A Systematic Inventory for Lepidoptera Species of Concern at Ranson-Edwards Homestead Park, Pine Valley Ranch and Deadman Gulch, Jefferson County, Colorado and Recommendations for their Conservation

1998 Field Season

Final Report

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This project would not have been possible without the interest and concern of Jefferson County Open Space department for the butterflies, skippers and moths of the Colorado Front Range. The Colorado Front Range is always a particularly exciting and interesting area for Lepidoptera surveys, as the diversity of these beautiful creatures is amazing. Keeping this in mind, we would like to acknowledge Frank Kunze of Jefferson County Open Space for giving us the opportunity and support to conduct these surveys.

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EXECUTIVE SUMMARY

Colorado's union of the Rocky Mountains with the Great Plains creates an exceptionally diverse set of circumstances: moist montane forests, lush tallgrass prairies, arid shortgrass prairies, and desert life zones. This fantastic and unusual array of distinct, but co-occurring ecosystems all can be encountered within the boundaries of Jefferson County's Open Space areas. This exceptional variety of habitats provides for a remarkably diverse assemblage of butterflies, skippers and moths. Representatives from the biogeographic regions of the northern arctic and boreal biomes, Rocky Mountains, southwestern deserts, and grasslands of the Great Plans may all be encountered here.

With this information in mind the Colorado Natural Heritage Program (CNHP) was contracted by Jefferson County Open Space in 1998 to conduct a systematic inventory of rare and imperiled butterflies, skippers, and moths (Lepidoptera) on selected Open Space properties. The goal of this project was to accumulated and examine existing biological data, incorporate appropriate field surveys, identify significant natural heritage resources (rare or imperiled Lepidoptera populations) occurring on Jefferson County Open Space Properties. The information is prioritized according to conditions of the populations and species' level of imperilment. We were also asked to make recommendations on actions that will protect these resources.

A total of seven Targeted Inventory Areas (TIAs) were selected for this survey in 1998. During the 1998 field season, all TIAs were surveyed. We located Lepidoptera of concern in five of the TIAs surveyed. More than one species of concern was located within two of the TIAs surveyed. Furthermore, we identified three species of moths, which are uncommon or rare in the collection at Colorado State University.

In all, six of the thirteen targeted species of concern were documented within the selected areas of Jefferson County Open Space. At least five of these were of global significance. A colony of the hops-feeding azure (*Celastrina humulus*), a globally rare butterfly found in restricted habitat on the Colorado Front Range, was newly documented for Pine Valley Ranch. Surveys at Pine Valley Ranch also resulted in a reconfirmation of the Listed Threatened Pawnee montane skipper (*Hesperia leonardus montana*), a subspecies of skipper that is restricted to the South Platte Canyon of Colorado. The Ottoe skipper (*Hesperia ottoe*), also a globally rare species was located successfully at Ranson-Edwards Ranch, as was the Arogos skipper (*Atrytone arogos*). The Regal fritillary (*Speyeria idalia*) also a globally rare species, and one that has seen a dramatic decline in numbers since the 1980s, was documented from these surveys at Ranson-Edwards Ranch. The remainder of targeted species encountered is of statewide significance. Overall, the concentration of rare Lepidoptera species in these three areas indicate that the management approaches of Jefferson County Open Space could have global impacts in the conservation of biological diversity.

Based on the combination of information collected in this study and previously existing information, three potential conservation sites have been identified for JCOS. The three sites in this report are designated as globally significant, based on the location of globally significant Lepidoptera species. Briefly, these three sites are the Rocky Flats Site (includes the Ranson-Edwards Homestead Park), Lookout Mountain (includes Deadman Gulch), and Pine Valley (includes Pine Valley Ranch Open Space).

INTRODUCTION

In 1998, The Colorado Natural Heritage Program (CNHP) was contracted by Jefferson County Open Space (JCOS) to assess the biodiversity values of Deadman Gulch and Pine Valley Open Space parks. A separate contract covered a newly acquired portion of open space, the Ranson-Edwards Homestead Park near the Rocky Flats area, and is also covered in this report. The goal of the project was to accumulate new biological data and examine existing data from the area, incorporate appropriate portions into the CNHP's Biological Conservation Database (BCD), and with appropriate field verification, identify significant natural heritage resources. Natural heritage resources are defined as rare, threatened, endangered, or sensitive species and significant natural communities that are monitored by CNHP. In short, we were to identify those sites supporting unique or exemplary natural communities, rare plants and rare animals, and other significant natural features. It is within the purpose of this effort to identify the conservation sites that will protect these most sensitive elements of natural diversity. We also supplied information for potential Lepidoptera habitat within these open space areas.

Lepidoptera Diversity of the Colorado Front Range

The Colorado Front Range and its eastern foothills are well known for their biological diversity (Opler 1994, Whitney 1983, Armstrong 1972). The convergence of the Rocky Mountains' interface with the Great Plains provides an unusual variety of environmental conditions, supporting moist and arid zones, mountain and plain habitats, forest and grassland communities. This provides for a heterogeneous group of organisms representing the biogeographic elements of northern arctic and boreal biomes, Rocky Mountains, southwestern deserts, and grasslands of the Great Plains.

Lepidoptera species are particularly numerous on the Front Range of Colorado. Approximately 176 of 750 North American (north of Mexico) species of butterflies and skippers are resident or regular colonists on the Colorado Front Range, making it the fourth richest butterfly region in the United States (Opler 1994, Opler and Krizek 1984). Additionally, the number of species of moths thought to occur in Colorado is estimated at about 3,000 (P.A. Opler pers. comm). At the highest elevations, butterflies and skippers of arctic affinities occur at their southern limits. Species typical of the Rocky Mountain boreal forests are found at middle elevations and reach their eastern limits here. The lowest elevations of the foothills and adjacent plains support Great Plains species at the western limits of their range, and those of the southwestern mountains and deserts occur near their northern limits. The highest species richness in butterflies occurs in the low foothills and foothill canyons (Opler 1994), an area rich in other taxa as well (Weber 1995, Jones 1987, Armstrong 1972). Generally, species richness estimates for moths are less well known. However, as more research is accumulated, indications for the species richness levels of moths in Colorado appear remarkable.

While the high diversity of species of this area is largely due to the mixing of these distinctive flora and faunas, several taxa are endemic to the Front Range foothills and adjacent plains (Opler 1994, Armstrong 1972). Such regional endemics are considered by the CNHP as high priorities for conservation efforts, and have importance on an evolutionary scale as well. Among butterflies, the hops-feeding azure (*Celastrina humulus*) and Schryver's elfin (*Callophrys mossii schryveri*) are two such examples.

Also of high conservation priority are species of the eastern Great Plains occurring in disjunct populations along the Colorado Front Range. Such species include the Ottoe skipper

(*Hesperia ottoe*), the Arogos skipper (*Atrytone arogos*), the dusted skipper (*Atrytonopsis hianna*), the crossline skipper (*Polites origenes*), and the two-spotted skipper (*Euphyes bimacula*). Such disjunct populations are often of conservation significance (Lesica and Allendorf 1995) because genetic diversity and adaptation of the species can be greatly affected by habitat fragmentation. The results of preserving genetic diversity and intact habitat can protect species from local catastrophic events. Furthermore, many of these species are associated with xeric or mesic tallgrass prairies (*Andropogon gerardii-Schizachyrium scoparium* or *Andropogon gerardii-Sorghastrum nutans*) that display a similar disjunct distribution and are potentially threatened by ever increasing land conversion. High rates of habitat destruction throughout the Great Plains region increases the importance of these disjunct populations. The Ottoe skipper is vulnerable throughout its range (G3G4), as is the Arogos skipper (G3G4), thus increasing the conservation importance of Colorado populations (see the section on **Natural Heritage Ranking System** for global, state, and biodiversity ranking definitions).

Other eastern species reaching the western limit of their distribution here are endemic to the western Great Plains shortgrass habitats. Species of conservation concern due to their local rarity or sensitivity to disturbance include the rhesus skipper (*Polites rhesus*) (G4S2S3) and the Colorado blue (*Euphilotes rita coloradensis*) (G4T2T3S2).

Still, other species of the Front Range are distinctly characteristic of the Southern Rocky Mountains. While many of these still find ample undisturbed habitat throughout the mountainous areas of Colorado, Snow's skipper (*Paratrytone snowi*) (G4S3) is of conservation concern and possible dependency on late-successional forest (Opler pers. comm).

Butterfly and skipper species whose ranges are centered in the deserts of southwest North America are also found on the Front Range. Of these, the arrowhead skipper (*Stinga morrisoni*) (G4S3S4) and the hilltop little skipper (*Amblyscirtes simius*) (G4S3) are of some conservation concern due to localized distributions and habitat preferences.

Purpose

The purpose of this study was to identify areas in special need of Lepidoptera monitoring, as well as to provide baseline information regarding which species are found in selected Jefferson County Open Space areas. Knowing the locations of rare or imperiled butterfly species is the first step towards effective conservation of the species and their habitats.

To assist in such efforts, the Colorado Natural Heritage Program conducted a systematic inventory of selected Jefferson County Open Space properties for Lepidoptera species of conservation concern. By combining detailed distributional information with available information regarding species' ecological requirements, useful protection and management recommendations have been made. The implementation of these recommendations would add considerably to the effective conservation of biological diversity on the Colorado Front Range, and have global implications for some species.

In addition to the value of protecting uncommon species, the presence and abundance of Lepidoptera species can serve as an indicator of environmental change, and may be severely affected by various management activities (Pollard and Yates 1993). Simple non-intrusive monitoring techniques described by Pollard and Yates (1993) have been widely employed in Great Britain and are gaining favor in the United States (Opler 1994). Such monitoring recommendations were to be made, if warranted.

MAJOR THREATS AND STRESSES TO THE BIODIVERISITY OF THE COLORADO FRONT RANGE

1. Alteration of natural ecological processes. Since colonial times, human settlement has drastically impacted large landscape features, including grasslands and forests along the Colorado Front Range. In general, most of the ecosystems along the Front Range of Colorado have evolved with natural disturbances such as grazing and/or fire. Alteration of these natural disturbances can alter ecological functions such as plant succession and nutrient and energy cycles that in turn impact other balances in the ecosystem.

2. Alteration of natural fire regimes in natural habitats allows certain species to invade sites where they otherwise would not occur and allows fire fuels to build up to catastrophic levels. Suppression of fires due to settlement and residential development has altered vegetation structure, plant community composition and has resulted in increased fire fuel loads. Fires that are more severe than they were historically could result (Hobbs 1987), especially in areas invaded by cheatgrass (*Bromus tectorum*) and smooth brome (*Bromopsis inermis*).

Fire return intervals in the southern Rocky Mountains range from estimates of 200-400 years for subalpine *Pinus contorta* (lodgepole pine) and *Picea engelmannii-Abies lasiocarpa* (Engelmann spruce-subalpine fir) forests to 50-150 years for lower elevation *Pinus contorta* forests (references summarized by Peet 1988). Insect outbreaks due to increased tree density have also had dramatic effects on Rocky Mountain forests, as have human impacts. Increases in fire frequency during the late 1800s, fire suppression after settlement, logging, road building, mining, and introduction of non-native species have altered the structure, composition, and distribution of many of the plant communities. While large stands are common, very few are thought to represent the pre-settlement condition of the forests. Site specific management can restore natural conditions to some extent but because of the large scale of many ecological processes in montane forests, natural systems would have to be managed in the context of multiple ownerships.

3. Alteration of grazing patterns along the Colorado Front Range allows for modifications in plant community composition, often negatively affecting native species populations. The elimination of many native herbivores and replacement with domestic livestock has altered this natural process. While management with domestic livestock often mimics the grazing of native herbivores, certain differences do affect the plant communities (Lauenroth and Milchunas 1991). Certain grazing practices, such as continuous grazing for the entire growing season, can alter the composition of plant communities over time by reducing the abundance of native species and allowing less desirable, non-native species or native increasers to increase in abundance.

4. Habitat loss, creation of edge habitats, and fragmentation can be detrimental to many species of concern known from the Colorado Front Range. In Colorado, housing and urban development, mining, water development, industry, agricultural conversion, and recreation continue to negatively impact natural plant communities and their faunal components. Loss of habitat occurs either through destructive removal of habitat or through the creation of "edge" habitats or zones.

Perhaps one of the least easily understood concepts is that of "edge" habitats. “Edge” habitats are zones of sharply contrasting habitats or landscapes (Schwarz *et al*. 1993). Natural examples of these zones may be a grassland and a riparian area, or a grassland and a forest edge. Edges are often created by naturally occurring processes such as floods or fires and will recover naturally over time. Edges can also be anthropologically created, for example: a grassland and an agricultural field or a grassland and a road. Edges are often dominated by plant species adapted to disturbance and have become, as a result, more common and widespread. These areas often attract high numbers of generalist animal species that are widespread and able to utilize disturbance tolerant plant species (Rathcke and Jules 1993).

These last examples of edge habitat have increasingly become the focus of habitat conservation. As our landscape is increasingly fragmented by large-scale, rapid anthropogenic conversion, these edges become increasingly abundant in the remaining open space areas. As a result, many generalist species of plants and animals become increasingly common in these areas, and compete, either directly or indirectly, for food sources with the specialist species (Rathcke and Jules 1993). The specialists, meanwhile, have become increasingly less common as the overall structure of their habitat landscape is dramatically altered, and interspecies competition has increased. Furthermore, the overall reduction of large landscapes jeopardizes the existence of the specialists further. Specialists that occur in small, patchy populations are more likely to be excluded from small fragments or be affected by local disturbance events that could cause the extinction of the entire population. Specialists that exploit sparse and/or scattered plant species could be threatened by fragmentation (Rathcke and Jules 1993). Should a large-scale disaster such as fire, flood, or disease occur, populations normally recolonizing after landscape recovery may actually be extirpated if they exist in an isolated fragment; they cannot travel the distance to recolonize similar habitat (Moffat and McPhillips 1993).

5. Construction of trails and roads negatively impact native plants, animals and plant communities. Increased recreation in open space areas has created a demand for trails and trail management. It is generally believed that pedestrian and bike trails do not substantially fragment the natural landscapes. However, any disturbance to a natural landscape can create fragmentation and edges. Trails, to the native components of a system, may be viewed as breaks or barriers in otherwise natural habitat. Such breaks may impede or eliminate movement by animals. For example, rodents may avoid trail openings because of exposure to predation (Harker *et al*. 1993). Habitat specialists are very exacting in environmental requirements and are obligated to conditions of habitat continuity. They often cannot survive for extended periods of time in small patches and fragments, and cannot exist, as plants occasionally do, in dormant states during intervals of habitat unsuitability (Oates 1995). Trails are also ideal places for early successional species to grow because disturbance is continuous and regular. With the arrival of early successional vegetation there are edges, and consequently, a preponderance of generalist species. It is known that with every edge habitat created, a larger proportion of interior or undisturbed habitat is lost (Schwarz *et al*. 1993). If the impact of additional formal and social trails is considered, the habitat and landscape is increasingly fragmented, resulting in creation of additional edge habitat, and increased displacement of natural habitat (Harker *et al*. 1993).

Trails and roads also provide ideal corridors for the spread of non-native and invasive plants. Many of these species are tolerant of or rely on continuous disturbance from use and maintenance of the trails to become established. Belcher and Wilson (1989) observed that most leafy spurge infestations were associated with areas that had been disturbed by human activities

such as vehicle tracks, road construction, and fire guards. Even in areas that seem relatively free of non-native species, seeds of non-native species often occur in the seed bank and remain viable for many years. With trail construction and use, the soil is disturbed, increasing the opportunity for aggressive non-native species to spread *via* trail corridors. Trail related erosion also increases the availability of habitat for non-native vegetation. When eroded trails become too difficult for use, construction of additional trails or going off trail creates additional negative impacts on the natural landscape.

6. Invasion of non-native species can result in the widespread replacement of native species, often greatly altering ecosystem functions, and is one of the most significant threats to the natural resources along the Colorado Front Range. European-American settlement of the area introduced numerous alien plant species. Some species were intentionally introduced as hay or pasture grasses (such as smooth brome), while others were accidentally introduced as contaminants in hay or grain crops or as garden escapees. Regardless of the source, the introduction of non-native species has significantly impacted natural communities. Numerous studies have shown that areas invaded by non-native species have reduced populations of both native plant and animal species (Bedunah 1992, Bock and Bock 1988). For example, cool season smooth brome and cheatgrass compete with later emerging native species for water and negatively affect the water status and productivity of the native species (Melgoza *et al*. 1990).

