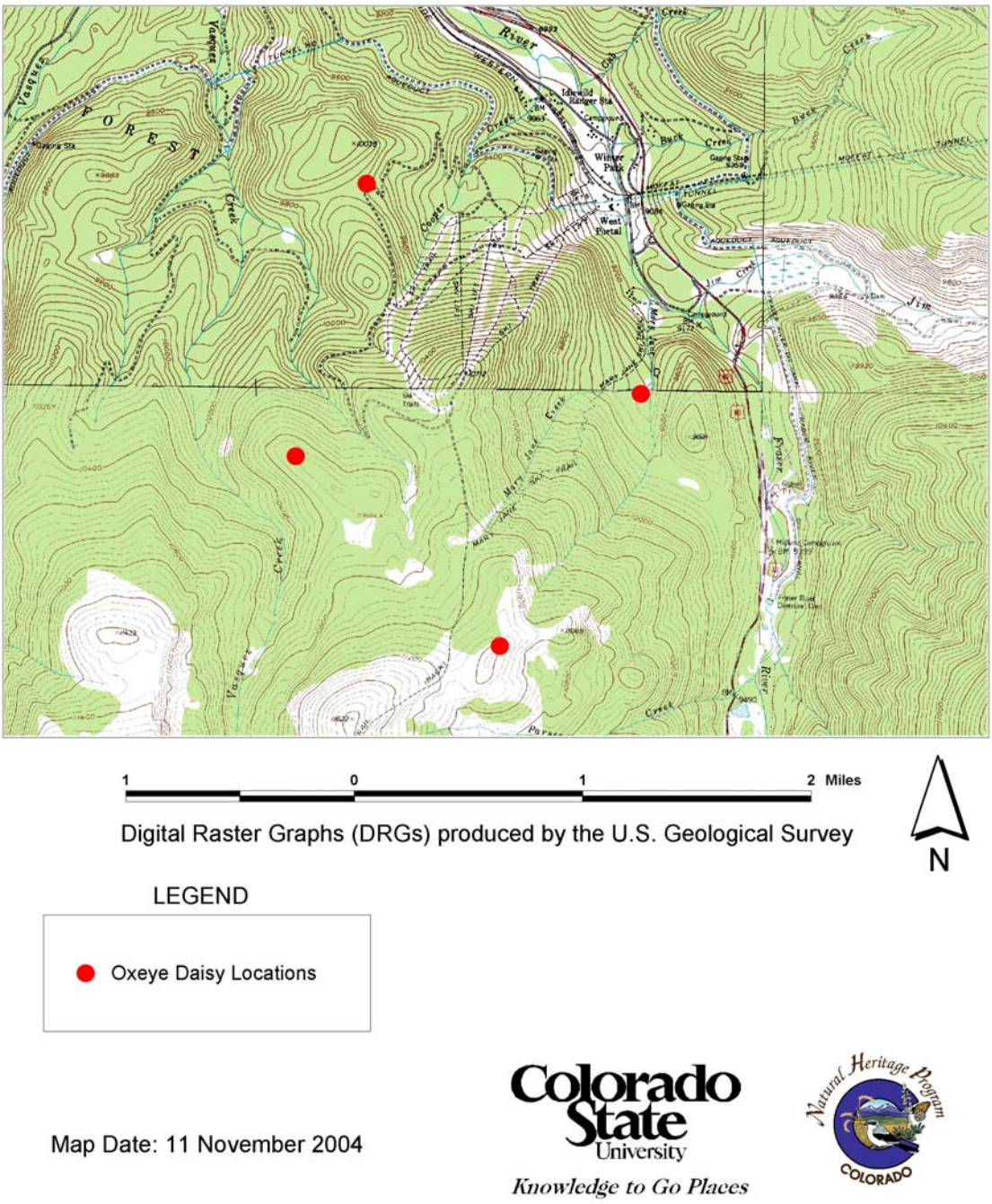

Figure 9. Locations of oxeye daisy (*Chrysanthemum leucanthemum*) identified during the survey of Winter Park Resort by the Colorado Natural Heritage Program. No other target weed species were found within the study area.

Table 7. Weed species targets for field surveys by CNHP at Winter Park Resort.

Scientific Name	Common Name	Notes
Linaria vulgaris	yellow toadflax	presence probable
Chrysanthemum leucanthemum	oxeye daisy	presence known at lower elevations
Cirsium arvense	Canada thistle	presence known at lower elevations
Anthemis cotula	mayweed chamomile	presence probable
Matricaria perforata	scentless chamomile	presence probable
Hieracium aurantiacum	orange hawkweed	presence probability low but suspected

Service requested that efforts be made to identify other similar fens in the Fraser Valley. It was thought that if other similar fens were found, the loss of the fen in Discovery Park would not result in the loss of the only known peatland in the area. Therefore, after assessment of the Discovery Park fen, an extensive survey of the Fraser River Valley was conducted on August 11, 2004 to attempt to identify other similar fens (Figure 10). Due to the limited scope of this survey it was not comprehensive and more survey work is needed.

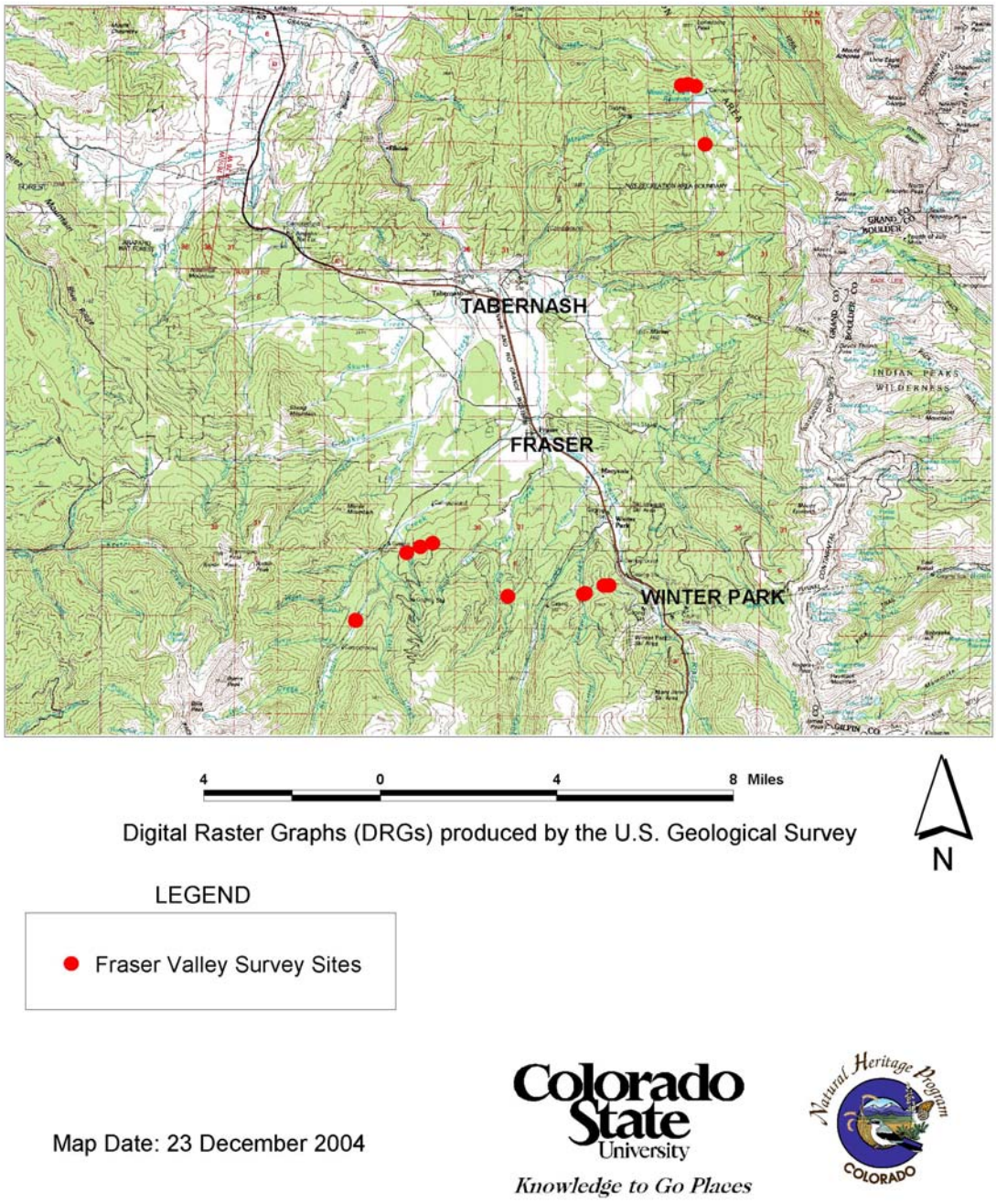

Figure 10. Extensive surveys of Grand County conducted by the Colorado Natural Heritage Program, targeting potential peatlands in the greater Fraser River Valley, in the vicinity of Winter Park Resort.

RESULTS

Two rare plant targets (*Lycopodium annotinum* and *Botrychium* species) were documented at Winter Park Resort within proposed project areas. Element occurrence records (EORs) were documented for *Botrychium echo* and *B. hesperium* at the Prospector chairlift site. Collections were made of *Lycopodium annotinum* at two locations (Table 8), one of which was within the Winter Park Resort permit boundary. Due to the small population size of the populations of *Botrychium* species at Winter Park Resort, collections were not made. The legal descriptions and other element occurrence data are found in the element occurrence records provided in Appendix C. Two potentially sensitive wetland sites were identified within the project footprint of the Summit Express Chairlift replacement.

Table 8. Plant specimens collected.

Collector	Collection #	Species	Repository
David G. Anderson	04-01	*Lycopodium annotinum*	COLO
David G. Anderson	04-02	*Lycopodium annotinum*	COLO

Botanical Survey of Parsenn Peak

The northeast facing upper slope of Parsenn Peak supports many common alpine species typical of the alpine fellfield ecological system (Rondeau 2001) (Figure 2). These include twinflower sandwort (*Minuartia obtusiloba*), sulphur indian paintbrush (*Castilleja sulphurea*), old man of the mountain (*Tetraneuris grandiflora*), Ross' avens (*Geum rossii* var. *turbinatum*), eight petal mountain avens (*Dryas octopetala*), and spearleaf stonecrop (*Sedum lanceolatum*). Krumholz and wolf trees of Engelmann spruce (*Picea engelmannii*) occur in sheltered areas of leeward slopes. No rare plant target species were found at Parsenn Peak. Two *Draba* species, *D.* c.f. *aurea* and *D. streptocarpa*, were observed within the project footprint.

Botanical Survey of Backside Parsenn Peak Improvement Area (Area G)

The lower slopes of Parsenn Peak above Vasquez Creek support forests dominated by subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*), with some lodgepole pine (*Pinus contorta*) (Figure 3). Near treeline the forest canopy is open with short (approximately 20 to 30 feet tall) trees. The understory is dominated by common subalpine forest species including whortleberry (*Vaccinium myrtillus*), sickle top lousewort (*Pedicularis racemosa*), and common juniper (*Juniperus communis*).

Near Vasquez Creek the canopy is nearly closed and tree density is greater. The age structure of the forest is diverse with much successful recruitment. Whortleberry (*Vaccinium myrtillus*) remains a dominant understory species but it is joined by a greater diversity of herbaceous perennials including heart-leaved arnica (*Arnica cordifolia*).

One occurrence of stiff clubmoss (*Lycopodium annotinum*) was discovered during this survey (Figure 6, Figure 11). *Lycopodium* species were included among the targets for this Botanical Survey (Table 5). Approximately 400 to 500 stems were found within an area of approximately 20 by 10 meters, creeping on rocks, under a rotten log, and through vegetation. The occurrence is near the proposed lift alignment near the eastern edge of the project footprint, near the proposed chairlift alignment, at 10,744 feet elevation. Associated species observed at this occurrence were *Vaccinium myrtillus,* heart leaved twayblade (*Listera cordata* ssp. *nephrophylla*), and lodgepole pine (*Pinus contorta*). Please see Figure 6 for the location of this occurrence, and Appendix C for element occurrence data associated with this occurrence.

One orchid species, heart leaved twayblade (*Listera cordata* ssp. *nephrophylla*), was found at several locations throughout the lower portion of Area G. While this is not a target species, it is noted here due to its potential sensitivity to modifications of its habitat such as canopy thinning. It was found in seepy areas and in small mossy swales where it grew preferentially in heavily shaded environments. Approximately 550 individuals were observed at nine locations, with approximately 300 of these at the ninth location. These sites are included among the raw data supplied to Winter Park Resort but are not included on the maps in this report.

The western portion of the project footprint is bounded roughly by a small, apparently perennial stream that had been delineated with wetland flags prior to this survey. It supports a rich carpet of obligate and facultative wetland/ riparian plant species including arrowleaf ragwort (*Senecio triangularis),* chiming bells (*Mertensia ciliata*), and brook saxifrage (*Saxifraga odontoloma*).