RECOMMENDATIONS

1. Develop and implement management plans for protecting the conservation sites profiled in this report. Particular attention should be paid to the site containing the tall- and mixed grass prairie at Ranson-Edwards Homestead Park. This strip of habitat is potentially contiguous from just south of Lyons in Boulder County to the Ranson-Edwards Homestead Park area in Jefferson County, and is a wonderful example of tallgrass prairie in Colorado. Compromising over site management, and accepting second- or third-best solutions jeopardizes the future of rare specialists, which are the most exacting in their requirements and the most sensitive to habitat change. Sedentary species, especially, need continuity of habitat. Without this continuous habitat, the individuals or populations are reluctant to cross or unable to recognize areas of unsuitable habitat, for example, a four-lane highway, or a patch of disturbed soil containing little or no native vegetation and many noxious weeds and increasers. Additionally, species with low mobility cannot exist for extended periods of time during successive years in unsuitable or degrading habitat (Oates 1995). By using Lepidoptera species as targets and tools for conservation management, many other coexisting and codependent organisms, such as their food plants, hostplants, and natural enemies, may be effectively safeguarded (New *et al*. 1995).

2. Incorporate the information included in this report to review proposed activities in or near conservation sites so that these activities do not adversely affect natural heritage elements found within. The sites presented in this report contain natural heritage elements of global significance. Any development activity either in or near the sites may affect the elements present. The tallgrass prairie areas are susceptible to the impacts of growth on the Colorado Front Range, particularly because of their proximity to urban growth and recreational pressures, and because many of these areas are prime for residential developments. Any loss of this rare ecosystem is permanent, and has direct impact to those rare specialists depending on this ecosystem for their survival. Should a proposed project potentially impact a site, planning personnel should contact persons, organizations or agencies with expertise in order to obtain detailed comments and feedback. A secondary priority should be given to those areas demonstrating excellent potential for further occurrences of Lepidoptera species of conservation concern.

3. Encourage cooperation among landowners, government agencies, and conservation organizations to protect natural diversity. Combine efforts with interested allies including Boulder County Open Space, City of Boulder Parks, Open Space and Mountain Parks, the Rocky Flats Environmental Technology Site, the US Forest Service, The Nature Conservancy, and private landowners to design and effect a practical strategic plan aimed for the long-term survival of the targeted Lepidoptera species and their habitats.

4. Encourage well-planned and proper management of natural heritage resources existing within these selected JCOS parks, and recognize that designation of conservation sites and open space designation does not necessarily confer complete protection of the plants, animals and plant communities. Developing a conservation plan is just one of many steps necessary to preserve natural heritage resources. Some of the most serious threats, however, are understood within an ecosystem context. For example, residential encroachment,

recreational development, fire suppression, noxious weed invasion, and altered hydrology are anthropogenic influences that are detrimental to habitat integrity and balance for natural heritage elements. Consideration of all ecosystem influences is meaningful when considering management plans for a site. In this context, building partnerships with other agencies and entities is essential in development of plans for long-term protection of a site. One substantial consideration in developing partnerships could be research and development of techniques to maintain or restore sites for preservation of rare natural heritage elements. There are many agencies and organizations available for consultation in the development of conservation plans, including the Colorado Natural Heritage Program, the Colorado Natural Areas Program, The Nature Conservancy, the Colorado Division of Wildlife, various academic entities and research facilities, and open space agencies in neighboring counties.

5. Natural heritage resource inventories should be continued when and where necessary, including inventory for species that cannot be adequately surveyed in one field season. Further inventories, research, and monitoring are necessary to acquire a more thorough comprehension of Lepidoptera habits and habitats. Continue to monitor, document, and verify both known and predicted localities for targeted Lepidoptera species. With continued management, especially in areas that are managed for burns and clearing, positive or negative occurrences should be reported. Sampling grids in areas of known or predicted occurrences of Lepidoptera may be set up to monitor presence/absence of species (A.R. Ellingson pers. comm). This would monitor and allow mapping of the extent of the populations in consecutive years. If major changes occur in presence/absence of Lepidoptera species, this should be an acute signal that both population numbers and any coinciding management activities should be carefully studied. Furthermore, despite the best efforts during the field season, it is very likely that some elements cannot be detected and are not identified in this report.

6. Increase public awareness of the benefits of protecting significant natural areas. Recognize that floral and faunal entities also inhabit and utilize the natural setting. Public awareness should be increased in regards to the ecological significance of invertebrates. Lepidoptera species, in part due to their aesthetic appeal to humans, is an excellent initiator group. This would not be limited, however, to their aesthetic values, but would incorporate their importance as environmental indicators, and would demonstrate the success of implemented management and conservation plans.

7. Actively discourage or prohibit the introduction and/or sale of non-native species known to negatively and profoundly affect natural areas. These include, but are not limited to purple loosestrife, Russian olive trees, Siberian elms, and perennial sweet pea. Natural area managers, public agencies, and private landowners should be strongly encouraged to remove these species from their properties. Property owners and residential developments immediately adjacent to open space areas should be encouraged to consider xeriscaping with locally native plants to minimize the risks of introducing new noxious species and the further spread of noxious weeds and exotics into natural areas. Form cooperative relationships with organizations and entities that have well-developed xeriscaping knowledge, i.e., The Colorado Native Plant Society, Denver Botanic Gardens, Metropolitan Water Conservation, Inc. and Xeriscape Colorado (Denver Water Department), and the Colorado State University (CSU) Extension Service (Knopf 1991). Also, many demonstration gardens exist in Front Range Cities, such as

the Chautauqua Ranger's Cottage at Chautauqua Park in Boulder, City of Arvada Public Works, Denver Water Department, the Fort Collins Xeriscape Garden at the Fort Collins City Hall, and the Holly Plant Environmental Research Center (PERC) at Colorado State University (Knopf 1991). If restoration of an area becomes necessary, CNHP recommends the use of locally native plants when introductions of such are necessary.

BACKGROUND

Colorado's Natural Heritage Program

To place this document in context, it is useful to understand the history and functions of the 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 with the State Division of Parks and Outdoor Recreation for 14 years, the Program was relocated to the University of Colorado Museum in 1992 and in 1995 to the College of Natural Resources at Colorado State University.

The multi-disciplinary team of scientists and information managers gathers comprehensive information on rare, threatened, and endangered species and significant natural communities of Colorado. Life history, status, and locational data are incorporated into a continually updated data system, the Biological Conservation Data System (BCD). 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. Information management staff carefully plots the data on 1:24,000 scale USGS maps and enter it into the BCD. The BCD can be accessed by many categories, including taxonomic group, global and state rarity rank, federal and state legal status, source, observation date, county, quadrangle map, watershed, management area, township, range, and section, precision, and conservation unit.

The CNHP is part of an international network of conservation data centers that use the Biological and Conservation Data System developed by The Nature Conservancy. The CNHP has effective relationships with several state and federal agencies, including the Colorado Natural Areas Program, Colorado Department of Natural Resources, the Colorado Division of Wildlife, the U.S. Environmental Protection Agency, and the U.S. Forest Service. Numerous local governments and private entities also work closely with CNHP. Use of the data by many different individuals and organizations, including Great Outdoors! Colorado encourages a proactive approach to development and conservation thereby reducing the potential for conflict. Information collected by the Heritage Programs throughout the globe provides a means to protect species before the need for legal endangerment status arises.

Concentrating on site-specific data for each element of natural diversity allows us to evaluate the significance of each to the conservation of Coloradoan and global natural biological diversity. By using species rarity ranks and element occurrence quality ratings, priorities can be established for the protection of the most sensitive or imperiled sites. An updated locational database and priority-setting system such as CNHP provides is an effective, proactive land-planning tool.

The Natural Heritage Network and Biodiversity

Colorado is well known for its rich diversity of geography, wildlife, plants, and natural communities. However, like many other states, it is experiencing a loss of much of its flora and fauna. This decline in biodiversity 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 biodiversity has been recognized for decades in the scientific community. However, many conservation efforts made in this country were not based upon preserving biodiversity; instead, they primarily focused on preserving game animals, striking scenery, and locally favorite open spaces. To address this absence of a methodical, scientifically based approach to preserving biodiversity, Robert Jenkins, in association with The Nature Conservancy, developed the Natural Heritage Methodology in 1978.

Recognizing that rare and specialist species are more likely to become extinct than common and generalist species, 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 its biology. 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 prioritizing conservation efforts so the most rare and imperiled species may be preserved first. As the scientific community began to realize that plant communities are as equally important as individual entities, this methodology has also been applied to ranking and preserving significant natural plant communities. By protecting and managing aggregate units, associated species that we do not track can be included and protected.

Natural Heritage Programs throughout North, Central, and South America utilize the Natural Heritage Methodology, forming an international database network. Natural Heritage Network data centers are located in each of the 50 U.S. states, five provinces of Canada, and 13 countries in Central and South America and the Caribbean. This network enables scientists to monitor the status of species from a state, national, and global perspective. It also enables conservationists and natural resource managers to make informed and 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 species such as viruses, bacteria, and protists, through multicellular kingdoms of fungi, 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 single populations. On a wider scale, diversity includes variations in the biological communities in which species live, the ecosystems in which communities exist, and the interactions among these levels. All levels are necessary for the continued survival of species and natural communities, and all are important for the well being of humans. It stands to reason that natural diversity should be of concern to everyone.

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

1. Genetic Diversity. The genetic variation within a population and among populations of a plant or animal species. The genetic makeup of a species is variable between populations of a species 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. This unique genetic information cannot be reclaimed.

2. Species Diversity. The total number and abundance of plant and animal species and subspecies in an area.

3. Community Diversity. The variety of natural communities or ecosystems within that area. These communities may be diagnostic or even endemic to an area. It is within these ecosystems that all life dwells.

4. 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 may also 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 lost of biological diversity for a region. Humans and the results of their activities are integral parts of most landscapes.

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

The Natural Heritage Ranking System

Information is gathered by CNHP on Colorado's plants, animals, and natural communities. Each of these species and natural communities is considered an **element of natural diversity**, or simply an **element**. Each element is assigned a rank that indicates its relative degree of imperilment on a five-point scale (i.e., 1 = extremely rare/imperiled, 5 = abundant/secure). The primary criterion for ranking elements is the number of occurrences, i.e., the number of known distinct localities or populations. This factor is weighted more heavily because an element found in one place is more imperiled than something found in twenty-one places. Other important factors are: size of the geographic range, number of individuals, trends in both population and distribution, identifiable threats, and number of already protected occurrences.

Element rarity ranks are assigned both in terms of the element's degree of imperilment within Colorado (its State or S-rank) and the element's level of imperilment over its entire range (its Global or G-rank). Taken together, these two ranks give an instant picture of the degree of imperilment of an element. CNHP actively collects, maps, and electronically processes specific occurrence information for elements considered extremely imperiled to imperiled (S1 - S3). Those with a ranking of S3S4 are "watchlisted," meaning that specific occurrence data are collected and periodically analyzed to determine whether more active tracking is warranted. Watchlisted species are noted in the lists by an asterisk (*) next to the species name. A complete description of each Natural Heritage rank is provided later in this section.

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 1, ranks followed by a "B", i.e., S1B, indicate that the rank applies only to the status of breeding occurrences. Similarly, ranks followed by an "N", i.e., 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.

Table 1. Definition of Colorado Natural Heritage Rarity Ranks.

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

G/S1 Critically imperiled globally/state because of rarity (five or fewer occurrences in the world/state; or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extinction.

G/S2 Imperiled globally/state because of rarity (six to 20 occurrences), or because of other factors demonstrably making 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).

G/S4 Apparently secure globally/state, though it might be quite rare in parts of its range, especially at the periphery.

G/S5 Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.

GX Presumed extinct.

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 not verified for an extended period, usually.

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 permanent 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 (i.e., S2S3), the actual rank of the element falls between the two numbers.

Protection Urgency Ranks

Protection urgency ranks (P-ranks) refer to the time frame in which conservation protection must occur. In most cases, this rank refers to the need for a major change of protective status (i.e., agency special area designations or ownership). The urgency for protection rating reflects the need to take legal, political, or other administrative measures to alleviate threats that are related to land ownership or designation. The following codes are used to indicate the rating best describing the urgency to **protect** the area:

P1 Immediately threatened by severely destructive forces to occur within one year of rank date; protect now or never!
P2 Threat expected within five years.
P3 Definable threat but not in the next five years.
P4 No threat known for foreseeable future.
P5 Land protection complete or adequate reasons exists not to protect the site; do not act on this site.

A protection action involves increasing the current level of legal protection accorded one or more tracts at a potential conservation area. It may also include activities such as educational or public relation campaigns or collaborative planning efforts with public or private entities to minimize adverse impacts to element occurrences at a site. It does not include management actions, i.e., any action requiring stewardship intervention. Threats that may require a protection action are as follows:

1. Anthropogenic forces that threaten the existence of one or more element occurrences at a site; i.e., development that would destroy, degrade or seriously compromise the long-term viability of an element occurrence and timber, range, recreational, or hydrologic management that is incompatible with an element occurrence's existence;
2. The inability to undertake a management action in the absence of a protection action; i.e., obtaining a management agreement;
3. In extraordinary circumstances a prospective change in ownership management that will make future protection actions more difficult.

Management Urgency Ranks

Management urgency ranks (M-ranks) indicate the time frame in which a change in management of the element or site must occur. Using best scientific estimates, this rank refers to the need for management in contrast to protection (i.e., increased fire frequency, decreased herbivory, weed control, etc.). The urgency for management rating focuses on land use management or land stewardship action required to maintain element occurrences at the potential conservation area.

A management action may include biological management (prescribed burning, removal of exotics, mowing, etc.) or people and site management (building barriers, rerouting trails, patrolling for collectors, hunters, or trespassers, etc.). Management action does not include legal, political, or administrative measures taken to protect a potential conservation area. The following codes are used to indicate the action needed to be taken at the area:

M1 Management action required immediately or element occurrences could be lost or irretrievably degraded within one year.
M2 New management action will be needed within five years to prevent the loss of element occurrences.
M3 New management action will be needed within five years to maintain current quality of element occurrences.
M4 Although not currently threatened, management may be needed in the future to maintain the current quality of element occurrences.
M5 No serious management needs known or anticipated at the site.

Element Occurrence Ranks

Actual locations of elements, whether they be single organisms, populations, or plant communities, 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. In order to prioritize element occurrences for a given species, an element occurrence rank (EO-Rank) is assigned according to the estimated viability or probability of persistence (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:

1. **Size**: a quantitative measure of the area and/or abundance of an occurrence such as area of occupancy, population abundance, population density, or population fluctuation.

2. **Condition**: an integrated measure of the quality of biotic and abiotic factors, structures, and processes within the occurrence, and the degree to which they affect the continued existence of the occurrence. Components may include reproduction and health, development/maturity for communities, ecological processes, species composition and structure, and abiotic physical or chemical factors.

3. **Landscape Context**: an integrated measure of the quality of biotic and abiotic factors, and processes surrounding the occurrence, and the degree to which they affect the continued existence of the occurrence. Components may include landscape structure and extent, genetic connectivity, and condition of the surrounding landscape.

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 there is insufficient information available to rank an element occurrence, an EO-Rank is not assigned. Possible EO-Ranks and their appropriate definitions are as follows:

A Excellent estimated viability.
B Good estimated viability.
C Fair estimated viability.
D Poor estimated viability.
E Verified extant, but viability has not been assessed.
H Historically known, but not verified for an extended period of time.

Potential Conservation Sites

To successfully protect populations or occurrences, it is necessary to delineate potential conservation sites. These potential conservation sites focus on capturing the ecological processes that are necessary to support the continued existence of a particular element of natural heritage significance. Potential conservation sites may include a single occurrence of a rare element or a suite of rare elements or significant features.