Botanical Survey of the Area Affected by Proposed Summit Express Chairlift Replacement

The upper slopes of the project footprint for the proposed Summit Express Chairlift Replacement support open subalpine forest with whortleberry (*Vaccinium myrtillus*) dominating the understory (Figure 4). Other taxa observed include *Pedicularis racemosa, Arenaria* c.f. *fendleri, Solidago* sp., *Achillea lanulosa,* and *Festuca* sp. Smooth brome (*Bromus inermis*) is common along roadcuts in the area. At lower elevations, the canopy becomes more closed and the trees are larger, with a greater prevalence of lodgepole pine (*Pinus contorta*). Pachystima (*Pachystima myrsinites*) and Oregon grape (*Mahonia repens*) were not seen above 10,050 feet in this area.

No plant species targets were found in surveys of this area. However, two sensitive locations were identified where proposed modifications may have a negative impact. The first area is a small seep on the northeast side of the existing chairlift (Figure 7, Figure 12). The seep has created a small wetland complex that supports many obligate and facultative wetland species including arrowleaf ragwort (*Senecio triangularis*), water sedge (*Carex aquatilis*), scentbottle (*Limnorchis dilatata*), bluejoint (*Calamagrostis canadensis*), five stamen mitrewort (*Mitella pentandra*), and elephantella (*Pedicularis groenlandica*). Several species of mosses and a thalloid liverwort (*Marchantia* sp.) are abundant among rotting logs that have fallen into the wetland. However, no *Sphagnum* species were observed.

Figure 11. Stiff club moss (*Lycopodium annotinum*) in Area G.

Figure 12. A small wetland within the footprint of the Summit Express Chairlift replacement project. The water source for this wetland is a small seep that emerges just below the tree at the upper right. The small trees behind the wetland probably discourage heavy summer use of this area. This wetland would be degraded by summer recreation activities if traversed by mountain bikes or foot traffic.

Another wetland area was noted at the bottom of this slope northwest of the chairlift terminal (Figure 7). Wetland species noted at this location include bog birtch (*Betula glandulosa*), plane leaf willow (*Salix planifolia*), hooded ladies' tresses (*Spiranthes romanzoffiana*), and elephantella (*Pedicularis groenlandica*).

Timed Moonwort (*Botrychium* ssp.) Surveys

No new occurrences of moonworts (*Botrychium* species) were identified as a result of timed moonwort surveys by CNHP. A previously identified occurrence of moonworts near the Prospector Chairlift terminal (Figure 13-16) was visited on two occasions to obtain a gestalt of suitable habitat at Winter Park Resort and to document the occurrence for inclusion in CNHP's comprehensive database of element occurrence records (BIOTICS).

Approximately 50 individuals were observed at Prospector Lift, belonging to at least three moonwort species. Attempts were made to identify the moonwort species present at Prospector Lift. *Botrychium* species are notoriously difficult to identify, and expert assessment is usually needed to positively identify them. At least two individuals at Prospector Lift are *Botrychium lanceolatum* (Figure 14). Others appear to be *B. echo* (Figure 15) and *B. hesperium* (Figure 16). Associated species include white clover (*Trifolium repens*), goldenrod (*Solidago* sp.), Rocky Mountain fescue (*Festuca* c.f. *saximontana*), and pussytoes (*Antennaria* sp.). Please see Appendix C for the complete element occurrence record for this location.

Apparently suitable moonwort habitat was observed at many locations, but as has been abundantly noted by many experts, moonworts are often absent from what appears to be highly suitable habitat (Johnson-Groh and Farrar 2003). Areas where the tempo and timing of disturbance appeared appropriate for supporting populations of moonworts were specifically targeted in the survey efforts. Moonwort "indicator species" were observed at many timed survey locations. These include tall blacklip ragwort (*Senecio atratus*), white clover (*Trifolium repens*), strawberry (*Fragaria* sp.), dwarf goldenrod (*Solidago simplex* var. *nana*), and young lodgepole pine (*Pinus contorta*).

Documentation of Selected Noxious Weeds

Only one target weed species, oxeye daisy (*Chrysanthemum leucanthemum*) was found within Winter Park Resort (Figure 17). Four occurrences of this species were located and mapped during this survey (Figure 9). Please see Appendix D for the complete tabular dataset collected for this portion of the survey.

The largest population of *Chrysanthemum leucanthemum* was found at the base of the Summit Express chairlift. It appears that the chairlift has led to the dispersal of this species from the bottom of this chairlift to its terminus upslope, where another population of *C. leucanthemum* was found.

Fraser Valley Peatland Survey

Twelve locations were visited throughout the Fraser Valley in Grand County to assess their merits relative to the Discovery Park Fen. These sites were selected based on topography, physiography, hydrology, and species composition. Due to time limitations, these sites were situated near roads where they could be accessed quickly. During this brief survey no wetlands that meet the definition of a fen were identified within the Fraser Valley. Please see Appendix A for the defining characteristics of montane fens.

Figure 13. The Prospector Chairlift Moonwort site. Juvenile lodgepole pines (*Pinus contorta*) often occur in populations of moonworts.

Figure 14. *Botrychium lanceolatum* at the Prospector Chairlift site.

Figure 15. *Botrychium echo* (identification somewhat tentative) at the Prospector Chairlift site.

Figure 16. *Botrychium hesperium* (identification somewhat tentative) at the Prospector Chairlift site.

Figure 17. Oxeye daisy (*Chrysanthemum leucanthemum*) at the upper terminal of the Summit Express Chairlift.

RECOMMENDATIONS

Botanical Survey of Parsenn Peak

There are no recommendations to offer with respect to this project footprint, since no target species, plant communities, or sensitive resources were located.

Botanical Survey of Backside Parsenn Peak Improvement Area (Area G)

Forest thinning in the lower portions of Area G is likely to result in changes to the species composition of the forest floor. Greater insolation will lead to drier soil moisture conditions and will favor species that thrive in full sun at the expense of species that prefer shade conditions. This is readily observed on many ski runs where species such as whortleberry (*Vaccinium myrtillus*), which has a relatively broad tolerance amplitude for light conditions, often dominates the understory. Although it is not among the target species, heartleaf twayblade (*Listera cordata* ssp. *nephrophylla*) is among the species that is not likely to persist under more open canopy conditions.

Avoidance of the identified target in this project footprint (stiff clubmoss, *Lycopodium annotinum*) is likely to help ensure its persistence. Shading from trees probably helps maintain the high soil moisture levels required by this species (Hornbeck et al. 2003). Thus it is likely that thinning or removal of trees that provide shade to this occurrence is likely to have negative impacts.

Avoidance of the small creek that roughly follows the western boundary of Area G during forest thinning will also help to maintain the integrity of this small riparian corridor and prevent excessive erosion.

Botanical Survey of the Area Affected by Proposed Summit Express Chairlift Replacement

Two small wetlands within this project footprint are sensitive to the proposed habitat modifications. At the seep on the slope, leaving the existing trees around the wetland perimeter would probably adequately discourage excessive impacts to the site while limiting anthropogenic disturbance of this wetland.

The wetland on the toeslope of this chairlift alignment already contains few trees, but appears vulnerable to impacts from heavy equipment that may be used in upgrading this chairlift. Disturbance of this wetland may alter its hydrology and encourage the spread of non-native species. Orchard grass (*Dactylis glomerata*) and timothy (*Phleum pratense*) are both present in portions of the wetland, and disturbance is likely to augment their spread.

Timed Moonwort (*Botrychium* ssp.) Surveys

Because no new moonwort occurrences were identified as a result of CNHP's timed moonwort surveys, recommendations are limited to the previously discovered occurrence at the Prospector Chairlift. There has been much consideration of appropriate management protocols for *Botrychium* species, due to their rarity and concern for their viability. Federal agencies including the USDA Forest Service have shown increased interest in these species but much work remains to be done in determining appropriate management protocols for *Botrychium* species. It appears that maintaining habitat in an open condition is the most prudent management decision until more is known about the impact of succession to a closed canopy (Johnson-Groh and Farrar 2003). Removal of woody species when the ground is frozen would minimize the risk to sporophytes and gametophytes, since the soil would be less vulnerable to disturbance. Mitigating recreation impacts to *Botrychium* species at Prospector Chairlift may be needed. This population is particularly vulnerable to impacts resulting from summer recreation use of ski slopes by mountain bikers or hikers. Temporary exclosures erected in the summer may prevent some impacts from inadvertent visits to this site by resting cyclists, picnicers, or other visitors. Installation of pipelines for snowmaking equipment or other underground utilities is likely to be detrimental to these plants if these pass through this site. There have been some recent attempts to transplant moonworts (e.g., ERO Resources Corporation 2003), but it is not yet known if moonworts can survive transplanting. Limited available data suggest that it is extremely unlikely that moonworts can survive transplanting (Cody and Britton 1989).

Beneficial management actions and general management guidelines for *Botrychium echo* and *B. hesperium* are reviewed in Anderson and Cariveau (2004a) and Anderson and Cariveau (2004b).

Documentation of Selected Noxious Weeds

All four populations of oxeye daisy (*Chrysanthemum leucanthemum*) found in 2004 appear to be fairly discrete at this time and could probably be eradicated or managed effectively. There is some risk of damage to the adjacent wetland at the base of the Summit Express Chairlift if herbicide is not administered discretely. Disturbance from replacing the Summit Express Chairlift is likely to facilitate the spread of oxeye daisy and other weeds into new locations. This can be mitigated to some extent by minimizing travel by heavy equipment from existing weed populations into newly disturbed areas, and by monitoring the project footprint area after completion of the project for any newly established weed populations, followed by treatment.

Fraser Valley Peatland Survey

Consideration of alternatives that do not impact the fen at Discovery Park appears warranted based on the results of surveys at Winter Park Resort in 2004 and on literature and research on fens in Colorado and elsewhere. Fens, which are formed by stable

discharge of groundwater, are one of Colorado's rare wetland types. They require wet, anaerobic soils, carbon accumulation from vigorous plant growth, low soil temperatures, and thousands of years to form their characteristic organic soils. Fens form rich islands of biodiversity and unique habitats in the typically dry conditions of the Rocky Mountains. They can harbor rare plants and animals and/or disjunct plants (Johnson 2000). Restoration of fens is thought to be difficult or impossible due to their reliance on groundwater and snowmelt sources (Windell et al. 1986). Due to their rarity and status as a non-renewable resource, the U.S. Fish and Wildlife Service has placed fens in Resource Category One, which requires "no loss of habitat value." Fens are delicate systems that form *in situ* over thousands of years, requiring highly stable conditions. Once damaged, recovery is slow and the resulting hydrologic alterations may result in permanent degradation (Johnson 2000). As with old-growth forests, restoration of fens is not possible within a management timeframe. Regionwide, the quality and availability of subalpine-montane wetland and fen habitat has declined due to fragmentation, hydrologic alteration, and edge effects that decrease the quality of small patches of natural vegetation. In Colorado alone, an estimated 1 million acres of wetlands (including fens and subalpine wetlands) (50% of the total for the state) were lost prior to 1980 (Dahl 1990). Since 1986, wetlands have been lost at a rate of 58,500 acres/year in the continental U.S. (Dahl 2000).

BIOGRAPHIES

DAVID G. ANDERSON is a botanist with the Colorado Natural Heritage Program (CNHP). Mr. Anderson's work at CNHP includes inventory and mapping of rare plants throughout Colorado, mapping weeds, maintaining and updating CNHP's database, and writing reports on the rare plants of Colorado. He has worked with CNHP since 1999. Much of Mr. Anderson's prior experience comes from five years of fieldwork studying the flora and ecosystem processes of the Alaskan and Canadian Arctic. Mr. Anderson also served in the Peace Corps as a science teacher in the Solomon Islands from 1996 to 1998. Mr. Anderson received his B.A. in Environmental, Populational, and Organismic Biology from the University of Colorado, Boulder (1991) and his M.S. in Botany from the University of Washington, Seattle (1996).

JILL E. HANDWERK is the Botany Information Manager at the Colorado Natural Heritage Program (CNHP). Ms. Handwerk maintains the database for over 500 species of rare and imperiled plants occurring in Colorado. In addition she has done inventory work on rare plants and weeds throughout Colorado. She has worked with CNHP since 1996. Ms. Handwerk brings with her a diverse background and long involvement in the botanical community. She worked in the landscape industry for over ten years, followed by another ten years as an assistant plant breeder for an agricultural research and development firm. Ms. Handwerk served as President of the Colorado Native Plant Society from 2000-2004. Ms. Handwerk received a B.S. degree in Horticulture from Colorado State University, Fort Collins (1977) and a Master's degree in Agriculture Business Management from California Polytechnic State University, San Luis Obispo (1983).

LITERATURE CITED

Anderson, D. and D. Cariveau. 2004a. *Botrychium hesperium* (Western Moonwort): A Technical Conservation Assessment [Online]. USDA Forest Service, Rocky Mountain Region. Available via the internet at http://www.fs.fed.us/r2/projects/scp/assessments.