The goal of the process is to identify a land area that can provide the habitat and ecological processes upon which a particular element or suite of elements depends for their

continued existence. The best available knowledge of each species' life history is used in conjunction with information about topographic, geomorphic, and hydrologic features, vegetative cover, as well as current and potential land uses. The proposed boundary does not automatically exclude all activity. It is a hypothesis that some activities will prove degrading to the element or the process on which they depend, while others will not. Consideration of specific activities or land use changes proposed within or adjacent to the potential conservation planning boundary should be carefully considered and evaluated for their consequences to the element on which the conservation unit is based.

Potential Conservation Site Boundaries

Once the presence of rare or imperiled species or significant natural communities has been confirmed, the first step towards its protection is the delineation of a potential conservation site planning boundary. In general, the potential conservation site planning boundary is an estimate of the landscape that supports the rare elements as well as the ecological processes that allow them to persist. In developing such boundaries, CNHP staff considers a number of factors that include, but are not limited to:

- the extent of current and potential habitat for the elements present, considering the ecological processes necessary to maintain or improve existing conditions;
- species movement and migration corridors;
- maintenance of surface water quality within the site and the surrounding watershed;
- maintenance of the hydrologic integrity of the groundwater, i.e., by protecting recharge zones;
- land intended to protect the site against future changes in the use of surrounding lands;
- exclusion or control of invasive exotic species;
- land necessary for management or monitoring activities.

As the label "potential conservation site planning" indicates, the boundaries presented here are for planning purposes. They delineate ecologically sensitive areas where land-use practices should be carefully planned and managed to ensure that they are compatible with protection goals for natural heritage resources and sensitive species. All land within the potential conservation site planning boundary should be considered an integral part of a complex economic, social, and ecological landscape that requires wise land-use planning at all levels.

Off-Site Considerations

Furthermore, it is often the case that all relevant ecological processes cannot be contained within a site of reasonable size. Taken to the extreme, the threat of ozone depletion could expand every site to include the whole globe. The boundaries illustrated in this report signify the immediate, and therefore most important, area in need of protection. Continued landscape level conservation efforts are needed. This will involve broad-county-wide or regional efforts as well as coordination and cooperation with private landowners, neighboring land planners, and state and federal agencies.

Ranking of Conservation Sites

One of the strongest ways that the CNHP uses these element and element occurrence ranks is to assess the overall biodiversity significance of a site, including one or many element occurrences. Based on these ranks, each site is assigned a **biodiversity** (or B-) **rank**:

B1 ***Outstanding Significance***: only site known for an element or an excellent occurrence of a G1 species.

B2 ***Very High Significance***: one of the best examples of a community type, good occurrence of a G1 species, or excellent occurrence of a G2 or G3 species.

B3 ***High Significance***: excellent example of any community type, good occurrence of a G3 species, or a large concentration of good occurrences of state rare species.

B4 ***Moderate or Regional Significance***: good example of a community type, excellent or good occurrence of state-rare species.

B5 ***General or Local Biodiversity Significance***: good or marginal occurrence of a community type, S1, or S2 species.

Legal Designations

Natural Heritage rarity ranks should not be interpreted as legal designations. Although most species protected under state or federal endangered species laws are extremely rare, all rare species do not 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 2 defines the special status assigned by these agencies and provides a key to the abbreviations used by CNHP.

Please note that the U.S. Fish and Wildlife Service has issued a Notice of Review in the February 28, 1996 Federal Register for plant and animal species that are "candidates" for listing as endangered or threatened under the Endangered Species Act. The revised candidate list replaces an old system that listed many more species under three categories: Category 1 (C1), Category 2 (C2), and Category 3 (including 3A, 3B, 3C). Beginning with the February 28, 1996 notice, the Service will recognize only those species that would have been included in the former Category 1 as candidates for listing. This includes those species for which the Service has sufficient information on their biological status and threats to propose them as endangered or threatened under the Endangered Species Act.

Candidate species listed in the February 28, 1996 Federal Register are indicated with a "C". While obsolete legal status codes (Category 2 and 3) are no longer used, CNHP will continue to maintain them in its Biological and Conservation Data system for reference.

Table 2. Federal and State Agency Special Designations.

1. *U.S. Fish and Wildlife Service (58 Federal Register 51147, 1993) and (61 Federal Register 7598, 1996*):
   - **LE** Endangered; taxa formally listed as endangered.
   - **E(S/A)** Endangered due to similarity of appearance with listed species.
   - **LT** Threatened; taxa formally listed as threatened.
   - **PE/PT** Proposed E or T; taxa formally proposed for listing as endangered or threatened.
   - **C** Candidate: taxa for which the Service has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened.
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:
     a. Significant current or predicted downward trends in population numbers or density.
     b. 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"):*

METHODS

The study followed a general method that the Colorado Natural Heritage Program has successfully employed in rare or imperiled species inventories.

Existing information collection. Existing information from all major local Lepidoptera collections (Henderson Museum at University of Colorado Boulder, Gillette Museum at Colorado State University, Denver Museum of Natural History) has been integrated into the BCD. Additional information was attained from the Ray E. Stanford personal collection. Also, much of the information regarding the habits and habitats of the Lepidoptera was provided *via* personal communication with Lepidopterists Ray E. Stanford, Andrew D. Warren, and Charles Slater.

Identify potentially occurring species. Using known county records (Stanford and Opler 1993) previously input in the BCD, a list of rare or imperiled Lepidoptera species known to occur in Jefferson County was compiled (Appendix E). Based on elevational range, the list was limited to those potentially occurring on the selected Jefferson County Open Space parks. Other potential county records from a list provided by Ray Stanford (1995) were identified from records in adjacent counties. Using habitat data common to both Jefferson County and the adjacent counties identified potential species.

Select and prioritize Targeted Inventory Areas. Targeted Inventory Areas (TIAs) were selected by identifying suitable habitats for the targeted species. The survey areas were prioritized by the targeted Lepidopteran's time of emergence, CNHP ranking, and by habitat condition. Use of aerial photographs proved particularly useful. The knowledge of Open Space staff was significant in targeting areas with high habitat potential. The inclusion of historical records and potential county records provided information for potential updates as well.

Field surveys. Field surveys took place during times concordant with the species' flight periods. Most surveys took place in late June through July, but some late (August) surveys were included. Trained personnel conducted the surveys, and collection was limited to voucher specimens of targeted species and to those species difficult to distinguish in the field. If a Federal listing protected the species, only on-site identification and photographs were attempted. The relative quality of rare or imperiled Lepidoptera was estimated (= element occurrence rank), and a brief assessment of relevant ecological processes, threats, and management concerns was noted during the surveys.

Delineation of potential conservation site planning boundaries. The potential conservation sites are delineated by a **potential conservation site planning boundary**. In developing these boundaries, a number of factors was considered including: habitat for rare Lepidoptera species, protection of water quality, protection from potentially detrimental land uses, and maintenance of ecological processes necessary for perpetuation of significant elements in the area.

RESULTS

A total of seven Targeted Inventory Areas (TIAs) was outlined for this survey in pre-field season analysis in 1998 (Table 3, Figs. 1,2,3). During 1998, all of these were actually surveyed (100%). Success in locating Lepidoptera species of conservation concern occurred in five (71.4%) of the TIAs surveyed. More than one species of concern was located within two of the areas surveyed. Colorado Natural Heritage Program field zoologists documented six of the 14 targeted Lepidoptera species of concern on Jefferson County Open Space through this inventory.

This section includes:

- A table with the targeted Lepidoptera species of concern;
- A table summarizing the Targeted Inventory Areas and related targeted Lepidoptera species of concern;
- A table summarizing the Potential Conservation Sites and Lepidoptera species of concern;
- A profile of each Potential Conservation Site, including site description, location, and protection and management considerations;
- A map of the site with the boundaries delineated on a 7.5 minute quadrangle, with the significant Lepidoptera species indicated;
- A photograph of the site;

Targeted Lepidoptera Species of Concern

Table 3 below outlines the targeted species of concern for the Jefferson County Open Space Areas as surveyed during 1998.

Table 3. Targeted Lepidoptera Species of Concern.

Element	Common name	Global Rank	State Rank	Federal Sens.	Federal Status	State Status
Grammia sp. 1	A tiger moth	G?	S?			
Doa ampla	A moth	G?	S1			
Celastrina humulus	Hops-feeding azure	G2	S2			
Hesperia leonardus montana	Pawnee montane skipper	G4T1	S1		LT	
Speyeria idalia	Regal fritillary	G3	S1	FS	C	
Hesperia ottoe	Ottoe skipper	G3G4	S2			
Atrytone arogos	Arogos skipper	G3G4	S2			
Euphyes bimacula	Two-spotted skipper	G4	S2			
Erynnis martialis	Mottled dusky wing	G4	S2S3			
Paratrytone snowi	Snow's skipper	G4	S3			
Stinga morrisoni *	Morrison's skipper	G4	S3S4			
Atrytonopsis hianna	Dusted skipper	G4G5	S2			

Element	Common name	Global Rank	State Rank	Federal Sens.	Federal Status	State Status
Callophrys mossii schryveri	Schryver's elfin	G4T3	S2S3			
Polites origenes	Crossline skipper	G5	S3			

* = Watchlisted species

Targeted Inventory Areas

Table 4 below summarizes the Targeted Inventory Areas (TIAs) and their associated Lepidoptera species of concern. These areas should also be considered to contain potential habitat for those associated species listed, but which were not encountered during 1998. Please see Figures 1, 2, and 3 for locations of the TIAs.

Table 4. Targeted Inventory Areas and Related Targeted Lepidoptera Species.

Targeted Inventory Area (TIA)	TIA #	USGS Quadrangle	Targeted Species
Ranson-Edwards North Drainage	RE1	Eldorado Springs	*Euphyes bimacula, Speyeria idalia*
Ranson-EdwardsSouth Drainage	RE2	Eldorado Springs	*Euphyes bimacula, Speyeria idalia*
Ranson-Edwards Prairie	RE3	Eldorado Springs	*Atrytonopsis hianna, Hesperia ottoe, Atrytone arogos, Polites origenes, Speyeria idalia*
Coal Creek	RE4	Eldorado Springs	*Speyeria idalia, Celastrina humulus*
Deadman Gulch	DG1	Morrison	*Doa ampla, Atrytonopsis hianna, Hesperia ottoe, Atrytone arogos, Polites origenes, Speyeria idalia,*
North Fork South Platte	PV1	Pine	*Callophrys mossii schryveri, Celastrina humulus, Paratrytone snowi*
Pine Valley Uplands	PV2	Pine	*Erynnis martialis, Stinga morrisoni, Hesperia leonardus montana,*

Potential Conservation Sites

The following pages outline the Potential Conservation Sites designated by the CNHP as they relate to the Lepidoptera species documented during this survey. The delineation of a potential conservation planning boundary in this report does not confer any regulatory protection on recommended areas. These boundaries are intended to guide planning and making decisions for the conservation of these significant areas.

All sites delineated in this report contain other rare and imperiled taxa that are also of conservation concern. This adds levels of complexity to management plans, and all of these elements should be considered in the design of such management plans. It also further indicates that Jefferson County Open Space properties are of very high conservation significance.

This report emphasizes protection and management needs for the Lepidoptera species of concern. While other taxa may benefit from such actions, specific needs of the other taxa are not addressed here. Information regarding the other occurrences listed here,

as well as protection of many of these elements is available at the Colorado Natural Heritage Program.

Table 5 below is intended to summarize the Potential Conservation Sites outlined in this report, and their attached Lepidoptera species of significance.

For complete Potential Conservation Site Information, please refer to the section on **Potential Conservation Sites**. For Global and State Rankings for each of the species of concern, please see Table 3. For definitions of Biodiversity Ranks, Protection Ranks, and Management Ranks, please refer to the section on **The Natural Heritage Ranking System**. For species information, please refer to **Appendix 1**.

Table 5. Potential Conservation Sites.

Potential Conservation Site	Biodiversity Rank	Protection Rank	Management Rank	Lepidoptera Species of Concern
Rocky Flats (Ranson-Edwards)	B2	P1	M2	*Speyeria idalia, Hesperia ottoe, Atrytone arogos*
Lookout Mountain	B3	P3	M2	*Celastrina humulus, Atrytone arogos, Erynnis martialis, Grammia* sp.1, *Doa ampla*
Pine Valley Ranch (within the South Platte Canyon megasite)	B3	P3	M2	*Celastrina humulus, Hesperia leonardus montana, Paratrytone snowi*

Figure 1. Targeted Inventory Areas at Ranson-Edwards Homestead Park.

Figure 2. Targeted Inventory Area at Deadman Gulch.

Figure 3. Targeted Inventory Areas Pine Valley Ranch.

Potential Conservation Site Format

Each potential conservation site is described in a standard site report reflecting data fields in CNHP's Biological and Conservation Data System (BCD). The sections of this report and the contents are outlined and explained below.

Biodiversity Rank (B-rank): The overall significance of the site in terms of rarity of the Natural Heritage resources and the quality (condition, abundance, etc.) of the occurrences. For definitions of Biodiversity Ranks, please refer to the section on **The Natural Heritage Ranking System.**

Protection Urgency Rank (P-rank): An estimate of the time frame in which conservation protection must occur. This rank generally refers to the need for a major change of protective status (i.e., ownership or designation as a natural area). For definitions of Protection Ranks, please refer to the section on **The Natural Heritage Ranking System**

Management Urgency Rank (M-rank): An estimate of the time frame in which conservation management must occur. Using best scientific estimates, this rank refers to the need for management in contrast to protection (legal, political, or administrative measures). For definitions of Management Ranks, please refer to the section on **The Natural Heritage Ranking System**

Location: General location and specific road/trail directions.

Legal Description: USGS 7.5 minute quadrangle name and Township, Range, and Section(s).

General Description: A brief narrative of the topography, vegetation, and current use of the potential conservation site. Common names are used along with scientific names.

Biodiversity Rank Justification: A synopsis of the significant elements occurring in the site. A table within the site profile lists the element occurrences found within the site (in order of Global Rank), their rarity ranks, the occurrence ranks and federal and state agency special designations. The species or community that is the primary element of concern is flagged within the table. See Table 1 for explanations of ranks and Table 2 for legal designations.

Boundary Justification: Justification for the location of the potential conservation site planning boundary delineated in this report, including all known occurrences of natural heritage resources and, in some cases, adjacent lands required for their protection.

Protection Rank Justification: A summary of major land ownership issues that may affect the site and the element(s) within the site.

Management Rank Justification: A summary of site management issues that may affect the long-term viability of the site.

ROCKY FLATS
(*includes the Ranson-Edwards Homestead Park*)

Biodiversity Rank: B2 (*Very high significance*)
This site contains a good quality occurrence of a globally rare xeric tallgrass community (*Andropogon gerardii-Schyzachrium scoparium*; a fair-ranked occurrence of a globally rare xeric tallgrass community *Andropogon-gerardii-Sporobolis heterolepsis*); two good quality occurrences of globally rare butterflies, the Ottoe skipper (*Hesperia ottoe*) and the Arogos skipper (*Atrytone arogos*); and a fair ranked occurrence of a globally imperiled butterfly, the hops-feeding azure (*Celastrina humulus*). There is also an unranked occurrence of another globally rare butterfly, the regal fritillary (*Speyeria idalia*). Furthermore, the Northern leopard frog and the Listed Threatened Preble's meadow jumping mouse (*Zapus hudsonius preblei*) also occur here.

Protection Urgency Rank: P1 *(Immediately threatened by severely destructive forces to occur within one year of rank date*)
The integrity of this site is severely threatened by the on-going and rapid development that is permanently changing the appearance of the Colorado Front Range. The future for the majority of this site remains very uncertain, as there are plans underway to construct a commercial site on a portion of the tallgrass prairie on the west side of Highway 93, and the future ownership of the RFETS remains highly uncertain. Because of the very high biodiversity significance of this site, CNHP strongly recommends a protection and management plan for one of the best remaining examples of this community type in Colorado and the associated imperiled species.

Management Urgency Rank: M2 *(New management action needed within five years to prevent loss of element occurrences*)
Threats from invasion of non-native plant species should be considered very seriously when developing management plans for any portion of this site. CNHP considers this continuing pressure on the xeric and riparian vegetation communities to be quite serious, especially considering their rarity. Also, the continued fragmentation of habitats by access and fire break roads, utility poles, ditches, and general site management activities is generating additional threats to the viability of native plant communities and consequently their associated animal species.