Anderson, D. and D. Cariveau. 2004b. *Botrychium echo* (Reflected Moonwort): A Technical Conservation Assessment [Online]. USDA Forest Service, Rocky Mountain Region. Available via the internet at http://www.fs.fed.us/r2/projects/scp/assessments.

Anderson, M., P. Bougeron, M.T. Bryer, R. Crawford, L. Engelking, D. Faber-Langendoen, M. Gallyoun, K. Goodin, D.H. Grossman, S. Landaal, K.D. Patterson, M. Pyne, M. Reid, L. Sneddon, and A.S. Weakley. 1998. International classification of ecological communities: terrestrial vegetation of the United States. Volume II. The National Vegetation Classification System: list of types. The Nature Conservancy, Arlington, Virginia.

Cody W. J. and D.M. Britton. 1989. Ferns and Fern Allies of Canada. Research Branch Agriculture Canada, Ottawa.

Dahl, T.E. 1990. Wetlands; Losses in the United States, 1780's to 1980's. U.S. Department of the Interior, Fish and Wildlife Service. St. Petersburg, FL.

Dahl, T.E. 2000. Status and Trends Of Wetlands in the Conterminous United States 1986-1997. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C.

ERO Resources Corporation. 2003. Moonwort Transplantation- Colorado Forest Highway 80, Guanella Pass Road, Park and Clear Creek Counties, Colorado. Unpublished report prepared for the Federal Highways Administration.

Flahault, C. and C. Shroter. 1910. Rapport sur la nomenclature phytogeographique. Proceedings of the Third International Botanical Congress, Brussels 1: 131-164.

Hornbeck, J.H., D.J. Reyher, C. Sieg, and R.J. Crook. 2003. Conservation Assessment for Groundcedar and Stiff Clubmoss in the Black Hills National Forest South Dakota and Wyoming. USDA Forest Service, Rocky Mountain Region. Black Hills National Forest. Custer, SD.

Johnson, J. B. 2000. The ecology of calcareous fens in Park County, CO. Dissertation. Department of Biology, Colorado State University. Fort Collins, CO.

Johnson-Groh, C. L. and D. R. Farrar. 2003. *Botrychium* Inventory and Monitoring Technical Guide (Draft). Unpublished report for the U.S.D.A. Forest Service.

Nature Conservancy, The. 1999. An Alliance Level Classification of Vegetation of the Conterminous Western United States. Submitted to the University of Idaho, Cooperative Fish and Wildlife Research Unit.

Rondeau, R. 2001. Ecological System Viability Specifications for the Southern Rocky Mountain Ecoregion. Fort Collins, CO: Colorado Natural Heritage Program.

Wilson, E. O. 1988. Biodiversity, National Academy Press. Washington, D.C.

Windell, J.T., B.E. Willard, D.J. Cooper, C.F. Knud-Hansen, L.P. Rink, and G.N. Kiladis. 1986. An Ecological Characterization of Rocky Mountain Montane and Subalpine Wetlands. National Ecology Center, USDI, Washington, DC.

APPENDIX A: ECOLOGICAL SPECIFICATIONS FOR MONTANE FENS

SOUTHERN ROCKY MOUNTAINS ECOREGION
MONTANE FEN—SMALL PATCH

Characteristic plant associations:

Carex aquatilis Herbaceous Vegetation
Carex aquatilis - Carex utriculata Herbaceous Vegetation
Carex lasiocarpa Herbaceous Vegetation
Carex simulata Herbaceous Vegetation.
Deschampsia cespitosa Herbaceous Vegetation
Eleocharis quinqueflora Herbaceous Vegetation
Kobresia myosuroides - Thalictrum alpinum
Kobresia simpliciuscula - Scirpus pumilus
(Picea engelmannii)/Betula glandulosa/Carex aquatilis-Sphagnum angustifolium

SCALE AND RANGE: SMALL PATCH AND LIMITED

Montane fen ecological system is a small patch system confined to specific environments defined by ground water discharge, soil chemistry, and peat accumulation of at least 40 cm. This system includes extreme rich fens and iron fens, both rare within the Southern Rocky Mountains ecoregion. Fens form at low points in the landscape or near slopes where ground water intercepts the soil surface. Ground water inflows maintain a fairly constant water level year-round, with water at or near the surface most of the time. Constant high water levels lead to accumulation of organic material. In addition to peat accumulation and perennially saturated soils, the extreme rich and iron fens have distinct soil and water chemistry, with high levels of one or more minerals such as calcium, magnesium, or iron. They usually occur as a mosaic of several plant associations dominated by either *Carex aquatilis, C. utriculata, C. simulata, C. lasiocarpa, Betula glandulosa, Kobresia myosuroides, K. simpliciuscula* and *Scirpus pumilus*. Moss (*Sphagnum* spp.) is indicative of iron fens. The surrounding landscape may be ringed with other wetland systems, e.g., riparian shrublands, or a variety of upland systems from grasslands to forest. Within the Southern Rocky Mountains ecoregion, this system is limited to a few small areas, notably South Park, Mount Evans, Grand Mesa, and Iron Creek.

The montane fen ecological system is rare in the Southern Rocky Mountains ecoregion. Since this system is reliant on groundwater any disturbances that impact water quality or quantity are a threat. These treats include groundwater pumping, mining, and improper placement of septic systems.

MINIMUM SIZE: 0.5 acre

SEPARATION DISTANCES: 1) substantial barriers to natural processes or species movement, including cultural vegetation greater than ¼ mile wide, major highways, urban development, or large bodies of water. 2) natural community from a different ecological system wider than ½ mile wide, 3) major break in topography, soils, geology, etc., especially one resulting in a hydrologic break.

Justification: Primary criteria to be considered are the hydrologic system and the surrounding landscape. The separation distance for intervening natural or semi-natural communities assumes a different hydrologic regime. They are often isolated hydrologically from other wetlands, and easily impacted by surrounding land use.

RANK PROCEDURE: 1) condition, 2) landscape context, 3) size. Condition and landscape context are the primary ranking factors, with size secondary.

CONDITION SPECIFICATIONS:
A –rated condition: Natural hydrologic regime intact. No or little evidence of wetland alteration due to increased or decreased drainage, clearing, livestock grazing, mining (esp. peat mining), etc. Native species that increase with hydrologic and surface disturbance e.g., *Deschampsia cespitosa* and *Carex aquatilis* are present in typical proportions in diverse communities, rather than in expansive, low diversity stands. Non-native species are generally not a problem in fens of the Southern Rockies, and A-ranked occurrences should exemplify this pattern by having no or very few exotic species present. Roads or other antrhopogenically induced fragmentation is limited to less than 1% of the occurrence.

B- rated condition: Natural hydrologic regime nearly intact. Alteration from local drainage, upstream water diversions, groundwater pumping, haying, or livestock grazing is easily restorable by ceasing such activities. Alterations that are generally recognized as unrestorable (e.g., peat mining) may be present, but on less than 10% of the occurrence. Native species that increase with hydrologic and physical disturbance are absent, low in abundance, or very restricted. Few exotic species are present, with little potential for expansion if restoration occurs. The occurrence is virtually intact with fragmentation from roads, etc. limited to less that 3% of the occurrence.

C-rated condition: Natural hydrologic regime altered by local drainage or groundwater pumping. Alteration may be from clearing, mining or livestock grazing and may be locally severe. Native species that increase with disturbance or changes in hydrology/nutrients may be prominent, but with restoration activities diversity in these communities can potentially be enhanced.

D –rated condition: Natural hydrologic regime or disturbance not restorable. Fundamental structure of the substrate has been destroyed to such an extent that the occurrence is effectively unrestorable. System remains fundamentally compromised despite restoration of some processes. Native species that increase with disturbance or changes in hydrology/nutrients are prominent to dominant. Exotic species may be present in significant numbers.

Justification for A-rated criteria: Montane fens in the Southern Rocky Mountains depend on perennial water regime, seasonally to permanently saturated soils, and occasional flooding disturbance. A-ranked occurrences have these processes intact, with no history of alteration to the hydrology or surface structure.

Justification for C/D threshold: C-ranked occurrences have potential for restoration over several decades with significant resources. In D-ranked occurrences, hydrologic alterations and surface structure have been altered so extensively that there is little or no potential for restoration of these fundamental aspects of fens.

SIZE SPECIFICATIONS:
A – rated size: Very large (> 2 acres)
B –rated size: Large (1 to 2 acres)
C –rated size: Moderate (.5 to 1 ac)
D –rated size: Small (< .5 ac)

Justification for A-rated criteria: Fens are usually composed of mosaics of different plant associations included within this system. Very large fen complexes contain the maximum diversity of species and plant associations. Occurrences of this size would likely contain sufficient internal variability to capture characteristic biophysical gradients, natural geomorphic features, and hydrologic variation. In A-ranked occurrences, the majority of the occurrence is buffered from edge effects (e.g., cattle grazing along the edges of the wetlands) and small hydrology alterations.

Justification for C/D threshold: C-ranked occurrences generally contain moderate species and plant association diversity, and are large enough to sustain some natural or human caused perturbations. D-ranked occurrences have noticeably reduced species and plant association diversity, and are to small to remain viable with changes to the hydrology. They are also extremely susceptible to invasions by native and non-native ruderal species making them subject to loss of typical fen plant associations and their associated plants and animals.

LANDSCAPE CONTEXT SPECIFICATIONS:
A-rated landscape context: Uplands or any other system within the ground watershed are largely unaltered by urban or agricultural uses (>90% natural), and include few to no recent clearcuts, peat or gravel mines, pastures that are excessively grazed, or roads. There are no barriers to movement of species, water, nutrients, or other natural forms of energy and material between the occurrence and the surrounding systems. There are also few barriers to movement between this occurrence and other occurrence of the same system that may be necessary to maintain population dynamics.

B-rated landscape context: Uplands surrounding occurrence and within ground watershed may have moderate urban or agricultural alteration (60 to 90% natural), or natural vegetation is heavily managed (e.g., grazing, haying). There are few unnatural barriers to the movement of species and materials, and the occurrence retains much connectivity

with adjacent systems and nearby occurrences of the same system. Some natural processes such as flooding and fire may be compromised.

C-rated landscape context: Uplands surrounding occurrence and within ground watershed are fragmented by urban or agricultural alteration (20 to 60% natural). However sufficient upland allows some degree of natural interactions between wetland and upland systems. Sufficient natural or semi-natural vegetation around the occurrence esists that the occurrence is not heavily influenced by human induced changes in hydrologic regimes, nutrient cycles, or in the uplands. Some barriers to movement of species and materials are present limited connectivity exists among upland fragments. Natural patterns of water flow, fire, or nutrient cycling have been heavily altered by human influences. Restoration of most of these natural processes to near their historic patterns is feasible.

D-rated landscape context: Uplands surrounding occurrence within ground watershed are mostly converted to agricultural or urban uses. Connectivity among natural vegetation patches and natural processes are almost nonexistent. Restoration is not feasible within reason.

Justification for A-rated criteria: These occurrences are within nearly intact watersheds and ecological processes, fully supporting the occurrences natural structure, composition, and function. Native systems surrounding the occurrence buffer the fens from any unnatural human influences resulting from changes in water flows, nutrient status, or other hydrologic alterations. Connectivity of habitats allows natural processes and species migration to occur.

Justification for C/D threshold: C-ranked occurrences receive at least some benefit from adjacent natural or semi-natural vegetation (e.g., there is movement across wetland and native upland boundaries), and there is limited buffering from upland influences. D-ranked occurrences receive very little benefit from natural surroundings, so they are subject to altered hydrology, nutrient influxes, invasive species, and population and diversity declines resulting from a cessation of organismal immigration

AUTHORSHIP: Renée Rondeau, John Sanderson, Denise Culver
Date: July 19, 2000 (edited February 27, 2001)

APPENDIX B: PHOTO DESCRIPTIONS

(FOR PHOTOS ON ENCLOSED CD)

4/9/04

439-442: Alpine in the surveyed area of the Parsenn Peak project footprint area
443-448: *Listera cordata* ssp. *nephrophylla* and habitat in Area G
449: Wetland below Area G
450-457: *Lycopodium annotinum* in Area G and its habitat
458-462: *Botrychium* spp. at Winter Park (including a nice one of c.f. *hesperium*)

4/10/04

463-465: *Chrysanthemum leucanthemum* at top of Summit express lift
466: View of survey area down summit express lift
467- 469: Wetland along summit express in affected area
470: Typical subalpine forest in affected area
471-501: *Botrychium* spp. at the Prospector Chairlift site

471-476: Marked clusters of *Botrychium* species (red = CNHP) and habitat
477-497: *B. echo* and *B. hesperium*. *B. echo* comes first in the series followed by shots of *B. hesperium*. Identity of these is tentative. Plant in the gravel at end of this series is probably *B. hesperium*.
498-501: *B. lanceolatum*

4/11/04

502-504: *Cornus canadensis* at Disco Park wetland site
505: *Linnaea borealis*
506-507: Disco park wetland site
508-509: More *Cornus canadensis*
510: Nipped tree at disco park wetland
511: *Lycopodium annotinum* at FS Road 156