Location: The Rocky Flats Potential Conservation Site is located along Colorado Highway 93, near the Jefferson-Boulder County line. This site includes the Rocky Flats Environmental Techn

Legal Descrip ngs, Golden and Ralston Buttes. T

General Desc ls Homestead Park Open of grassland and ponderc s and the foothills. The Open S e elevation ranges from about 207 ft) in the

northeastern corner where Coal Creek leaves the Open Space. The slopes typically harbor grassland, dominated by a variety of grasses and forbs. The Open Space also includes about 1402m (4600 ft) of Coal Creek that flows along the eastern border of the Open Space. The riparian area along Coal Creek is characterized by narrow-leaf and plains cottonwood trees and a variety of shrubs such as willows, chokecherry, hawthorn, and skunkbrush.

Biodiversity Rank Justification: This conservation site has retained much of its native character due to the general exclusion of the public that occurred in the buffer zone surrounding the Rocky Flats Environmental Technology Site (RFETS) during the Cold War. Although RFETS operations and activities have impacted some of the targeted natural elements, particularly on the facility's eastern half, much of the study area remains in relatively natural condition and only moderately fragmented. The most significant element occurrences are xeric tallgrass prairie (*Andropogon gerardii-Schyzachrium scoparium)* and the hops-feeding azure.

The xeric tallgrass prairie is believed to be globally imperiled, as native tallgrass and mixed grass prairies throughout the United States are considered to be about 90% destroyed (Swengel and Swengel 1995). Approximately 20 patches are currently known in Colorado, and this particular patch is considered to be the largest in the state. The hops-feeding azure (*Celastrina humulus*) is a butterfly considered a Colorado Front Range endemic with approximately 23 occurrences known throughout the state.

Rana pipiens
Photo by Phyllis M. Pineda

The site is very significant because it harbors a diverse variety of butterfly and skipper elements that are dependent on the mixed grass communities of the Colorado Front Range. Both the Ottoe skipper (*Hesperia ottoe*) and the Arogos skipper (*Atrytone arogos*) are considered to be disjunct populations along the northern Colorado Front Range, as the larger and more continuous populations occur (or formerly occurred) in eastern North America. No occurrences are known between the Colorado Front Range and western Nebraska. Disjunct populations are often of great conservation interest, as the genomes of these populations become increasingly distinct from the larger eastern populations over time, and possibly result in a systematically distinct species or subspecies. The regal fritillary (*Speyeria idalia*) was encountered at the Ranson-Edwards Homestead Open Space on two separate occasions. Populations of this very large and strikingly beautiful butterfly have declined significantly since the 1980s due to conversion of its prairie habitat to agricultural and residential uses. Although a colony was not confirmed from this site, the date of encounter (mid-July) suggests that a colony may exist or that the habitat provides adequate resources for individuals to thrive. Further surveys are recommended to verify the presence or absence of a colony.

Two occurrences (populations) of the Listed Threatened Preble's meadow jumping mouse (*Zapus hudsonius preblei*) are known to occur in the drainages defined by the proposed conservation site boundary. These occurrences are ranked separately, one considered of good

quality, and the other of fair quality. Curiously, this mammal shares a somewhat congruous habitat distribution with the hops-feeding azure. Also newly documented within the boundaries of the Ranson-Edwards Ranch was a rather gregarious population of the Northern leopard frog (*Rana pipiens*). These frogs were found along drainages and shallow ponds, and the occurrence is considered to be of good quality.

Table 6. Natural Heritage Elements at the Rocky Flats Site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	Last Observation Date	*EO Rank
***Andropogon gerardii-Schyzachrium scoparium*†**	**Xeric tall grass prairies**	**G2**	**S2**		**1998-07-27**	**B**
Andropogon-gerardii-Sporobolis heterolepsis	Xeric tall grass prairies	G2	S1S2		1998-07-27	C
Celastrina humulus	Hops-feeding azure	G2	S2		1995-06-26-	C
Speyeria idalia	Regal fritillary	G3	S1	FS	1998-07-13	Unranked
Zapus hudsonius preblei	Preble's meadow jumping mouse	G5T2	S1	LT	1994-09-21	B
Zapus hudsonius preblei	Preble's meadow jumping mouse	G5T2	S1	LT	1994-09-21	C
Hesperia ottoe	Ottoe skipper	G3G4	S2		1998-07-27	B
Atrytone arogos	Arogos skipper	G3G4	S2		1998-07-27	B
Aristida basiramea	Forktip three awn	G5	S1		1994-09-01	Unranked
Amorpha nana	Dwarf leadplant	G5	S2S3		1998-07-27	C
Rana pipiens	Northern leopard frog	G5	S3		1998-07-27	B

*= Element Occurrence
† = Basis for Biodiversity Rank

Boundary Justification: The conservation site boundaries for the Rocky Flats Site include the poloygonal boundaries of xeric tallgrass prairie patches (both on the Ranson-Edwards Homestead Park and on the Rocky Flats Environmental Technology Site), the Great Plains riparian community in Rock Creek, the Preble's meadow jumping mouse occurrences in Rock Creek and upper Woman Creek, and the invertebrate occurrences. The connecting factor for all of these elements is the xeric tallgrass prairie occurrence. Although fragmented by highways, roads, trails, gravel pits, it is considered one occurrence, is contiguous habitat, and management for the entire occurrence as a single entity is in the best interest of the closely associated Lepidoptera elements, and is recommended by the CNHP.

Protection Rank Justification: Approximately 1/2 of the Rocky Flats Conservation Site occurs on the Rocky Flats Environmental Technology Site. The western 1/2 lies on private property, Jefferson County Open Space property and State Land Board property. Parcels that exist to the south of this site are reportedly considered for commercial or industrial development (Rick Brune pers. comm.). As of this writing, future plans for the RFETS buffer zone has yet to be decided, and the possibility for development exists. Disturbances, such as mining, residential or commercial development and weed invasion will undoubtedly impact this rare ecosystem, negatively affecting habitat quality. This will subsequently have detrimental effects on the rare plants and animals in this site. Purchase of available parcels by an open space entity is strongly

recommended. Any increase in the portion of land that is protected by open space would serve to benefit the high level of biodiversity found here.

Management Rank Justification: The principal threats to this site appear to be development pressures, habitat fragmentation, invasion of non-native plant species, improper livestock grazing practices, and alteration of surface and ground water hydrology of Coal Creek. These threats are common to many open space areas along the Front Range of Colorado.

The CNHP recommends that Jefferson County Open Space make weed management a high priority. Diffuse knapweed (*Centauria diffusa*), Dalmatian toadflax (*Linaria dalmatica*), leafy spurge (*Euphorbia esula*), Canada thistle (*Cirsium arvense*), musk thistle (*Carduus nutans*), cinquefoil (*Potentilla recta*), goatgrass (*Ageilops cylindrica*), houndstongue (*Cynoglossum officinale*), St. Johnswort (*Hypericum perforatum*), Canada bluegrass (*Poa compressa*), and Kentucky bluegrass (*Poa pratensis*) are among those considered as the greatest threats. These exotics are especially prevalent in gulches and low lying places, and aggressively compete with native nectaring sources for Lepidoptera adults, or with the larval food supply (*Viola* spp.) for the regal fritillary (*Speyeria idalia*). A first step would be to consider annual weed monitoring in the form of an annual weed inventory of the Open Space property focusing on land adjacent to Plainview Road, which is likely be the major avenue for weed introduction. The annual weed inventory would be followed by control of the patches of priority weeds that are newly discovered or on old patches that need re-treatment.

The canopy of ponderosa pine on the upslope portion of this site is increasing in density probably due to relatively recent fire suppression. Increased tree density alters habitat structure and may result in loss of understory plants that are not shade tolerant. Such understory plants are required by both the larval and adult stages of butterflies. Plans for controlled burning or tree thinning should be integrated, to decrease the canopy density, so that reduction or loss of the graminoid-forb understory does not occur.

Certain grazing practices, such as continuous grazing for the entire growing season, can alter the plant communities over time. The abundance of mountain muhly (*Muhlenbergia montana*), Parry's oatgrass (*Danthonia parryi*), western wheatgrass (*Pascopyrum smithii*), green needlegrass (*Stipa viridula*), prairie dropseed (*Sporobolus heterolepis*), Indiangrass *(Sorghastrum nutans*), and big bluestem (*Andropogon gerardii*) west of Plainview Road reflect vegetation in good condition. Summer grazing can impact the warm season species (big bluestem), which is required for larval development for the prairie dependent butterflies (*Hesperia ottoe, Atrytone arogos, Polites origenes).* Heavy, continuous grazing can often result in these species being reduced in abundance or eliminated and replaced by less desirable species.

Figure 4. Rocky Flats Potential Conservation Site (includes Ranson-Edwards Homestead Park).

LOOKOUT MOUNTAIN
(*includes Deadman Gulch*)

Biodiversity Rank: B3 (*High significance*).
The Lookout Mountain Site contains fair quality occurrence for two unranked but rare moths, including one undescribed species. Additionally, this site contains unranked but extant occurrences of a globally imperiled species, the hops-feeding azure (*Celastrina humulus*), a globally rare species, the Arogos skipper (*Atrytone arogos*), and a state rare species, the mottled duskywing (*Erynnis martialis*). Historically, this site contained occurrences for various globally rare and state rare species of butterflies and skippers, and habitat does remain for these species.

Protection Urgency Rank: P3 (*Definable threat, but not within five years*)
Although the majority of land in this site is protected by open space ownership and management, it is surrounded by residential or other anthropogenic development, which further fragments and isolates this habitat patch. Such isolation may be detrimental to the butterfly occurrences within this site, as isolation decreases the chances of genetic exchange between populations and increases the risk of local extirpation.

Management Urgency Rank: M2 (*New management action is needed within the next five years to prevent loss of element occurrences*)
Encroaching and surrounding development is increasingly isolating this site. Much of the invasive non-native plants that impact the native animal and plant communities are a direct result of physical disturbances in developing areas. Focus should be on controlling invasive exotic plants, and perhaps developing a management plan for improving the quality of the natural plant communities. On higher slopes, the tree canopy is increasing (both Douglas fir and ponderosa pine), and ponderosa pine is increasing in density downslope, probably due to fire suppression. Increased tree density alters habitat structure and may result in loss of understory plants that are not shade tolerant and also contributes to habitat isolation. Reducing canopy density by burning or thinning would reduce the impacts on, or loss of, understory plant species.


Phyllis M. Pineda

Location: The Lookout Mountain Site is located at the base of the Colorado Front Range foothills, just west of Golden in Jefferson County. This site may be accessed from Colorado Highway 6 *via* Golden on Lariat Loop Road, which meanders throughout much of the site.

Legal Description: USGS 7.5 minute quadrangles: Golden, Morrison and Evergreen. Township and range 3S 70, sections 32-34, and township and range 4S, 70W, sections 3-10, 15-17.

General Description: Elevation: 1767 to 2200m (5800 to 7220 ft). Fire, erosion, and low annual precipitation are three factors that influence the vegetation types found here. The

geology of this area is mostly of the Ratake-Cathedral-Rock outcrop complex containing slopes and ridges that face east, west or south, with 25 to 60 percent slopes (USDA 1984). The soils in this complex are mostly formed in clayey and loamy material derived from sedimentary rocks. Soils are suitable for wildlife habitat, woodland, recreation areas, pasture, grazing, community development, and some crops. Soils are typically shallow and well drained. Soil blowing is minimal, and rock fragments make up about 35 to 80 percent of the soil volume (USDA 1984). A mosaic of plant communities exists here. The higher areas are mostly ponderosa pine communities with a graminoid understory, most of which is relatively new growth. Fire scars are not apparent. Mountain mahogany shrubland communities (*Cercocarpus montanus*) and yucca (*Yucca glauca*) with an understory of big bluestem grass (*Andropogon gerardii*) dominate the midslopes. Bottoms of slopes are typically of shrubland/grassland communities, mostly plum (*Prunus americana*), chokecherry (*Prunus virginiana*), sumac (*Rhus glabra* or *trilobata*) and buckbrush (*Ceanothus fendleri*), with an abundant accumulation of exotic plants in the understory at this level. Hillsides are definitely much less weedy than downslope. Graminoids in all communities include one or more of the following: big blue stem (*Andropogon gerardii*), blue grama (*Bouteloua gracilis*), western wheat (*Pascopyrum smithii*), and buffalo grass (*Buchloë dacytloides*).

Biodiversity Rank Justification: This site contains extant occurrences of a globally imperiled butterfly, the hops-feeding azure butterfly (*Celastrina humulus*). This butterfly is considered a Colorado Front Range endemic with approximately 23 occurrences presently known in the state. A diverse variety of butterfly and skipper species that are peculiar to the grassland communities of the Colorado Front Range also are extant here. Both the Arogos skipper (*Atrytone arogos*) and the mottled duskywing skipper (*Erynnis martialis*) are considered to be disjunct populations along the Colorado Front Range, as the larger and more continuous populations occur in the eastern North America. No occurrences are known between the Colorado Front Range and western Nebraska. Disjunct populations are often of great conservation interest, as the genomes of these populations become increasingly distinct from the larger eastern populations over time, and possibly result in a systematically distinct species or subspecies. Use of an ultraviolet light moth trap also resulted in the capture of a variety of unusual moth species. Several were rare in the Colorado State University insect collection, and others did not match any other known specimens, and remain unidentifiable to date. The case of the unidentified specimens does not infer that these are unknown to science, but that possibility does exist.

Table 7. Natural Heritage Elements at the Lookout Mountain Site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	Last Observation Date	*EO Rank
Celastrina humulus	Hops-feeding azure	G2	S2		1992-06-14	E
Atrytone arogos	Arogos skipper	G3G4	S2		1991-06-30	E
Erynnis martialis	Mottled duskywing	G4	S2S3		1998-07-05	C
Callophrys mossii schryveri	Schryver's elfin	G4T3	S2S3		1974-04-27	H
Polites origenes	Crossline skipper	G5	S3		1977-06-11	H
Viola pedatifida	Prairie violet	G5	S2		1914-05-30	H
Doa ampla	A moth	G?	S1		1992	E
Grammia sp. 1	A tiger moth	G?	S?		1992	E
Pero sp. (not identifiable)	A geometrid moth	Not ranked	Not ranked		1998-07-28	E
Ixala desperaria	A geometrid moth	Not ranked	Not ranked		1998-07-28	E
Euxoa sp.	A geometrid moth	Not ranked	Not ranked		1998-07-28	E

*= Element Occurrence

Boundary Justification: The boundaries are meant to define a small watershed. Certain management activities on upslope areas from the site could affect the site itself. The boundary is meant to allow for genetic exchange to occur between rare element occurrences, to lessen the impact of increased habitat fragmentation and isolation, and for careful consideration on increased recreational development, i.e., roads, trails, and parking lots. Adjacent residential areas or encompassed residential development is included to manage for weedy plant invasions, and to protect habitat from further isolation.

Protection Rank Justification: Although the majority of land in this site is protected by Open Space ownership and management, it is surrounded by residential or other anthropogenic development, further fragmenting and isolating this habitat patch. Such isolation may be detrimental to the butterfly occurrences within this site, as isolation decreases the chances of genetic exchange between populations and increases the risk of local extirpation through localized catastrophic events or disease incidence.

Management Rank Justification: Encroaching and surrounding development is increasingly isolating this site. Several plant exotics that impact native plant and animal communities are a direct result of physical disturbances in developing areas. Controlling invasive exotic plants includes development of a management plan to improve the quality of natural plant communities and would aid in protecting the long-term viability of the site and associated animal species. Both upslope and downslope, the tree canopy is increasing in density, probably due to relatively recent fire suppression. Increased tree density alters habitat structure and may result in loss of understory plants that are not shade tolerant. Such understory plants are required by both the larval and adult stages of butterflies. Controlled burning or tree thinning should be integrated, to decrease the canopy density so that continued loss of the graminoid-forb understory does not occur.

Figure 5. Lookout Mountain Potential Conservation Site (includes Deadman Gulch).

PINE VALLEY
(*Includes Pine Valley Ranch Open Space*)

Biodiversity Rank: B3 (*High significance*). This site contains a fair quality occurrence of a globally imperiled species, the hops-feeding azure (*Celastrina humulus*), and contains fair estimated quality habitat for the Pawnee montane skipper (*Hesperia leonardus montanus*). A fair estimated occurrence of a globally rare grassland community also exists within the boundaries of this site. A state rare species of skipper butterfly is also found here.

Protection Urgency Rank: P3 (*Definable threat, but not in the next five years*). A portion of this site is owned and managed by Jefferson County Open Space. A smaller portion is owned and managed by the Bureau of Land Management, and the remainder is managed primarily by the US Forest Service. Purchase of the BLM portion by an open space entity is highly recommended. Any increase in the portion of land that is protected by open space would serve to benefit the high level of biodiversity found here

Management Urgency Rank: M2 (*New management action needed within five years to prevent loss of element occurrences*). This site has areas of rapid residential growth and increased recreation. Increased tree density, fire suppression, dispersal of exotic noxious weeds, and habitat fragmentation decrease the quality of habitat for the rare butterfly species here. Management plans should closely focus on maintenance of natural ecological processes, noxious weed management and well-planned recreational access to prevent loss of any of the rare species found within this site.

Location: The Pine Valley Site is located Jefferson County, Colorado, about 1.6 kilometers due west of Pine. This site incorporates portions of the north fork of the South Platte River.

Legal Description: USGS 7.5 minute quadrangles: Pine, Bailey, Green Mountain, and Windy Peak. Townships and ranges 007S, 008S, 070W, 071W.

Phyllis M. Pineda

General Description: Elevation: 2087 to2682 m (6850 to 8800 ft). Geology: Strongly sloping to very steep slopes with somewhat excessively drained and well drained gravelly, loamy and immature soils of Pike's Peak granite (USDA 1992). Thirty to fifty percent slopes. Vegetation: (Slopes) South-facing slopes mostly dominated by Ponderosa pine with an understory of mountain mahogany (*Cercocarpus*

montanus), pine dropseed (*Blepharoneuron tricholepsis*), mountain muhly (*Muhlenbergia montana*) and blue grama (*Bouteloua gracilis*). North-facing slopes are mostly dominated by Douglas fir (*Pseudotstuga menziesii*) interspersed with blue spruce (*Picea pungens*). Valley bottom is mostly dominated by a willow/mesic forb plant association (*Salix* spp.) and scattered blue spruce (*P. pungens*) situated along the course of the river. The flood plain was probably formerly colonized by various sedges, native grasses, and other wetland tolerant plants, but now contains mostly exotic plants, i.e., leafy spurge (*Euphorbia esula*), Canada thistle (*Cirsium arvense*), musk thistle (*Carduus nutans*), cheatgrass (*Bromus tectorum*), smooth brome (*Bromus inermis*), orchard grass (*Dactylis glomerata*), Kentucky blue grass (*Poa pratensis*) and ox-eye daisy (*Heliopsis helianthoides*).

Biodiversity Rank Justification: This site contains a fair ranked occurrence of a globally imperiled butterfly species, the hops-feeding azure (*Celastrina humulus*). This butterfly species is known to occur only in gulches and canyons along the Colorado Front Range, and is presently considered as endemic to Colorado. This butterfly is restricted to canyons and gulches with high natural erosion or disturbance rates containing its larval hostplant wild hops (*Humulus lupulus*). There are approximately 23 occurrences presently known in Colorado. The biodiversity rank of this site, however, is not influenced by the presence of the Listed Threatened Pawnee montane skipper, (*Hesperia leonardus montana*) although it does occur here. Those Pawnee montane skippers occupying this area are actually a subpopulation of a larger population of this skipper, for which the larger proposed **South Platte Canyon Conservation Site** was previously defined. For more information regarding the South Platte Canyon Conservation Site, please inquire with the CNHP.

Table 8. Natural Heritage Occurrences at the Pine Valley Site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	Last Observation Date	*EO Rank
***Celastrina humulus*†**	Hops-feeding azure	G2	S2		1998-07-15	C
Hesperia leonardus montana	Pawnee montane skipper	G5T1	S2	LT		C
Paratrytone snowi	Snow's skipper	G4	S2			C
Danthonia parryi	Parry's oatgrass montane grassland community	G3	S3			C

*= Element Occurrence
† = Basis for Biodiversity Rank

Boundary Justification: The majority of the elements within this site are situated along the canyon bottom. Therefore, the boundaries for this site are meant to encompass this small watershed. The elements are affected to a reasonable extent by the ecological processes taking place higher on the slopes, especially because this area is prone to a high rate of natural erosion. The boundary is intended to include a management buffer for additional weedy plant species that may wash downslope from roadsides and other traveled corridors, and from other anthropogenic disturbances.

Protection Rank Justification: Currently, a portion of this site is owned and managed by Jefferson County Open Space, another by the US Forest Service, and a very small portion by the Bureau of Land Management. The great majority of this site is privately owned. Purchase of the BLM portion of the site, of conservation easements, and of private portions methods of preventing isolation or loss of habitat. To protect the integrity of the occurrences, and to maintain genetic integrity across populations, as much intact and continuous habitat as possible is most beneficial for the plant, animal, and plant community occurrences within this site.

Management Rank Justification: The valley bottom is heavily invaded by weedy exotics: leafy spurge (*Euphorbia esula*), Canada thistle (*Cirsium arvense*), musk thistle (*Carduus nutans*), cheatgrass (*Bromus tectorum*), smooth brome (*Bromus inermis*), orchard grass (*Dactylis glomerata*), Kentucky blue grass (*Poa pratensis*) and ox-eye daisy (*Heliopsis helianthoides*). Although some of these forbs (especially the ox-eye daisy) are aesthetically pleasing, their presence may have displaced native butterfly hostplants, potentially impacting the populations at this site. These exotics should be actively managed to improve and maintain the natural ecological integrity of the flood plain. The area also appears to have undergone some degree of fire suppression, resulting in increased canopy density. Increased canopy density will result in loss of understory forbs that are requirements for both the adult and larval butterfly elements within the site. Increased tree density additionally increases fire hazard. A high intensity fire in this area has the potential of effectively eliminating all canopy cover, and expose the already highly erosive soils to potential floods. Elimination of the canopy would alter the habitat structure, rendering it unsuitable for Lepidoptera specialists. A high intensity fire would also kill any resident, habitat specific Lepidoptera and extirpate them from the area.

Figure 6. Pine Valley Potential Conservation Site (includes Pine Valley Ranch).

CONCLUSIONS

The anticipated importance that Jefferson County Open Space lends to conservation is further supported by these findings. These properties support or potentially supports habitat for several species of conservation concern, including rare and imperiled species of both global and statewide concern.

These finding further address the need to implement comprehensive and cooperative management plans to secure the population viability of rare species here, especially that of the Ottoe skipper, the hops-feeding azure, and the Pawnee montane skipper. Should proper management and conservation plans be developed and practiced, those species encountered in this survey have potential for long-term viability. Management considerations should be given to all elements (flora and fauna) occurring or potentially occurring on the open spaces or within any of the related sites.

Examples of threats to continued survival and viability of these species include continued or increased residential development throughout the area, road and trail construction, recreational development, exotic plant invasion, introduction of new exotic plants, and increased tree density into a formerly more open habitat. A contiguous landscape with minimal habitat fragmentation and natural ecological functions will help insure the survival of these elements. Management actions will have to consider the impacts that urban development, past management, and management on adjacent lands has on the sites and to the species contained within.

The conservation sites presented here can be used as baselines for designing and implementing management plans to secure viable populations of the targeted species.

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APPENDICES

These appendices will provide some brief background information regarding those species of concern targeted for the Jefferson County Open Space. It may be useful to incorporate some of this information as a management tool for any plans or actions taken by open space personnel.

In Appendix A, the characterization abstracts for each species targeted in these inventories are given in taxonomic order. This appendix includes both those species known to occur and those potentially occurring within the study sites.

Each abstract gives information with respect to taxonomy, global and state distribution, habitat, phenologies, and management issues. These are intended to be a guide for basic information regarding these species. More detailed information can be found in Scott (1986) and Ferris and Brown (1981).

Appendix B is a table giving a brief overview of the targeted species adult phenologies, in respect to their flight times. These are listed in order of seasonal appearance.

In Appendix C, a list of associated butterfly and skipper species of butterflies is given in taxonomic order. It is not an exhaustive list of all species known from Jefferson County, but rather a list of species as they were documented from the study areas during the 1998 field season.

Appendix D is a table of all Lepidoptera species previously known from Jefferson County. Information regarding species, last date of observation and last place of observation may be found in this table.

Appendix A. Characterization Abstracts

Invertebrate Characterization Abstract

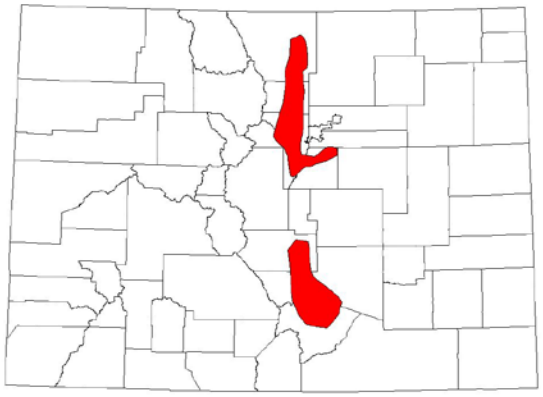
Erynnis martialis
Mottled dusky wing

Photo by Paul Opler

Taxonomy:
Class: Insecta
Order: Lepidoptera
Family: Hesperiidae
Genus: *Erynnis*

Taxonomic Comments: No subspecies are listed for this species (Miller and Brown 1981). The second phenotype of the afranius duskywing (*Erynnis afranius*) is often mistaken for *E. martialis*; fortunately, the two almost never occupy the same habitat simultaneously (Ferris and Brown 1981).

CNHP Ranking: G4S2S3



Statewide distribution of *Erynnis martialis*
Source: Stanford and Opler 1993

Distribution: Global range: Eastern United States from Massachusetts and New York west across Ontario and the Great Lakes states to Minnesota and western Iowa, then south to Georgia, the Gulf states, and central Texas (Opler and Krizek 1984). West to eastern Nebraska, eastern Kansas, the Ozarks, and disjunct isolated populations in the eastern foothills of the Rocky Mountains in central Colorado, and in the Black Hills (Opler 1994, Stanford and Opler 1993, Opler and Krizek 1984, Ferris And Brown 1981). State range: Front Range foothills from to 3000m (8200 ft) (Ferris and Brown 1981). Reported from nine counties (Stanford and Opler 1993): Boulder, Clear Creek, Custer, Douglas, Fremont, Huerfano, Jefferson, Larimer, Pueblo.

Habitat Comments: Elevational range: 1371 to 3000m (4500 to 8200 ft). Usually confined to hilly country containing its hostplant buckbrush (*Ceanothus* spp.) (Opler and Krizek 1984). Inhabits shrubby foothills with stands of mahogany (*Cercocarpus* spp.) and buckbrush (*Ceanothus* spp.) and oak woodlands (Ferris and Brown 1981). Also, wooded uplands; open woods and thickets; clumps of vegetation on plains (Pyle 1981).

Phenology: One flight mid May-June in Colorado; two flights throughout the rest of the range (Scott 1986, Opler and Krizek 1984). Males perch on hilltops (Ferris and Brown 1981). Seldom abundant (Pyle 1981).

Larval Hostplant: Shrub Rhamnaceae, including *Ceanothus americanus, herbaceus, fendleri*; adults sip nectar of flowers, including *Ceanothus* spp. (Scott 1986).

Known Threats and Management Issues: Foothills habitats at risk of loss by anthropogenic alteration, including: fire suppression, habitat fragmentation, and urban development.

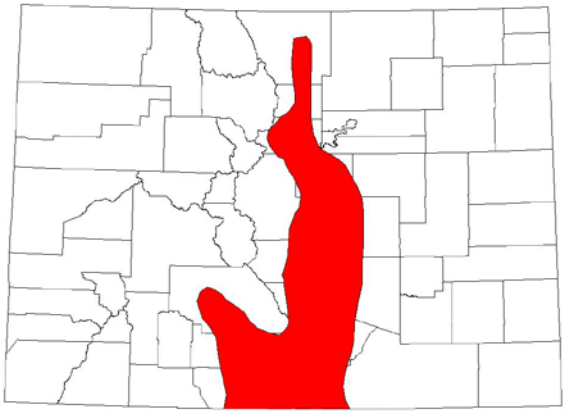
Invertebrate Characterization Abstract

Stinga morrisoni
Morrison's skipper

Taxonomy:
Class: Insecta
Order: Lepidoptera
Family: Hesperiidae
Genus: *Stinga*

Taxonomic Comments: A monotypic genus.

CNHP Ranking: G4S3S4



Statewide distribution of *Stinga morrisoni*
Source: Stanford and Opler 1993

Distribution: Global range: Along the Colorado Front Range from the Wyoming border south through Colorado, into New Mexico, Arizona, and Texas. State range: From Larimer County southward. Known from 15 counties in Colorado: Alamosa**,** Clear Creek, Custer, Douglas, El Paso, Fremont, Gilpin, Huerfano, Jefferson, Larimer, Las Animas, Park, Saguache, Teller (Stanford and Opler 1993). Boulder County was documented for the first time during this study.

Habitat Comments: Occupies open pinyon and ponderosa pine foothills in the upper Sonoran, below 2926m (9600 ft) (Scott 1986). May have an association with crumbly granitic soils (R. Stanford pers. comm.).

Phenology: One flight, May through Mid-June in the Colorado Foothills. Late-May through early-July at higher altitudes (Scott 1986). Uncommon to locally common in most years Males perch all day on hilltops, usually next to shrubs or trees, to await females.

Larval Hostplant: Not well known; blue grama (*Bouteloua gracilis*) or little blue stem (*Schizachyrium scoparium*) is suspected by habitat association (Ferris and Brown 1981).

Known Threats and Management Issues: Species' habitat is rapidly being developed from Colorado Springs to Fort Collins; low elevations along the Colorado Front Range Foothills are especially favored for development. Fire suppression, habitat fragmentation, and weedy invasions also affect quality of habitat. Historically threatened by logging.

Invertebrate Characterization Abstract

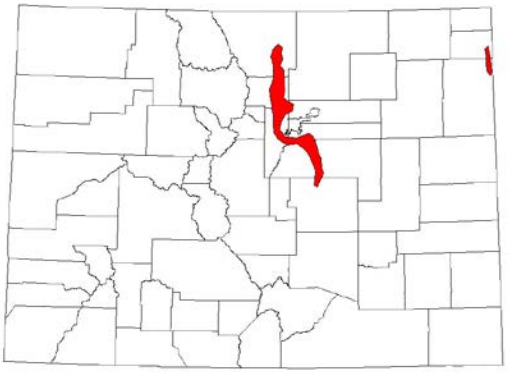
Hesperia ottoe
Ottoe Skipper

Photo by Phyllis M. Pineda

Taxonomy:
Class: Insecta
Order: Lepidoptera
Family: Hesperiidae
Genus: *Hesperia*

Taxonomic Comments: No subspecies reported (Miller and Brown 1981). Western populations of this species average paler in color on the upperside compared to more eastern populations, but this coloring can be variable (Scott 1986).

CNHP Ranking: G3S2



Statewide distribution of *Hesperia ottoe*
Source: Stanford and Opler 1993

Distribution: Global range: Great Plains range extends from southern Manitoba south to northern Texas, and northeastward to the Great Lakes Regions (Scott 1984, Ferris and Brown 1981). State range: Base of the Front Range from El Paso County north to Larimer County, and a few records from the eastern plains of Colorado. Apparently a Front Range disjunct restricted to mid- and tallgrass prairies. Known from nine counties in Colorado: Arapahoe, Boulder, Douglas, Elbert, El Paso, Jefferson, Larimer, Phillips, Yuma (Stanford and Opler 1993).

Habitat Comments: In Colorado, this species occupies mid- to tallgrass undisturbed prairies or high quality grazed prairie on the plains and Front Range foothills, especially gently sloping meadows below 1920m in elevation (6300 ft). Avoids weedy conditions (Scott 1986, Ferris and Brown 1981, Pyle 1981).

Phenology: The Ottoe skipper has one brood per year, with adults flying from mid-June through early August, reaching peak abundance in early July (Sedman and Hess 1985, Opler and Krizek 1984). The adult males begin to emerge before the females. Emergence is extended over a two-week period in late-June through mid-July, with females offset by about a week. Life span for adults is about 19 days in nature. Males perch on flowers or low plants during warm daylight hours when seeking mates (Dana 1991).

Larval Hostplants: Big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*) side oats grama (*Bouteloua curtipendula*) (Scott 1986).

Known Threats and Management Issues: Declines are likely due to continued destruction of prairie habitat by conversion to cropland and urban developments. Additionally, along the Colorado Front Range, increased loss of its disjunct habitat may be attributed to increased tree density into former prairie habitat, due in part to fire suppression.

Invertebrate Characterization Abstract

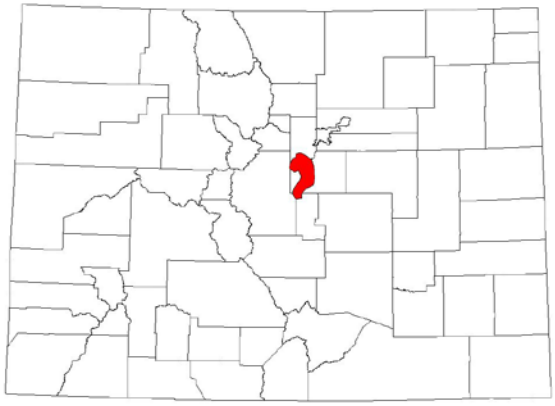
Hesperia leonardus montana
Pawnee Montane Skipper


Photo by Phyllis M. Pineda

Taxonomy:
Class: Insecta
Order: Lepidoptera
Family: Hesperiidae
Genus: *Hesperia*

Taxonomic Comments: Two subspecies of *Hesperia leonardus* are found in Colorado. *Hesperia leonardus pawnee* is widespread in eastern Colorado from approximately Huerfano County northward. *Hesperia leonardus montana*, however, is restricted to the South Platte River valley in the foothills southwest of Denver, Colorado (Scott 1986). *Hesperia leonardus montana* was officially listed as a threatened species in the Federal Register on September 25, 1987 (52FR36176) (U.S.F.W.S 1994).

CNHP Ranking: G4T1S1, Listed threatened.


Statewide distribution of *Hesperia leonardus pawnee*
Source: Stanford and Opler 1993

Distribution: Global range: This subspecies is only known from the South Platte Canyon of Colorado. State range: Positively confirmed from Douglas, Jefferson, Park, and Teller Counties in the South Platte Canyon of Colorado.

Habitat Comments: This skipper butterfly is restricted to an elevational range between 1889 and 2255m (6,200 and 7,400 ft). May be encountered in very open ponderosa pine woodland on outcrops of Pikes Peak granites where soils are thin and unstable. Sparse vegetation, usually less than 30% ground cover, characterizes the understory. Critical features of the habitat include open aspect presence of the larval foodplant, blue grama grass (*Bouteloua graclis*) and adequate nectar sources for adults, most notably blazing starflower (*Liatris punctata*). Other composite flowers may be used as well.

Phenology: This subspecies is univoltine (one flight per year). Observations of flying adults have been observed as early as July 30 and as late as September 17. It is likely that *H. l. montana* flies until a major killing frost (ERT 1986). Adult emergence and flight activity correlates closely with bloom period and location of the blazing starflower (*Liatris punctata*),

with peak activity occurring between August 20 and September 5 (Keenan 1985). Larvae hibernate as last instars (Scott 1981).

Food Comments: Blue grama (*Bouteloua gracilis*) is the only known host plant. Adults preferably and most often use blazing starflower (*Liatris punctata*) as a nectar source, but other nectar sources are also frequented. Additional nectar sources include: musk thistle (*Carduus nutans*), aster (*Aster laevis*), Canada thistle (*Cirsium arvense*), horsemint (*Monarda fistulosa*), geranium (*Geranium caespitosa*), sunflower (*Helianthus* spp.), and senecio (*Senecio spartoides*) (ERT 1986).

Known Threats and Management Issues: At the time of its listing, Pawnee montane skipper habitat was threatened with the proposed construction of Two Forks Dam and Reservoir by the Denver Water Department and associated development. It was estimated that 22 percent of the habitat would be destroyed, resulting in a loss of 23 to42 percent of the population if the reservoir were constructed. In 1990, the U.S. Environmental Protection Agency did not approve the construction of the dam and the project was shelved. The immediate principle threat to the skipper's habitat was removed. However, in the long term, plans to develop a reservoir in the South Platte Drainage will likely resurface.

Because of the limited habitat and range of the Pawnee montane skipper, unexpected environmental, demographically random (stochastic events) could also have a major deleterious effect on the population. Examples include; forest fires, floods, extreme climatic conditions, introduction of a competitor for caterpillar host or nectar plant(s), or decimation of skipper population by predators or parasitic insects. If only smaller reserve units are left due to human related fragmentation of habitat, they should be connected by continuous easements, and preservation and active management of these intervening units should allow for genetic exchange. It is important to preserve populations throughout the range in both the South and North Forks in order to buffer against a single event or combination of events that might eliminate the butterfly from one of these areas. Human related activities with major, moderate and minimal negative effects were summarized by Opler in 1987. Activities with major effects include: (1) any activity or combination of activities that eliminates more than 5 percent of any population group's habitat area; (2) any habitat displacing activity located in an area of blazing star density of 150 or more flowering stems per acre; (3) any activity or development that creates large blocks of unsuitable habitat; i.e., large paved parking lots, wide paved roads with broad, graveled shoulders and adjacent herbiciding, wide (more than 730 m) powerline rights-of way treated with herbicides, subdivisions with large lawns, cultivated plots, or heavily grazed habitat. Activities with moderate effects include: (1) campgrounds that are not located in areas with the highest skipper densities or in areas of blazing star density (150 or more flowering stems per acre), and that do not involve extensive areas covered by parking lots, lawns, ballfields, or scraped areas; (2) narrow (one-lane with occasional pullouts) paved or improved roads that avoid major blazing star concentrations. (3) low density housing or commercial development that results in a cumulative 5 percent or less loss of the suitable habitat of any of the remaining population groups rendered unsuitable by roads, structures, lawns, plantings, parking lots or associated habitat alteration. Activities with minimal effect include recreational activities on the water or on the water's edge and narrow rights-of ways for powerlines maintained for host and nectar plants. The area occupied by the skipper is owned and/or administered by the Denver Water Department, the U.S. Forest Service (Pike National Forest), Jefferson County, and private

individuals (USFWS 1994). The maintenance of high quality skipper habitat may require management efforts such as the simulation of natural disturbance processes and the control of noxious exotic weeds. Management techniques and tasks discussed at Fish and Wildlife Service Recovery team meetings included the use of prescribed fire and other forest thinning techniques having minimal impact on the understory, maintenance of native plant communities through planning, and revegetation with native host and nectar plants through mitigation. Small scale experimental management is recommended in a mosaic pattern until the effectiveness of different techniques is evaluated.

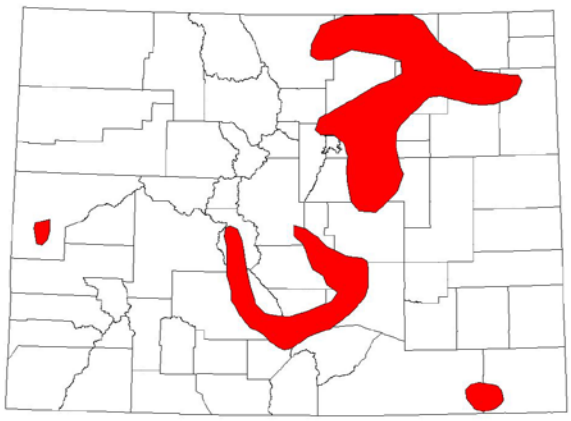
Invertebrate Characterization Abstract

Polites rhesus
Rhesus skipper

Taxonomy:
Class: Insecta
Order: Lepidoptera
Family: Hersperiidae
Genus: *Polites*

Taxonomic Comments: No subspecies reported (Ferris and Brown 1981). Examination of genitalic characteristics indicate that this species, and its sister species *P. carus*, should be included in the genus *Polites*. This moves both species of the genus *Yvretta* to *Polites*, thus creating the Yvretta group within the genus *Polites* (Burns 1994).

CNHP Ranking: G4S2S3



Statewide distribution of *Polites rhesus*
Source: Stanford and Opler 1993

Distribution: Global range: In shortgrass prairie, this species ranges from southern Canada (Saskatchewan and Alberta) in a fairly narrow strip through the western Great Plains and southern Rocky Mountains of the United States (Stanford and Opler 1993), to the high mountains of Central Mexico (Burns 1994). State Range: Known from 20 counties in Colorado: Alamosa, Arapahoe, Baca, Chaffee, Custer, Denver, Douglas, El Paso, Elbert, Fremont, Huerfano, Jefferson, Larimer, Las Animas, Morgan, Park, Pueblo, Saguache, Weld**,** Yuma (Stanford and Opler 1993).

Habitat Comments: Upper Sonoran to lower Canadian zone shortgrass and mixed-grass prairie habitats (Scott 1986); records from 1150 to 2850m (3800 to 9300 ft) (Ferris and Brown 1981).

Phenology: One flight, mostly May, and late-May to mid-June at higher altitudes (Scott 1986); mid-June in South Park (Ferris and Brown 1981). Rare in most years, but in wet seasons it may swarm over prairies and congregate on blossoms of prostrate milk vetch species (*Astragalus* spp.) (Ferris and Brown 1981). Males will perch during sunny warm mornings on hilltops to await females. Adults will sip nectar of flowers, especially Drummond's milkvetch (*A. drummondii*) (Scott 1986).

Larval Hostplant: Blue grama (*Bouteloua gracilis*).

Known Threats and Management Issues: Existing threats are fragmentation of habitat by conversion to agricultural use, or by mismanagement of grazing regimes, possibly reducing cover of hostplant.

Invertebrate Characterization Abstract

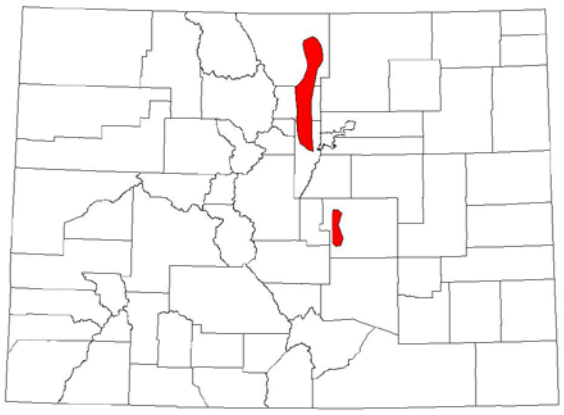
Polites origenes rhena
Cross-line skipper

Photo by Paul Opler

Taxonomy:
Class: Insecta
Order: Lepidoptera
Family: Hesperiidae
Genus: *Polites*

Taxonomic Comments: Two subspecies occur in North America: *origenes* and *rhena*. *Polites origenes rhena* occurs in Colorado (Ferris and Brown 1981) and is larger and more tawny than eastern subspecies *origenes* (Ferris and Brown 1981). Resembles *P. themistocles*, but is slightly larger and darker; the mail stigma is straight, females usually (and males often) have faint hindwing spots, and females nearly lack an orange upper-forewing streak.

CNHP Ranking: G5S3



Statewide distribution of *Polites origenes*
Source: Stanford and Opler 1993

Distribution: Global range: This species occurs in the eastern United States and southern Canada, with disjunct populations in tallgrass meadows adjoining the Rocky Mountain foothills, and similar habitats in the Black Hills of South Dakota (Ferris and Brown 1981). State range: Colorado Front Range lower foothill canyons where they open onto the plains (Ferris and Brown 1981, Brown 1957). Known from 13 counties in Colorado (Stanford and Opler 1993): Adams, Arapahoe, Boulder, Custer, Douglas, El Paso, Elbert, Fremont, Gilpin, Jefferson, Larimer, Las Animas, Pueblo.

Habitat Comments: Elevational range: 1645 to 2316m in Colorado (5400 to7600 ft). Grasslands, serpentine or sandy barrens, canyon openings near plains typify its preferred habitat landscape (Pyle 1981). May be encountered in swales and grassy meadows adjoining the Rocky Mountain foothills (Ferris and Brown 1981).

Phenology: One brood emerging in mid-June through July in Colorado (Ferris and Brown 1981, Pyle 1981). Males perch all day in grassy swales and valley bottoms to await females (Scott 1986).

Larval Hostplant: In Colorado, the hostplant is suspected to be big bluestem (*Andropogon gerardii*) by habitat association (Stanford pers. comm).

Known Threats and Management Issues: Habitat, especially along the foothills of Colorado is subject to continued destruction of prairie habitat by conversion to cropland and for urban developments. Additionally, habitat loss may be attributed to increased tree density into formerly open prairie habitat.

Invertebrate Characterization Abstract

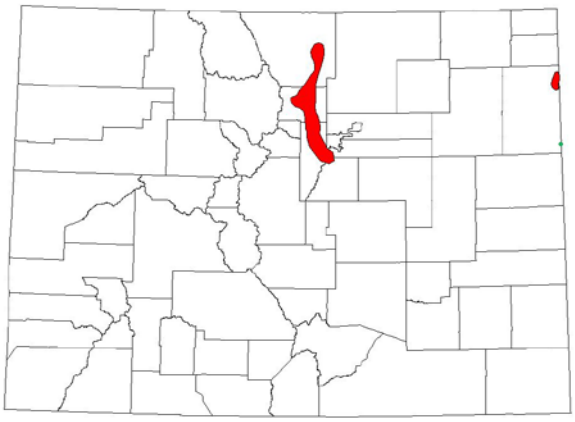
Atrytone arogos iowa
Arogos skipper

Photo by Phyllis Pineda

Taxonomy:
Class: Insecta
Order: Lepidoptera
Family: Hesperiidae
Genus: *Atrytone*

Taxonomic Comments: Most authors recognize two subspecies: *arogos* formerly Atlantic and Gulf coastal plains from New York to Florida and Louisiana and *iowa* of the Great Plains, with subspecies *iowa* demonstrating reduced dark markings (Ferris and Brown 1981). Colorado populations are subspecies *iowa*.

CNHP Ranking: G3G4S2



Statewide distribution of *Atrytone arogos*
Source: Stanford and Opler 1993

Distribution: Global range: The Arogos skipper occupies a patchy range from Long Island south along the Piedmont and coastal plain to peninsular Florida and west along the Gulf to eastern Texas. A separate group of populations occurs on the prairies from southern Minnesota and adjacent Wisconsin west to eastern Wyoming and south to Missouri, Oklahoma, and northeastern Colorado (Opler and Krizek 1984). State range: Known only from the northern lower Front Range and extreme northeastern Colorado in five counties (Stanford and Opler 1993): Arapahoe, Boulder, Jefferson, Larimer, Yuma.

Habitat Comments: Maximum elevation: 1890m (6200 ft). May be encountered in relatively undisturbed sloping mixed- and tallgrass prairie meadows (Ferris and Brown 1981).

Phenology: Short flight with emergence of adults beginning in late-June through mid-July near the foothills, a week or two earlier eastward on the plains. Males perch on flowers and tall grasses to await females, mainly in the afternoon when thunderclouds have developed. In sunny morning hours when most butterflies are active, Arogos skipper individuals are difficult to find except on flowers (Ferris and Brown 1981).

Larval Hostplant: Big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), possibly switch grass (*Panicum* spp.) (Scott 1986).

Known Threats and Management Issues: Prairie habitats have been severely altered by agricultural conversion, urban development, fire suppression, and mismanagement of livestock grazing. These threats continue to impact prairie habitat fragments (Panzer 1988). Introduced grasses and other forbs, i.e., smooth brome (*Bromus inermis*), cheat grass (*Bromus tectorum*) and knapweed (*Centaurea* spp.) threaten to invade existing prairie habitats. Additionally, increased tree density negatively affects the quality of suitable habitat.

Invertebrate Characterization Abstract

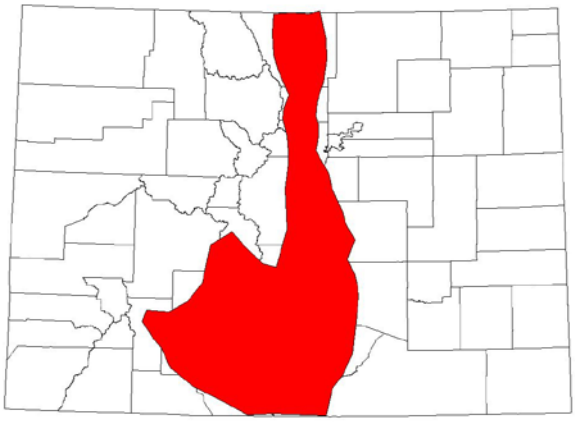
Paratrytone snowi
Snow's skipper

Photo by Paul Opler

Taxonomy:
Class: Insecta
Order: Lepidoptera
Family: Hesperiidae
Genus: *Paratrytone*

Taxonomic Comments: Burns (1992) moved *snowi* into the genus *Paratrytone* (from the genus *Ochlodes*) based on female and male genitalic characters. Rocky Mountain specimens are typical *snowi*; a subspecies with larger spots occurs in central Mexico (Ferris and Brown 1981).

CNHP Rank: G4S3



Statewide distribution of *Paratrytone snowi*
Source: Stanford and Opler 1993

Distribution: Global range: Restricted to the central and southern Rocky Mountains south to Puebla, Mexico, with records from Arizona, New Mexico, Colorado, southeast Wyoming, and two to six (taxonomic question) counties in Mexico (Stanford and Opler 1993, Ferris and Brown 1981). State range: Known from 19 counties in Colorado (Stanford and Opler 1993): Boulder, Chaffee, Conejos, Costilla, Custer, Douglas, El Paso, Gunnison, Hinsdale, Huerfano, Jefferson, Larimer, Las Animas, Mineral, Park, Pueblo, Rio Grande, Saguache, Teller.

Habitat Comments: Elevational range is 2072 to 2926m (6800 to 9600 ft). Inhabits upper Transition to Canadian Zone woodlands, especially the upper edge of ponderosa pine forest (Scott 1986) and riparian habitats in pine forests (Ferris and Brown 1981). In some areas of Colorado, it is known to frequent wet montane meadows (Emmel *et al*. 1992). Usually encountered in gulches and ravine bottoms in sunny openings.

Phenology: Flies in mid-July to early-August in most areas, July in northern Colorado (Scott 1986). Males perch all day in narrow dry gullies to await females, and court there and elsewhere at flowers (Scott 1986). Horsemint (*Monarda* spp. especially *fistulosa*) is a favored nectar source (Ferris and Brown 1981).

Larval Hostplant: Hostplant is unknown; however, J. Scott has observed oviposition on the grass pine dropseed (*Blepharoneuron tricholepsis*), and observed attempted oviposition on mountain muhly (*Muhlenbergia montana*) in southern Colorado (Ferris and Brown 1981).

Known Threats and Management Issues: This species prefers a high quality, open woodland. Preferred habitats are at risk due to deforestation for timber harvest, or increased tree density. Increased tree density may be attributed to a successional response to fire suppression; this potentially increases the threat of large-scale fires, possibly destroying suitable habitat.

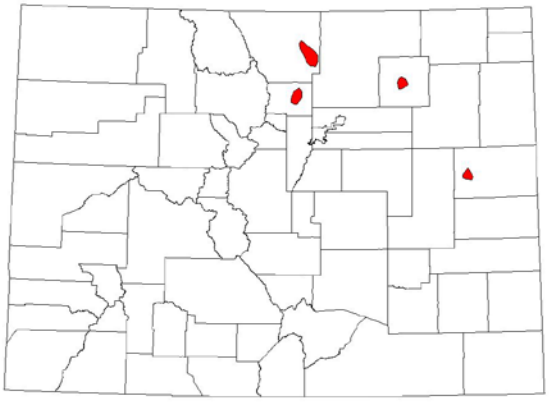
Invertebrate Characterization Abstract

Euphyes bimacula
Two-Spotted Skipper

Taxonomy:
Class: Insecta
Order: Lepidoptera
Family: Hesperiidae
Genus: *Euphyes*

Taxonomic Comments: Two subspecies are provisionally recognized in North America: *acanootus* and *illinois* (Miller and Brown 1981). Colorado populations are assigned provisionally to the subspecies *illinois*. The western populations are larger and brighter above than eastern populations, but more dull gray beneath with prominent veins on ventral-hindwing (Ferris and Brown 1981).

CNHP Rank: G3G4S1



Statewide distribution of *Euphyes bimacula*
Source: Stanford and Opler 1993

Distribution: Global range: From New England and Ontario south to Virginia and westward to Wisconsin, Iowa, Nebraska and northeast Colorado (Ferris and Brown 1981). State range: Known from four counties in northeastern Colorado: Boulder, Larimer, Morgan, and Yuma (Stanford and Opler 1993).

Habitat Comments: This species is a post-glacial relict inhabiting bogs, marshes, pond edges and adjacent fields, and sedge meadows containing *Carex* spp. (Ferris and Brown 1981, Pyle 1981).

Phenology: Short flight from late June through mid-July (Ferris and Brown 1981). Males await females while perched on tall stalks in open sedge marshes and are extremely wary. Both sexes visit flowers (Ferris and Brown 1981).

Larval Hostplant: Nebraska sedge (*Carex nebrascensis*) (Stanford pers. comm.).

Known Threats and Management Issues: Development of wetlands for hay, pasture, cropland, livestock watering holes or reservoirs are the most serious threats to this skipper. Additionally, aggressive exotic plants, such as Canada thistle (*Cirsium arvense*), leafy spurge (*Euphorbia esula*) and common teasel (*Dipascus sylvestris*) negatively impact suitable habitat by displacing native vegetation in these meadows.

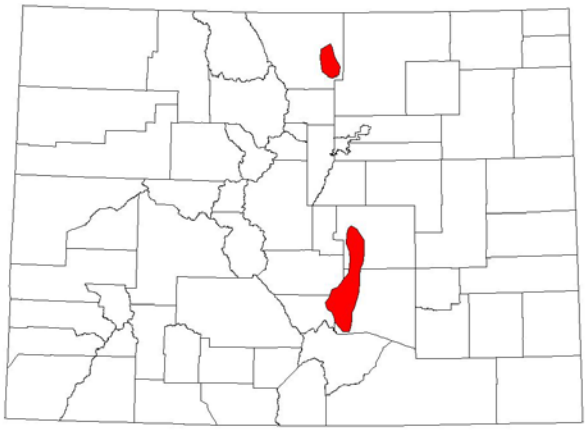
Invertebrate Characterization Abstract

Atrytonopsis hianna turneri
Dusted skipper

Taxonomy:
Class: Insecta
Order: Lepidoptera
Family: Hesperiidae
Genus: *Atrytonopsis*

Taxonomic Comments: Two subspecies are recognized in North America: *turneri* and *hianna* (Miller and Brown 1981). Subspecies *turneri* occurs in Colorado (Ferris and Brown 1981). Subspecies *hianna* has few or no under-hindwing spots when compared with subspecies *turneri* (Scott 1986).

CNHP Rank: G4G5S2



Statewide distribution of *Atrytonopsis hianna*
Source: Stanford and Opler 1993

Distribution: Global range: Frequents northeastern North America from Saskatchewan and New England south to Florida and the Ozark Plateau. Several disjunct western populations comprise the Rocky Mountain subspecies. New Mexico records require confirmation (Ferris and Brown 1981). State range: Found in the foothills of the Arkansas headwaters, and in Larimer County (Stanford and Opler 1993). Larimer County populations are apparently peripheral to eastern populations, while Arkansas drainage populations are believed to be disjunct (Scott 1986, Ferris and Brown 1981). Known from five Colorado counties: Custer, El Paso, Fremont, Larimer, Pueblo.

Habitat Comments: Inhabits Transition Zone open dry fields, open woodland, and prairie gulches (Scott 1986). This skipper is found in bluestem grasslands, and often on acid pine or pine-oak barrens or prairies (Pyle 1981). Inhabits relatively undisturbed canyons and open pine woodlands from 1615 to 2195m (5300 to 7200 ft). These habitats are subject to fire, and the skipper must either survive burning or be a good colonist (Opler and Krizek 1984, Pyle 1981).

Phenology: In Colorado, it has one brood, with adults flying from May to mid-June. Males perch in flat clearings or gullies, usually on the ground to await females. Adults will nectar on beardtounge (*Penstemon*) species, and on blackberry, strawberry, and clover (Scott 1986).

Larval Hostplants: Big bluestem (*Andropogon gerardii*) and little bluestem (*Schizachyrium scoparium*).

Known Threats and Management Issues: Given its lower Front Range distribution, it may be threatened by increasing development. Fire suppression is changing the character of its Front Range habitat reducing the open shrublands and woodlands preferred by this species.

Invertebrate Characterization Abstract

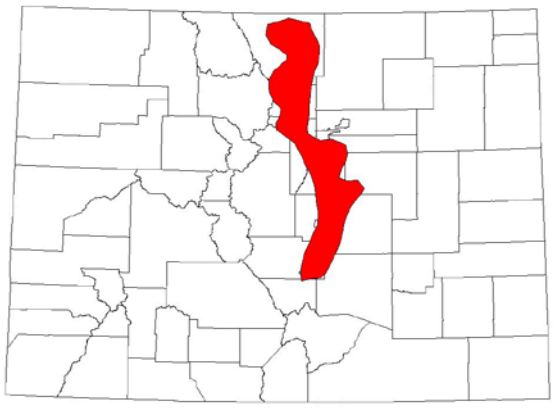
Callophrys mossii schryveri
Schryver's elfin

Photo by Paul Opler

Taxonomy:
Class: Insecta
Order: Lepidoptera
Family: Lycaenidae
Genus: *Callophrys*

Taxonomic Comments: Formerly in the genus *Incisalia.* The *mossii* complex is separated from *fotis* complex due to its preference for stonecrop (*Sedum* spp.) as a hostplant. Subspecies *schryveri* occurs in Colorado (Ferris and Brown 1981). *C. mossii schryveri* range is restricted to the Rocky Mountain region. *Callophrys mossii schryveri* contrasts with species *C. mossii* in that it is smaller, has a lighter dorsal color in the male; and more contrasting ventral hindwing markings (Scott 1986).

CNHP Rank: G4T3S2S3



Statewide distribution of *Callophrys mossii schryveri*
Source: Stanford and Opler 1993

Distribution: Global range: The *mossii* complex is confined to the northwestern portion of the United States and southwestern Canada extending south to central California and to east-central Colorado (Stanford and Opler 1993, Ferris and Brown 1981). State range: Foothills and lower montane canyons between 1828 and 2438m (6000 to 8000 ft) (Ferris and Brown 1981). Known from nine counties in the Colorado Rocky Mountain region (Stanford and Opler 1993): Boulder, Clear Creek, Douglas, El Paso, Fremont, Gilpin, Jefferson, Larimer, and Pueblo.

Habitat Comments: Elevational range is between 1828 and 2438m (6000 to 8000 ft). Occupies suitable habitat in Transition to lower Canadian Zone wooded canyons containing the hostplant (Scott 1986). Canyons with steep rocky slopes, mossy bare summits and ridges, brushy foothill ravines, sagebrush hillsides and flats (Pyle 1981).

Phenology: One brood. Flies from February to June depending on locality (Pyle 1981). It is one of the first non-hibernating butterflies to appear in the spring (Ferris and Brown 1981). Stays

close to the hostplant, flying erratically and close to the ground, often in inaccessible areas. Males come to damp earth, perching on low shrubs or ground, females are more reclusive and remain higher up on slopes (Pyle 1981). Adults are local, moving an average of only 50m for males and 52m for females over a lifetime (Scott 1986). Males perch all day on shrubs in gulches and on slopes to await females (Scott 1986).

Larval Hostplant: Stonecrop (*Sedum lanceolatum*).

Known Threats and Management Issues: The greatest current threats are extensive urbanization and alteration of habitat. Noxious exotic plants, recreational development and water development continue to threaten lower foothill canyons (even on public lands). The absence of fire and increased tree density may negatively impact hostplant.

Invertebrate Characterization Abstract

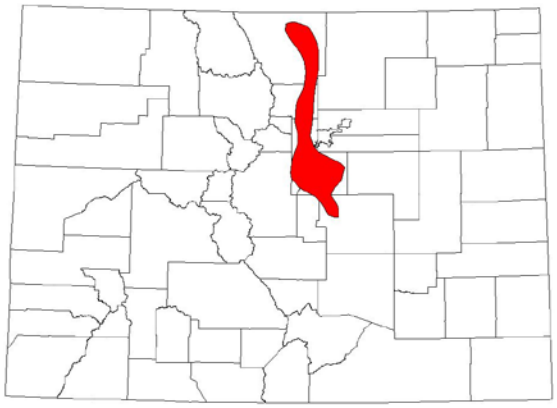
Celastrina humulus
Hops-feeding azure

Photo by Phyllis Pineda

Taxonomy:
Class: Insecta
Order: Lepidoptera
Family: Lycaenidae
Genus: *Celastrina*

Taxonomic Comments: Formally described in 1998, this is the species incorrectly referred to as "form" *neglectamajor* from Colorado. Wright is a leading expert on this genus and the authors make a solid case for this as a valid taxon, although the authors note it could possibly end up as a subspecies of some eastern species (Scott and Wright 1998). This species appeared in earlier CNHP reports as *Celastrina* sp.1.

CNHP Rank: G2S2



Statewide distribution of *Celastrina humulus*
Source: Stanford and Opler 1993

Distribution: Global range: Foothills of eastern Colorado Rockies (Wright 1995). State range: Probably endemic to the Front Range of Colorado (Opler pers. comm.). Documented from eight Front Range counties in Colorado : Adams, Arapahoe, Boulder, Douglas, El Paso, Elbert, Jefferson, Larimer (Stanford and Opler 1996, Ellingson *et al*. 1996, Stanford and Opler 1993).

Habitat Comments: Minimum elevation: 1615m (5300 ft). Typical habitats are mountain canyons and valleys that contain permanent water and contain wild hops (*Humulus lupulus*) (Wright 1998) found clambering over shrubs and rocky slopes in canyons and foothills (Weber 1976).

Larval Hostplant: Wild hops (*Humulus lupulus*).

Phenology: Adult flight: Single brood, emerging late May to June; rarely found through mid-July (Wright 1995, Opler pers. comm.). Larval hostplant is wild hops (*Humulus lupulus*).

Known Threats and Management Issues: Extensive urbanization and alteration of habitat is a major threat. Noxious exotic plants, recreational development and water development also continue to threaten lower foothill canyons (even on public lands). Its formal description may increase collecting pressure (Opler pers. comm.). Management should include control of noxious weeds and control tree density. Hostplant is a disturbance tolerant plant requiring open, sunny areas within canyon habitats. There is some concern that collection of the flowers (for beer brewing purposes) may affect larval food supply.

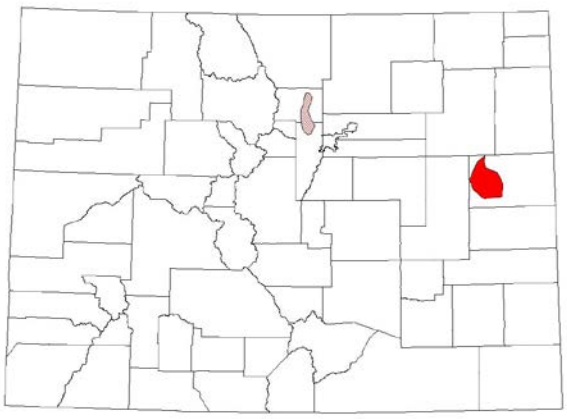
Invertebrate Characterization Abstract

Speyeria idalia
Regal fritillary

Taxonomy:
Class: Insecta
Order: Lepidoptera
Family: Nymphalidae
Genus: *Speyeria*

Taxonomic Comments: One of the two most unique species in the genus. Genus sometimes lumped with *Argynnis* in older literature (Ferris and Brown 1981).

CNHP Rank: G3S1



Statewide distribution of *Speyeria idalia*
Source: Colorado Natural Heritage Program

= Confirmed colony
= Sighting, no colony confirmed

Distribution: Global range: The range historically extended from New Brunswick to southern lower Michigan, Manitoba, and eastern Montana and in Appalachians to northern Georgia. It suffered a drastic loss of range in the 1980s, especially since 1987. Populations are known to be historic or extirpated in all six New England states, eastern Canada (Ontario, Quebec, New Brunswick), New York, New Jersey, West Virginia, Ohio, and Michigan. Status is unknown in Virginia but extant (1993-94); an apparently reliable report for North Carolina in 1994 (Swengel and Swengel 1994). State range: One confirmed colony in Kit Carson County (Stanford pers. comm). Sightings of worn individuals outside of breeding season known from 11 other Colorado counties (Stanford and Opler 1993): Boulder, Douglas, El Paso, Gilpin, Jefferson, Kit Carson, Logan, Morgan, Park, Sedgwick, and Yuma.

Habitat Comments: Found in moist meadows and undisturbed prairie lands near marshes (Ryke *et al*. 1994, Ferris and Brown 1981). Range reduced with conversion of prairies to agriculture, but this species may re-establish in moist areas associated with reservoirs and irrigation projects (Ferris and Brown 1981).

Phenology: One brood with emergence of adults sometimes staggered; therefore, it may be found during most of the summer (Ferris and Brown 1981). One flight June through early September (Scott 1986). Females mate soon after emergence, but delay oviposition for at least a month. Females oviposit on dead vegetation near the hostplant. The larvae overwinter as hatchlings and are nocturnal feeders of violets (*Viola* spp.) in the spring (Ryke *et al*. 1994).

Larval Hostplant: Herb Violaceae including birdfoot violet (*Viola pedatifida*) (Scott 1986).

Known Threats and Management Issues: Declines are likely due to continuing destruction and fragmentation of plains habitat by the conversion of prairies to cropland. Although individuals are sometimes found near irrigation projects and other artificial moist habitats, emphasis should be placed on the preservation of native habitat in natural condition.

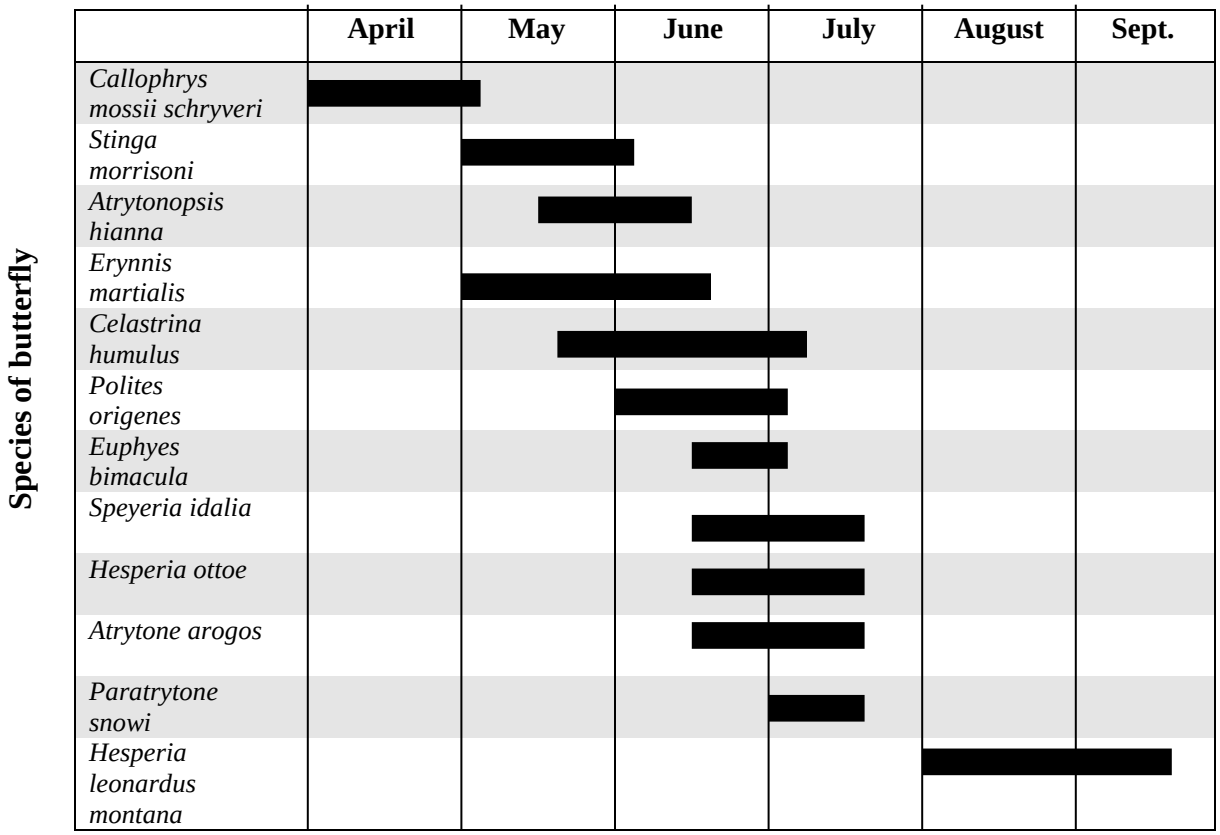
This species is a highly mobile species and may require corridors of undisturbed habitat, or large unfragmented portions of habitat in order to maintain genetic viability and diversity.

Appendix B. Lepidoptera Phenologies

This table is intended to provide an outline for adult appearances (flight and mating times) for each of the targeted species of concern. Phenology information is derived from Scott (1986) and from Ferris and Brown (1981).

For Global and State Rankings, please see the section on **Natural Heritage Ranking System**. For species information, please see the Species Characterization Abstracts in Appendix A.

Table 9. Adult Phenologies for Targeted Species of Concern.



Appendix C. Associated Lepidoptera Species.

A checklist is provided below of species that were verified in the study areas during 1998. Any and all specimens taken have been deposited at the C.P. Gillette Museum of Arthropod Diversity at Colorado State University in Fort Collins, Colorado. All species are listed in taxonomic order.

FAMILIY GEOMETRIDAE (INCHWORM MOTHS)

Pero sp.	A geometer moth
Ixala desperaria	A geometer moth
Coryphista meadi	Barberry geometer
Euchlaena sp.	A geometer moth
Nemoria sp.	An emerald moth
Semiothisa curvata	An angle moth

FAMILY SPHINGIDAE (SPHINX OR HAWK MOTHS)

Hemaris sp.	Clear winged sphinx
Hyles lineata	White lined sphinx

FAMILY ARCTIIDAE (TIGER, LICHEN AND WASP MOTHS)

Grammia favorita	Favorite tiger moth
Lophocampa ingens	A tussock moth

FAMILY NOCTUIDAE (OWLET OR NOCTUID MOTHS)

Euxoa auxilaris	A dart moth
Euxoa sp.	A dart moth
Euagrotis exuberans	A dart moth
Renia discoloralis	Discolored renia
Setagrotis piscipellis	A noctuid moth
Spaelotis sp.	A dart moth
Crassivesica bocha	A noctuid moth
Abagrotis trigona	A dart moth
Apamea lateritia	A cutworm moth
Condica discistriga	A noctuid moth
Schinia mortuo	A flower moth

FAMILY HESPERIIDAE (SKIPPERS AND SKIPPERLINGS)

Epargyreus clarus	Silver-spotted skipper
**Erynnis martialis*	Mottled duskywing
Erynnis pacuvius	Pacuvius duskywing
Erynnis afranius	Afranius duskywing
Erynnis persius	Persius duskywing
Pyrgus communis	Common checkered-skipper
Piruna pirus	Russet skipperling
Oarisma garita	Garita skipperling
Hesperia comma	Common branded skipper
**Hesperia ottoe*	Ottoe skipper
**Hesperia leonardus montana*	Pawnee montane skipper
Hesperia pahaska	Pahaska skipper
Polites themistocles	Tawny-edged skipper
Polites mystic	Long dash
**Atrytone arogos*	Arogos skipper
Atrytone logan	Delaware skipper
Ochlodes sylvanoides	Rare skipper
**Paratrytone snowi*	Snow's skipper
Poanes taxiles	Taxiles skipper
Euphyes vestris	Dun skipper

FAMILY PAPILIONIDAE (SWALLOWTAILS)

Parnassius smintheus	Rocky Mountain Parnassian
Pterourus rutulus	Western tiger swallowtail
Pterourus multicaudata	Two-tailed swallowtail
Pterourus eurymedon	Pale swallowtail

FAMILY PIERIDAE (WHITES AND SULFURS)

Pontia occidentalis	Western white
Artogeia rapae	Cabbage white
Colias eurytheme	Orange sulfur
Nathalis iole	Dainty sulfur

FAMILY LYCAENIDAE (COPPERS, HAIRSTREAKS, BLUES, AND METALMARKS)

Lycaena dione	Gray copper
Lycaena heteronea	Blue copper
Lycaena dorcas	Dorcas copper
Harkenclenus titus	Coral hairstreak
Satyrium behri	Behr's hairstreak
Mitoura siva	Juniper hairstreak
Strymon melinus	Gray hairstreak
Hemiargus isola	Reakirt's blue
Everes amyntula	Western tailed-blue
Celastrina ladon	Spring azure
**Celastrina humulus*	Hops feeding azure
Euphilotes enoptes ancilla	Dotted blue
Lycaeides melissa	Melissa blue
Icaricia icariodes	Boisduval's blue
Apodemia nais	Nais metalmark

FAMILY NYMPHALIDAE (FRITILLARIES, CHECKERS, ANGLEWINGS, AND NYMPHS)

Euptoieta claudia	Variegated fritillary
Speyeria aphrodite	Aphrodite fritillary
**Speyeria idalia*	Regal fritillary
Speyeria edwardsii	Edwards' fritillary
Speyeria coronis	Coronis fritillary
Speyeria callippe	Callippe fritillary
Speyeria atlantis	Atlantis fritillary
Speyeria hesperis	Atlantis unsilvered fritillary
Polydryas arachne	Arachne checkerspot
Charidryas gorgone	Gorgone checkerspot
Phyciodes tharos	Pearl crescent
Phyciodes pratensis	Field crescent
Euphydryas anicia	Anicia checkerspot
Polygonia satyrus	Satyr comma
Polygonia gracilis	Hoary comma
Nymphalis antiopa	Mourning cloak
Vanessa cardui	Painted lady
Basilarchia atlantis	Red admiral
Basilarchia weidemeyerii	Weidemeyer's admiral
Asterocampa celtis	Hackberry emperor
Coenympha tullia	Ochre ringlet
Cercyonis pegala	Common wood nymph
Cercyonis meadii	Mead's wood nymph
Cercyonis oetus	Small wood nymph

*Tracked by the CNHP

Appendix D. Lepidoptera Species known from Jefferson County, Colorado.

Table 10, below, lists the Lepidoptera species of concern known from Jefferson County. This table contains the most complete information available to the Colorado Natural Heritage Program, and while all information is as complete as possible, additions to this list are part of an on-going process.

Table 10. Rare and imperiled Lepidoptera species known from Jefferson County.

Species Name	Common Name	Survey Site	Last Observation Date
Erynnis martialis	Mottled dusky wing	Mount Zion	7/5/98
Erynnis martialis	Mottled dusky wing	Ralston Buttes	8/14/89
Erynnis martialis	Mottled dusky wing	Apex Park	6/18/83
Erynnis martialis	Mottled dusky wing	2 Mi SW Golden	5/1/68
Erynnis martialis	Mottled dusky wing	Bear Creek Canyon	6/14/68
Erynnis martialis	Mottled dusky wing	Golden Gate Canyon/Tucker Gulch	4/27/80
Erynnis martialis	Mottled dusky wing	Indian Gulch	6/15/67
Erynnis martialis	Mottled dusky wing	Red Rocks Park	5/30/69
Erynnis martialis	Mottled dusky wing	Lookout Mtn	6/12/82
Erynnis martialis	Mottled dusky wing	Tinytown	5/17/92
Erynnis martialis	Mottled dusky wing	South Platte Canyon	6/2/96
Hesperia ottoe	Ottoe skipper	Rocky Flats	7/91
Hesperia ottoe	Ottoe skipper	Red Rocks Park	7/11/84
Hesperia ottoe	Ottoe skipper	Mt. Zion	7/7/85
Hesperia ottoe	Ottoe skipper	Plainview Prairie	7/27/98
Hesperia leonardus montana	Pawnee montane skipper	North Fork South Platte - West	8/19/88
Hesperia leonardus montana	Pawnee montane skipper	North Fork South Platte River-East	8/31/98
Hesperia leonardus montana	Pawnee montane skipper	South Platte River-Confluence To Deckers	8/18/94
Hesperia leonardus montana	Pawnee montane skipper	Cheesman	8/31/95
Hesperia leonardus montana	Pawnee montane skipper	S. Platte River, Park/Teller, County Line	8/29/95
Polites origenes	Cross-line skipper	Coal Creek Canyon	7/11/75
Polites origenes	Cross-line skipper	Clear Creek Canyon	7/3/84
Polites origenes	Cross-line skipper	Red Rocks Park	7/21/76
Polites origenes	Cross-line skipper	Lookout Mountain	6/11/77
Polites origenes	Cross-line skipper	Indian Gulch	6/30/69
Polites origenes	Cross-line skipper	Chimney Gulch	7/4/29
Polites origenes	Cross-line skipper	Rocky Flats	7/4/72
Atrytone arogos	Arogos skipper	Chimney Gulch	8/10/91
Atrytone arogos	Arogos skipper	Green Mountain	1979
Atrytone arogos	Arogos skipper	Red Rocks Park	1979
Atrytone arogos	Arogos skipper	Woman Creek Grasslands	7/19/95
Atrytone arogos	Arogos skipper	Mt. Zion	6/30/91
Atrytone arogos	Arogos skipper	Plainview Prairie	7/27/98
Atrytone arogos	Arogos skipper	Clear Creek Canyon	7/5/98
Paratrytone snowi	Snow's skipper	Pine Valley Ranch	7/14/98
Paratrytone snowi	Snow's skipper	Nott Creek Trailhead	7/15/94
Paratrytone snowi	Snow's skipper	Golden Gate Canyon	7/26/73

Species Name	Common Name	Survey Site	Last Observation Date
Callophrys mossii schryveri	Schryver's elfin	Guy Gulch	4/18/82
Callophrys mossii schryveri	Schryver's elfin	Clear Creek Canyon	4/28/82
Callophrys mossii schryveri	Schryver's elfin	Chimney Gulch	4/11/82
Callophrys mossii schryveri	Schryver's elfin	Mt. Zion	4/17/84
Callophrys mossii schryveri	Schryver's elfin	Coal Creek Canyon	5/2/59
Callophrys mossii schryveri	Schryver's elfin	Ralston Creek	5/24/80
Callophrys mossii schryveri	Schryver's elfin	Red Rocks Park	5/15/95
Callophrys mossii schryveri	Schryver's elfin	Golden Gate Canyon/Tucker Gulch.	4/20/69
Callophrys mossii schryveri	Schryver's elfin	Lookout Mountain	4/27/74
Callophrys mossii schryveri	Schryver's elfin	Deer Creek Canyon	4/2/71
Callophrys mossii schryveri	Schryver's elfin	Waterton	4/5/69
Celastrina humulus	Hops feeding azure	Mt. Zion	6/14/92
Celastrina humulus	Hops feeding azure	Coal Creek	7/5/97
Celastrina humulus	Hops feeding azure	Red Rocks Park	6/16/81
Celastrina humulus	Hops feeding azure	Lookout Mountain	6/19/69
Celastrina humulus	Hops feeding azure	Chimney Gulch	7/3/82
Celastrina humulus	Hops feeding azure	Rock Creek Drainage	6/26/95
Celastrina humulus	Hops feeding azure	Pine Valley Ranch	7/14/98
Celastrina humulus	Hops feeding azure	Coal Creek	7/5/97
Celastrina humulus	Hops feeding azure	Coal Creek	7/5/97
Speyeria idalia	Regal fritillary	Plainview Prairie	7/13/98
Doa ampla	A moth	Deadman Gulch	
Grammia sp. 1	A tiger moth	Deadman Gulch	