APPENDIX C: ELEMENT OCCURRENCE RECORDS

This Box to be completed by CNHP Office
Project name: _____
New Update EONUM: _____

COLORADO NATURAL HERITAGE PROGRAM
PLANT SPECIES OF SPECIAL CONCERN SURVEY FORM

COLORADO STATE UNIVERSITY-COLLEGE OF NATURAL RESOURCES
Mailing Address: 8002 Campus Delivery, Fort Collins, CO 80523-8002
Physical Address: 259 General Services Bldg., Fort Collins, CO 80523
Attn: Jill Handwerk

We Need Your Help. *If you have information on the location of a rare plant, rare animal or ecological community and would like to help us build the Natural Heritage inventory, please complete the form below. - Thank you!*

DATE OF SURVEY: 08/09/2004
OBSERVER(S)NAME/AFFILATION: David G. Anderson & Jill Handwerk/ CNHP
OBSERVER(S) ADDRESS: 259 General Service Bldg., Colo. State Uni., Ft. Collins, CO 80523
OBSERVER(S) PHONE: 970/491-5857

TAXONOMY
SPECIES SCIENTIFIC NAME: *Botrychium* c.f. *echo*, *B.* c.f. *lanceolatum*, *B.* c.f. *hesperium*, and possibly *B.* c.f. *minganense*

LOCATION
SURVEY SITE NAME: Prospector Lift, Winter Park Resort
COUNTY: Grand USGS QUADRANGLE: Fraser
TOWNSHIP: 2S RANGE: 75W SECTION: Unsurveyed 1/4 SEC: SE4
UTM ZONE AND COORDINATES: Zone 13 4414558.5N 433168.2E
ADDITIONAL COORDINATES: 4414614.2N 433158.7E
DATUM: NAD 27
ELEVATION (at population center and range of population if known): 10,110 ft.
NATIONAL FOREST/BLM DISTRICT: Arapahoe/Roosevelt NF
LAND OWNERSHIP/MANAGEMENT (if not USFS/BLM):
_____

LOCATIONAL ACCURACY/MAPPING INSTRUCTIONS: Attach a copy of the appropriate part of the USGS 7.5' topographic map and delineate the population and all subpopulations (if present) on the map using the guidelines below. Label subpopulations if you have population or habitat information for them.

- If the population/subpopulation area is <12.5 meters (40 ft.) in diameter, place a single point on the map marking its location. If necessary, indicate these point locations with an arrow so they are easier to see.
- If the population/subpopulation area is>12.5 meters (40 ft.) in diameter, draw a polygon on the map.

1. Is your depiction of the individuals on the topographic map within 6m (20ft) of their actual location on the ground?
☐ Yes x No (if no, answer question 2 below)
2. You are accurate to within ____meters 24 feet of the actual location.
If the area occupied is long, narrow and less than 12.5 meters wide, please indicate: Length: _____(m)
Width: _____(m)

DIRECTIONS TO SITE (refer to roads, trails, geographic features, etc.): Winter Park Ski Area, Prospector Lift summit, southeast-facing slope just downhill from the summit of the lift.

POPULATION BIOLOGY
ESTIMATED NUMBER OF INDIVIDUALS (or exact count, if feasible; if plants are spreading vegetatively, indicate number of aerial stems): Total of approximately 30 *Botrychium* species in 3 sub populations.
NUMBER OF SUB POPULATIONS (if applicable): Three
SIZE OF AREA COVERED BY POPULATION (acres): 0.02-0.06 acres
PHENOLOGY (percentage flowering, fruiting, vegetative): Sporulating
ANY SYMBIOTIC OR PARASITIC RELATIONSHIPS (e.g. pollinators)? None observed.
EVIDENCE OF DISEASE, PREDATION OR INJURY? Some stems were broken or damaged; appeared to have been trampled on.
REPRODUCTIVE SUCCESS (evidence of seed dispersal and establishment): Sporulating, with some juveniles present.

HABITAT
ASSOCIATED PLANT COMMUNITY (list dominant species currently present, include age structure if known):
Lodgepole, spruce-fir forest. Many young lodgepoles (2-3 ft tall); no large trees.

HABITAT TYPE: Ski slope.
ADDITIONAL ASSOCIATED PLANT SPECIES: *Trifolium repens*, *Festuca* c.f. *saximontana*, *Solidago* sp., and *Antennaria* sp.
ASPECT (S, SE, NNW, etc.): South-southeast % SLOPE: 10-15%
SLOPE SHAPE (concave, convex, straight, etc.): Convex
LIGHT EXPOSURE (open, shaded, partial shade, etc.): Open
MOISTURE (dry, moist, saturated, inundated, seasonal seepage, etc.): Dry
PARENT MATERIAL: Granitic SOIL TEXTURE: Coarse loam
GEOMORPHIC LAND FORM (e.g. glaciated mountain slopes and ridges, alpine glacial valley, rolling uplands, breaklands, alluvial-colluvial-lacustrine, rockslides): Mountain slope

EVIDENCE OF THREATS AND DISTURBANCE (e.g. effects on population viability due to mining, recreation, grazing, exotic species): Threats include possible trampling by hikers/mountain bikers, and ski area maintenance work; lower portion of occurrence is adjacent to ski area service road, which is also used by mountain bikers. A berm to slow runoff passes through the occurrence.

DOCUMENTATION
PHOTOGRAPH TAKEN (if so, indicate photographer and repository): David G. Anderson, CNHP.
SPECIMEN TAKEN (if so, list collector, collection number and repository:)
_____
IDENTIFICATION (list name of person making determination, and/or name of flora or book used): David G. Anderson and Jill Handwerk; used Weber and Wittman 2001, Wagner 1983, and silhouettes provided by Peter Root.

This Box to be completed by CNHP Office
Project name: _____
New Update EONUM: _____

COLORADO NATURAL HERITAGE PROGRAM
PLANT SPECIES OF SPECIAL CONCERN SURVEY FORM

We Need Your Help. *If you have information on the location of a rare plant, rare animal or ecological community and would like to help us build the Natural Heritage inventory, please complete the form below. - Thank you!*

COLORADO STATE UNIVERSITY-COLLEGE OF NATURAL RESOURCES
Mailing Address: 8002 Campus Delivery, Fort Collins, CO 80523-8002
Physical Address: 259 General Services Bldg., Fort Collins, CO 80523
Attn: Jill Handwerk

DATE OF SURVEY: 08/09/2004
OBSERVER(S)NAME/AFFILATION: Dave Anderson & Jill Handwerk / CNHP
OBSERVER(S) ADDRESS: 259 General Service Bldg., Colo. State Uni., Ft. Collins, CO 80523
OBSERVER(S) PHONE: 970/491-5857

TAXONOMY
SPECIES SCIENTIFIC NAME: *Lycopodium annotinum*

LOCATION
SURVEY SITE NAME: Area G, Winter Park Ski Area
COUNTY: Grand USGS QUADRANGLE: Berthoud Pass
TOWNSHIP: 2S RANGE: 75W SECTION: 21 1/4 SEC: SE4 of NW4
UTM ZONE AND COORDINATES: Zone 13 4412416.7N 432607.2E
ADDITIONAL COORDINATES: _____
DATUM: NAD 27
ELEVATION (at population center and range of population if known): 10,744 ft.
NATIONAL FOREST/BLM DISTRICT: Arapahoe/Roosevelt NF
LAND OWNERSHIP/MANAGEMENT (if not USFS/BLM):
_____

LOCATIONAL ACCURACY/MAPPING INSTRUCTIONS: Attach a copy of the appropriate part of the USGS 7.5' topographic map and delineate the population and all subpopulations (if present) on the map using the guidelines below. Label subpopulations if you have population or habitat information for them.

- If the population/subpopulation area is <12.5 meters (40 ft.) in diameter, place a single point on the map marking its location. If necessary, indicate these point locations with an arrow so they are easier to see.
- If the population/subpopulation area is>12.5 meters (40 ft.) in diameter, draw a polygon on the map.

1. Is your depiction of the individuals on the topographic map within 6m (20ft) of their actual location on the ground?
☐ Yes x No (if no, answer question 2 below)
2. You are accurate to within ____meters 29 feet of the actual location.
If the area occupied is long, narrow and less than 12.5 meters wide, please indicate: Length: _____(m)
Width: _____(m)

DIRECTIONS TO SITE (refer to roads, trails, geographic features, etc.): Winter Park Ski Area, Area G.

POPULATION BIOLOGY
ESTIMATED NUMBER OF INDIVIDUALS (or exact count, if feasible; if plants are spreading vegetatively, indicate number of aerial stems): Total of 400-500 stems.
NUMBER OF SUB POPULATIONS (if applicable): _____
SIZE OF AREA COVERED BY POPULATION (acres): 0.02 acres
PHENOLOGY (percentage flowering, fruiting, vegetative): Vegetative.
ANY SYMBIOTIC OR PARASITIC RELATIONSHIPS (e.g. pollinators)? None observed.
EVIDENCE OF DISEASE, PREDATION OR INJURY? None observed.
REPRODUCTIVE SUCCESS (evidence of seed dispersal and establishment): Well established stand on several downed and decaying logs.
HABITAT
ASSOCIATED PLANT COMMUNITY (list dominant species currently present, include age structure if known):
Mesic spruce-fir forest with a wide range of age/size classes. Many large, mature trees.

HABITAT TYPE: Sub alpine forest.
ADDITIONAL ASSOCIATED PLANT SPECIES: *Vaccinium myrtillus*, *Pedicularis racemosa*, and *Listera cordata* ssp. *nephrophylla*.
ASPECT (S, SE, NNW, etc.): West-northwest % SLOPE: 10-15%
SLOPE SHAPE (concave, convex, straight, etc.): Convex
LIGHT EXPOSURE (open, shaded, partial shade, etc.): Shaded
MOISTURE (dry, moist, saturated, inundated, seasonal seepage, etc.): Moist
PARENT MATERIAL: Granitic SOIL TEXTURE: Silty loam
GEOMORPHIC LAND FORM (e.g. glaciated mountain slopes and ridges, alpine glacial valley, rolling uplands, breaklands, alluvial-colluvial-lacustrine, rockslides): Mountain slope

EVIDENCE OF THREATS AND DISTURBANCE (e.g. effects on population viability due to mining, recreation, grazing, exotic species): Future ski area improvements should avoid this area.

DOCUMENTATION
PHOTOGRAPH TAKEN (if so, indicate photographer and repository): Dave Anderson, CNHP
SPECIMEN TAKEN (if so, list collector, collection number and repository:) Dave Anderson and Jill Handwerk, to be deposited at Colorado State University Herbarium.
IDENTIFICATION (list name of person making determination, and/or name of flora or book used): Dave Anderson and Jill Handwerk

APPENDIX D: NOXIOUS WEED FORMS FOR WINTER PARK RESORT

Scientific Name: *Chrysanthemum leucanthemum*

Observation Date: August 10, 2004

Observer Name (first/last)/Affiliation: Dave Anderson & Jill Handwerk/CNHP

GPS point name; UTM's at center of occurrence: CHLE1; 4412153.7N 434017.7E

Estimated Accuracy: 25 ft.

Est. # of individuals/ ramets: 200

Estimated occupied acreage: 0.01

Phenology of weed when observed: Flowering

Plant community type: Sub alpine spruce-fir

Do rare plants co-occur with weed? No If yes, with:

Scientific Name: *Chrysanthemum leucanthemum*

Observation Date: August 10, 2004

Observer Name (first/last)/Affiliation: Dave Anderson & Jill Handwerk/CNHP

GPS point name; UTM's at center of occurrence: CHLE2; 4413923.1N 435011.1E

Estimated Accuracy: 30 ft.

Est. # of individuals/ ramets: 1000

Estimated occupied acreage: 1.0

Phenology of weed when observed: Flowering

Plant community type: Cultural vegetation; timothy (*Phleum pratense*), smooth brome (*Bromus inermis*)

Do rare plants co-occur with weed? No If yes, with:

Scientific Name: *Chrysanthemum leucanthemum*

Observation Date: August 10, 2004

Observer Name (first/last)/Affiliation: Dave Anderson & Jill Handwerk/CNHP

GPS point name; UTM's at center of occurrence: 084; 4415402.5N 433081.4E

Estimated Accuracy: 17 ft.

Est. # of individuals/ ramets: 500

Estimated occupied acreage: 0.25

Phenology of weed when observed: Flowering

Plant community type: Disturbed ski slope

Do rare plants co-occur with weed? No If yes, with:

Scientific Name: *Chrysanthemum leucanthemum*

Observation Date: August 10, 2004

Observer Name (first/last)/Affiliation: Dave Anderson & Jill Handwerk/CNHP

GPS point name; UTM's at center of occurrence: 085; 4413484.5N 432579.3E

Estimated Accuracy: 18 ft.

Est. # of individuals/ ramets: 100

Estimated occupied acreage: 0.1

Phenology of weed when observed: Flowering

Plant community type: Disturbed soil near ski lift terminal

Do rare plants co-occur with weed? No If yes, with: