NATURAL HERITAGE INVENTORY, MONITORING AND MANAGEMENT RECOMMENDATIONS

for

SIGNIFICANT SPECIES AND NATURAL COMMUNITIES

at the

RANSON – EDWARDS HOMESTEAD PARK OPEN SPACE

JEFFERSON COUNTY, COLORADO

Submitted to

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December 20, 1998

Executive Summary

The Ranson-Edwards Homestead Park Open Space contains a number of biologically significant features. These include one imperiled grassland plant community, (the *Andropogon gerardii-Sporobolus heterolepis* xeric tallgrass prairie); three imperiled butterfly species, (the Arogos skipper, regal fritillary, and Ottoe skipper); two vertebrates, (the Preble's meadow jumping mouse and the northern leopard frog); and one plant, (the dwarf leadplant). The key ecological processes necessary for the continued survival of these species and the plant community are fire and grazing in the grassland, and hydrology in the riparian area. Threats to these biological features include invasion of alien plant species, alteration of natural fire and grazing regimes, habitat fragmentation, and changes to the hydrologic regime of Coal Creek. Management recommendations and suggestions on locations of facilities are presented which will help conserve these features. Managing invasive alien plant species is the greatest management challenge for the Open Space. Eleven permanent transects have been established to monitor the effects of management and other activities on the vegetation of the Open Space. First year results of the monitoring are presented.

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I. Introduction

The Ranson – Edwards Homestead Park Open Space is a unit of the Jefferson County Open Space system. The property that forms the Ranson – Edwards Homestead Park Open Space was acquired in order to preserve the Mountain Backdrop North and Coal Creek area; preserve the Porter (Quarter) Circle and Rocky Flats Natural Areas identified in the Colorado Natural Heritage Program inventory; preserve the Coal Creek stream corridor; preserve critical wildlife habitat; and potentially to provide a trail corridor (Harrison, 1994). Land Stewardship Consulting, in association with the Colorado Natural Heritage Program, was retained by Jefferson County Open Space to inventory the natural features, design and implement a monitoring program, and propose management recommendations for the Ranson – Edwards Homestead Park Open Space.

II. Ranson – Edwards Homestead Park Open Space Environment

A. Location and Access to the Open Space

The Ranson – Edwards Homestead Park Open Space is located in northwestern Jefferson County about one mile west of State Highway 93, one mile north of State Highway 72, and one mile south of the Boulder County line (Figure 1). To access to the Open Space from the intersection of State Highway 93 and 72, drive west toward Coal Creek Canyon on Highway 72 for 1.75 miles. Turn north (right) on Plainview Road for 0.6 miles. At this point, the Open Space begins on the east (right) side of Plainview Road (Figure 2). At a fence line 0.25 miles further north, the Open Space includes land on both sides of Plainview Road. Continue driving north for another 1.1 miles. At this point, a private driveway continues northwest, while Plainview Road turns west and climbs a moderately steep grade through a ponderosa pine savanna. In another 0.8 miles, Plainview Road crosses the Denver and Rio Grande railroad tracks at the western boundary of the Open Space.

All of the Open Space is readily accessible on foot from Plainview Road without trespassing on private land. There are two primitive roads that originate on Plainview road and lead east across the Open Space to Coal Creek and to the northeastern portion of the Open space, respectively. These two-track roads are open to vehicle traffic for administrative purposes and are posted to discourage public vehicular use.

B. Landscape position and physiography

The Open Space consists of approximately 780 acres of grassland and ponderosa pine forest and savanna located on the boundary of the plains and the foothills. The Open Space slopes gently toward the east away from the foothills. The elevation ranges from about 6800feet in the northwestern corner to about 6200 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 4600 feet 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.

C. Climate

The average annual precipitation at Lakewood, which is located 16 miles southeast of the Open Space, was 15.86 inches from 1961 - 1990, with most of the precipitation falling during the growing season (Owenby and Ezell 1992). Precipitation at the Open Space is somewhat higher than at Lakewood because of the higher elevation of the Open Space. Summer rains are usually reliable and provide the moisture necessary to support the local grasslands. The wettest three months are May, June and July with an average of 6.45 inches of moisture while the driest three months are December, January and February with an average of 1.55 inches of precipitation (Owenby and Ezell 1992). The average temperature in January, the coldest month, is 30.2 degrees F while the average temperature in July, the warmest month, is 71.9 degrees F (Owenby and Ezell 1992). Wide and rapid fluctuations in temperature are not uncommon during the winter. Such changes in temperature are problematic for many species of trees and shrubs.

D. Soils

The most common type of soil on the Open Space is the Flatirons very stony sandy loam on 5-30 percent slopes (Figure 3). The soil is classified as a Mollisol (Aridic Paleustoll). The soil is deep and well drained and is formed in noncalcareous, cobbly, gravelly and loamy material of the Rocky Flats Alluvium. Permeability is slow and available water capacity is low. Rock fragments make up 35 – 80 % of the volume of the soil (Price and Amen, undated). The shallower and rockier soils in the northwestern portion of the Open Space support stands of ponderosa pine, while deeper soils on the remainder of the property typically support grassland.

E. Geology

The property is located where the Rocky Flats gravel transects with the Pierre shale (Figure 4). Gravel-capped bedrock erosion surfaces, such as the Rocky Flats, are common along the Front Range foothills drained by the Arkansas and South Platte Rivers (Malde 1955). Rocky Flats has the form of a fan with its apex near the mouth of Coal Creek Canyon (Malde 1955). These materials, with the exception of the sandstone and siltstone that were derived from hogbacks along the foothills, have their source in the drainage basin of Coal Creek, which extends about 7 miles into the mountains (Malde 1955). The chief gravel constituent, quartzite, is derived from the Coal Creek quartzite (Malde 1955). A list of the geologic units present on the Open Space is found in Table 1.

Rocky Flats is capped by gravel that ranges in thickness from 1-50 ft, and averages about 10 ft. The thinnest parts are over bedrock ridges, and the thickest are in broad, shallow channels cut into the bedrock (Malde 1955). No orderly variation in average thickness of the capping gravel was found (Malde 1955). The gravel has been

strongly weathered. Quartzite fragments are comparatively fresh internally but have a stained and crumbly rind (Malde 1955). The deposit also includes coarse sand and boulders.

The Pierre shale conformably overlies the Niobara formation. It is a lead-gray to brown or black shale of marine origin, which weathers to olive gray or brown (Spencer 1961). Although generally homogeneous, the Pierre shale contains some siltstone, silty sandstone, beds of limestone, and limestone concretions (Spencer 1961).

F. Water

The Open Space is drained locally by Coal Creek which flows through the eastern portion of the property (Figure 2). Coal Creek originates in the foothills about 8 miles west of the Open Space and flows northeast from the Open Space across Jefferson and Boulder County until it joins with Boulder Creek. Coal Creek flows all year, although its flows are greatly depleted by irrigation withdrawals during the summer months. There are two small ponds on the Open Space that were built to provide water for livestock. In addition, there are several small seep wetlands located in local topographic depressions. These wetlands are supported mostly by ground water discharge.

III. Biological Significance of the Open Space

One of the goals of this project is to determine the extent of the significant plant community identified during the survey of Jefferson County by CNHP (Pague et al., 1993). Significant plant communities as considered by CNHP are good condition, common plant communities and those that are rare or imperiled.

The site was field surveyed during the summer of 1998. All major plant communities were visited and the dominant and common plant species noted. These plant communities were then classified by comparison to existing descriptions in the literature, and CNHP files and databases.

The most significant plant community identified at the site is the big bluestem-prairie dropseed plant community (*Andropogon gerardii-Sporobolus heterolepis).* This plant community is ranked G2/S1S2, indicating that it is imperiled throughout its global range (G-rank) and within the state (S-rank, Table 2). (See the Appendix for an explanation of Natural Heritage rankings.) In Colorado, tallgrass prairie remnants often support several imperiled butterfly species, and this is the case at Ranson - Edwards Homestead Park. The highest quality part of the grassland in located mainly west of Plainview Road. While the species characterizing this grassland are also present east of Plainview Road, this part of the open space is more heavily dominated by alien plant species. We hypothesize eastern part of the grassland could be restored to better condition using the management recommendations included in this report.

Also present are seeps above Coal Creek that are dominated by prairie cordgrass (*Spartina pectinata*), sedges and rushes, and the riparian woodland along Coal Creek that is dominated by narrow-leaf cottonwood (*Populus angustifolia*), plains cottonwood (*Populus deltoides* ssp. *monilifera*), chokecherry (*Prunus virginiana*), coyote willow (*Salix exigua*), hawthorn (*Crataegus macracantha* and *C. erythropoda*), and leadplant (*Amorpha fruticosa*).

Several other imperiled species are known from the site or adjacent areas (Table 1). The northern leopard frog (*Rana pipiens* - G/S3) and the dwarf leadplant (*Amorpha nana* – G5/S2S3) were also documented at the site during the surveys. The Preble's meadow jumping mouse (*Zapus hudsonius preblei* - G5T2S1) has been documented from Coal Creek at Ranson-Edwards Homestead Park. Several imperiled butterfly species were documented at the site during the summer of 1998 including the Ottoe skipper (*Hesperia ottoe*- G3?/S2), Arogos skipper (*Atrytone arogos* – G3G4/S2), and the regal fritillary (*Speyeria idalia* – G3/S1). The butterfly species will be addressed in more detail in a separate report (P. Pineda, in progress). Areas of Open Space that contain significant grassland and butterfly habitat are shown in Figure 5.

Butterfly and skipper species are particularly numerous on the Front Range of Colorado. Approximately 176 of 750 North American (north of Mexico) species of butterflies are resident or regular colonists on the Colorado Front Range, making it the fourth richest (number of species) butterfly region in the United States (Opler 1994, Opler and Krizek 1984). Butterfly species of the eastern Great Plains occurring in disjunct populations along the Colorado Front Range are of high conservation priority. Such species include the Ottoe skipper (*Hesperia ottoe*) and the Arogos skipper (*Atrytone arogos*). 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. Many of these species are associated with xeric or mesic tallgrass prairies (*Andropogon gerardii-Schizachyrium scoparium, Andropogon gerardii-Sorghastrum nutans,* and *Andropogon gerardii-Sporobolus heterolepis* plant communities) which have similar disjunct distributions and are increasingly threatened by land conversion.

IV. Key Ecological Processes Affecting the Biologically Significant Features of the Open Space

We hypothesize that the key processes affecting the Open Space (at least in the historic past) were fire (low-intensity, ground fires that maintained the grassland and prevented encroachment of trees and shrubs); large animal grazing and associated trampling.

We believe that fire was historically an important ecological process on the Open Space and that it ought to be re-introduced to recycle nutrients, recycle plant litter and control cool-season weeds. Technically speaking, prescribed burning would be fairly

easy at Ranson – Edwards Homestead Park. Prescribed burning in the riparian area should be avoided to prevent impacts to the Preble's meadow jumping mouse. Monitoring would need to follow burning at some level, at least to check for noxious weeds that might colonize after disturbance.

Large animal grazing was a ubiquitous feature of the Great Plains, mainly in the form of bison but also from elk, deer, native sheep and pronghorn. Today, domestic livestock have replaced these native grazers and browsers. Ideally, we can regard livestock grazing as a potential tool to help accomplish the proposed management goal and its associated objectives. However, if livestock grazing were to be used as a tool, it should be managed so as to move toward the management goal and not simply to graze cattle.

Another key ecological process is periodic flooding along Coal Creek. Flooding recharges local ground water adjacent to Coal Creek on which riparian and wetland species depend during the remainder of the growing season. In addition, cottonwoods depend on flooding to provide suitable sites for seed germination. Without flooding, the cottonwoods along Coal Creek would eventually die out. The continued existence of the Preble's meadow jumping mouse along Coal Creek is also tied indirectly to periodic flooding because flooding supports the riparian plant vegetation upon which the jumping mouse depends.

V. Threats to the Biologically Significant Features of the Open Space

The principal threats to the Open Space appear to be invasive, non-native species; poorly managed livestock grazing; excessive levels of recreation; 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.

A. Invasion by Alien Plant Species

Controlling noxious weeds is the single biggest management challenge and priority for the Open Space.

The invasion of alien (non-native) species can result in the widespread replacement of native species, often greatly altering ecosystem functions (Vitousek 1990). This appears to be one of the most significant threats to biodiversity at Ranson / Edwards Homestead Park and has significantly impacted natural communities. For example, cheatgrass (*Bromus tectorum*) competes with native species for water and negatively affects their water status and productivity (Melgoza et al., 1990). Numerous studies have shown that areas invaded by non-native species have reduced populations of native plant and animal species (Bedunah 1992, Bock and Bock 1988).

There are at least 36 species of alien plant species on the Open Space (Table 4). It is not physically possible to attempt to control all alien plant species. Therefore, we

propose that Jefferson County Open Space prioritize alien weed species for management. Hiebert and Stubbendieck (1993) have developed a method for prioritizing alien weeds based on a weed's potential to inflict the damage on the Open Space and a weed's susceptibility to control efforts. Preliminarily, we consider diffuse knapweed (*Acosta 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*) as priority noxious weed species. However, we recommend that the County conduct a weed prioritization following the approach of Hiebert and Stubbendieck (1993) to refine this list. The Nature Conservancy has commissioned reports on many invasive alien plant species that are problems in the western US. These reports are called Element Stewardship Abstracts and cover biology, ecology, threats, and control methods for the respective species. The abstracts are available free of charge from the Conservancy via the internet.

The first management priority for the Open Space is weed control. The monitoring program gives considerable attention to noxious weeds. As discussed in more detail below, we propose a detailed inventory of the noxious weeds present on the Open Space, with the main product being a map that shows the locations and sizes of patches of priority noxious weed species. We also propose annual weed monitoring in the form of an annual weed inventory of the Open Space property focusing on land adjacent to Plainview Road, which we hypothesize will 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.

B. Altered Fire Regimes

Alteration of natural fire regimes in natural habitats can allow certain species to invade sites where they otherwise would not occur and can allow fire fuels to build up to dangerous levels.

Fires in European settlement times along the Colorado Front Range are thought to have been fairly frequent and, therefore, of low intensity. Suppression of fires, due to settlement, has altered vegetation structure (e.g., allowing tree species to invade grasslands) and composition, and increased fire fuel loads. This could result in fires that are more severe than they were historically (Hobbs 1987), especially in areas invaded by cheatgrass, smooth brome, Kentucky bluegrass, and Canada bluegrass.

Few data are available detailing the natural fire regimes of the tallgrass remnants along the Colorado Front Range. Fire regimes in the tallgrass prairies of the midwestern U.S. have been extensively studied and fires were thought to occur naturally as often as every 3 to 5 years (Steinauer and Collins 1996). Fire frequency data from the midwestern U.S. probably do not accurately characterize conditions along the Colorado Front Range because environmental factors (especially climate), and species composition and plant

production are quite different. Nonetheless, fires are still considered an important factor in most prairies. Wright and Bailey (1980) suggested that fire frequencies in the shortgrass and mixedgrass prairie may have been between 5 to 10 years on average on level topography to 20 to 30 years on dissected topography.

The increased density and spread of ponderosa pine to lower elevations from fire suppression has been well documented in Colorado (Veblen and Lorenz 1991). This may be impacting grassland communities by altering the environment so that certain shrubs and herbaceous plants, and animals associated with those species can no longer survive.

C. Altered Grazing Regimes

The plant communities along the Colorado Front Range have evolved with and adapted to grazing. Certain grazing patterns utilizing domestic livestock may be used to mimic that of native herbivores.

Plant communities along the Colorado Front Range have evolved with disturbance from native herbivores and are well adapted to grazing. On the prairies of the Great Plains, bison and other large ungulates, and numerous smaller animals were known to remove a large proportion of the above ground and below ground biomass produced by plants (Lauenroth and Milchunas 1991). These herbivores undoubtedly were present in the area and affected the vegetation. Elimination of many of the native herbivores and replacement with domestic livestock has altered this natural process. While domestic livestock often mimic the grazing of native herbivores, certain differences do affect plant communities (Lauenroth and Milchunas 1991).

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. These species are very palatable to livestock. Heavy, continuous grazing can often result in these species being reduced in abundance or eliminated and replaced by less desirable species.

D. Habitat Loss, Edge Effects and Fragmentation

Habitat loss, creation of edge habitats, and fragmentation of grasslands and riparian areas can be detrimental to many plant and animal populations.

Since colonial times, human settlement has had a drastic effect on large landscape features, including the Great Plains prairies and the Front Range of Colorado. It is estimated that between 95 and 99 percent of all tallgrass prairie in the United States, some of which has a disjunct distribution along the Colorado Front Range corridor, has been eliminated (Swengel and Swengel 1995, Moffat and McPhillips 1993). In the midwestern

U.S. elimination of this habitat was accomplished mainly through the conversion of native prairie to agricultural fields. In Colorado, housing and urban development, mining, water development, and recreation have also impacted these plant communities. The construction of Planview Road has resulted in loss of habitat in the area that became the Ranson - Edwards Homestead Park Open Space. Additional habitat loss at could occur from construction of parking areas, trails and roads and from off-site activities such as diversion of water from Coal Creek upstream of the Open Space.

Edge areas are zones of contrasting habitats or landscapes meet (Schwarz et al. 1993). These areas often attract high numbers of generalist animal and plant species. As our landscape is increasingly fragmented by large-scale, rapid anthropogenic conversion, habitat edges become increasingly abundant. As a result, many generalist species have become increasingly common in these areas, and compete, either directly or indirectly, for resources with the specialist species (e.g., Rathcke and Jules 1993). 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, interior or undisturbed habitat is lost (Schwarz et al. 1993).

Fragmentation refers to the subdivision of a habitat by the creation of contrasting habitats and reduces larger blocks of habitat to smaller blocks. Fragmentation can also create more edge in a particular habitat. For example, Plainview Road has fragmented the grassland habitat that lies on either side of the road within the Open Space. 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 has the potential to create fragmentation and edges. For example, rodents may avoid trail openings because of exposure to predation (Harker et al. 1993). The same impact holds true for insects.

Animal specialists are relatively exacting in environmental requirements, obligated to conditions of habitat continuity. They often cannot survive for extended periods of time in small habitat patches in fragmented landscapes, and cannot exist, as plants occasionally do, in dormant states during intervals of habitat unsuitability (Oates *in* Pullin 1995). Specialists that occur in small, patchy populations (like many of the Front Range butterflies) 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 resources could be threatened by fragmentation (e.g., Rathcke and Jules 1993). Populations that would normally re-colonize after landscape-scale disturbance such as fire, flood, or disease may actually be extirpated if they exist in isolated fragments (Moffat and McPhillips 1993).

Trails are ideal places for early successional species to grow because disturbance on and adjacent to the trail is continuous and regular. If the impact of additional trails, both formal and social, is considered, habitats and landscapes are increasingly fragmented, with much additional edge habitat being created, resulting in smaller blocks of natural habitat (Harker et al. 1993).

E. Hydrology

Eliminating the natural cycle of flooding and depleting base flows in Coal Creek would severely impact the riparian areas along Coal Creek.

The cycle of flooding could be severely altered or eliminated if a water storage reservoir were constructed on Coal Creek upstream of the Open Space. In addition, construction of a reservoir would probably lead to downcutting of the channel of Coal Creek for several miles downstream of the reservoir. This, in turn, would dry out riparian areas along Coal Creek due to the decline of the water table adjacent to the creek. Such a chin of events could be catastrophic for the population of Preble's meadow jumping mouse that lives on the Open Space in riparian areas along Coal Creek.

Depletion of base flows in Coal Creek could lead to a lowering of the water table along Coal Creek. This could arise if irrigation water were diverted from Coal Creek in or upstream of the Open Space. This could damage or kill riparian plant species, such as cottonwood trees what depend on a steady supply of ground water for their survival (M. Scott, pers. comm.)

VI. Management Goal and Objectives

The overall goal for the Open Space is to maintain or enhance the native plant and animal species and natural communities and the ecological processes that sustain them.

In the context of this plan, a goal is a general statement that sets a broad management direction. We propose that the goal for the Ranson – Edwards Homestead Park Open Space for the next 5 years should be to maintain or enhance the native plant and animal species and natural communities and the ecological processes that sustain them. This is consistent with the purposes expressed by the Jefferson County Commissioners when the Open space property was purchased (Harrison 1994).

A management objective specifies a standard, desired state, threshold value of trend relative to one or more attributes of an ecosystem (Anonymous 1996). Ideally, it should be realistic and achievable; specific and measurable; and clearly articulated and focused (Anonymous 1996). It should also specify where and by when this should occur. All management objectives in this plan pertain to the Ranson – Edwards Homestead Park Open Space for the period 1998 – 2003 (Table 3).

VII. Management Recommendations to Restore and Maintain Biologically Significant Features

A. Prescribed burning

Small-scale (30-40acre) cool-season or dormant season prescribed burns can reduce the abundance of widespread, cool-season, non-native species (e.g., Kentucky bluegrass, Canada bluegrass) which impact the natural communities, while protecting butterfly populations, and control the buildup of fire fuels. Burning can also prevent and reduce the encroachment of ponderosa pines into grassland.

Prescribed burns during the dormant season are known to be effective in reducing cool-season, non-native species and allowing an increase in the abundance of desirable warm-season grasses. However, several native cool season grasses can be impacted by burning, especially with heavy fuel loads. Needle-and-thread grass, green needlegrass, and western wheatgrass can be harmed by spring or fall burning (FEIS 1998). Timing may be very difficult because several of the native and non-native species may be growing at nearly the same time in the spring. Impacts can be minimized by burning while the desirable grasses are dormant but undesirable species (e.g., Kentucky bluegrass, Canada bluegrass, Japanese brome) are active. Fall burning may be possible because fuel loads are adequate to carry a fire and conditions are dry. This may not be the case in the spring. Frequent spring or dormant season burning may allow warm-season species to compete more effectively, but could be harmful to butterfly populations and is not recommended. The same area should not be burned more than once every 5-10 years to avoid impacting butterfly populations. In general, burning during drought can be harmful to many grass species even with dormant season burns (Culver 1997).

Only a small proportion of the habitat should be burned in any one year (possibly 30-40 acres). Vegetation management for butterflies should consider the availability of microhabitats, some of which provide refuges during certain weather cycles (Murphy et al., 1990). Understanding butterfly habitats based on their needs of plants, solar radiation, etc. is important when planning management activities so that not all of one type of habitat is impacted at one time. The regal fritillary may especially sensitive to burning therefore a review of prescribed burning plans by a knowledgeable lepidopterist would be advised.

Fire suppression along the Front Range over the past century has resulted in a dramatic expansion of ponderosa pine trees into areas that were formerly grassland (Mast et al. 1997). Ponderosa pine forest or savanna now occupies approximately 100 acres of Open Space. We propose that this trend should be reversed in order to reclaim some of the grasslands that have been converted to ponderosa pine forest or savanna. Prescribed burning in the areas now occupied by ponderosa pine is an effective and practical way to help accomplish this objective (Arno et al. 1995). The burns that would be conducted would be relatively low-intensity understory burns that would kill small ponderosa pine trees and reinvigorate many but not all of the grassland species. The 100-acres now

by ponderosa pine could be subdivided into four management units, with one unit being burned initially every third year. This would reduce adverse impacts on organisms such as butterflies that are harmed by large-scale burning. Follow-up burns could be conducted every 10 – 15 years in each management unit.

B. Livestock grazing

Grazing during the cool-season or dormant season could be effective in reducing cool-season, non-native species (cheatgrass, Canada bluegrass, smooth brome, Kentucky bluegrass) and reducing fire fuel buildup in grassland communities.

Large portions of the Open Space are heavily populated with non-native species, particularly Canada bluegrass, Kentucky bluegrass, smooth brome, and cheatgrass which are all cool-season grasses. Controlling these species may be accomplished most effectively with controlled livestock grazing and prescribed burning. Grazing in the spring to target non-native cool-season species may allow the native warm-season species to compete more effectively compete.

We suggest employing grazing that mimics historical grazing patterns which were characterized by high intensity but short duration. However, short duration, high intensity management often used in grassland reclamation may be detrimental to sensitive butterfly populations (Oates 1995). Again, using small pastures to avoid impacts to all of one type of microhabitat in a short time frame would help to reduce the chances of impacting sensitive butterfly populations.

A key requirement of grazing is ensuring that desirable grazed plants have adequate time to recover before the next grazing. When plants are growing rapidly, it is important to keep grazing periods short (e.g., a few days to a week) to prevent animals from grazing new regrowth before it has had a chance to contribute to the plant's recovery. When plants are growing slowly, grazing periods can be much longer because significant new regrowth will not occur for several weeks. When plants are dormant, grazing periods can be very long because regrowth is not occurring and thus will not be regrazed. The appropriate lengths of grazing periods depend on factors such as soil moisture, temperature and solar insolation that influence the pace of plant growth. Therefore, grazing periods need to be adjusted frequently during the growing season to prevent overgrazing of desirable plant species.

The particulars of how the grazing occurs have a large influence on how grazing affects species and communities. If livestock grazing were to continue at Ranson – Edwards Homestead Park, we would recommend small, temporary paddocks created with electric fence, with the paddocks grazing for a maximum of one week per grazing cycle. The length of a grazing cycle would be dictated by the recovery of plants and not the needs of the livestock or the convenience of the grazing lessee. Dormant season grazing would likely be the best for the grassland and would present the lowest risk of overgrazing. However, dormant season grazing might not appeal to the current lessee –

where is he going to put his cattle during the rest of the year? The uplands east of the county road appear to be in poorer condition than those west of the road; therefore, grazing might occur on the grassland east of the road, with the riparian areas along Coal Creek being off limits, at least initially.

C. Hand-pulling to control invasive alien plant species

Some weeds can be controlled easily by hand pulling.

Hand pulling is appropriate for small patches of weeds that have shallow root systems. This is particularly true in the first stage of weed invasion for a particular species when plant numbers are low. Hand pulling is easy to implement and does not require equipment beyond a pair of gloves and plastic bags. Invasive plant species that can be controlled by hand pulling include diffuse knapweed (*Acosta diffusa*), Dalmatian toadflax (*Linaria dalmatica*), musk thistle (*Carduus nutans*), and jointed goat grass (*Aegilops cylindrica*). These species occur in low numbers on the Open Space and could be controlled by hand pulling. It is important for persons pulling weeds to use gloves and wash their hands thoroughly with soap and water after field work because certain weed species contain chemicals that can irritate skin. It is also important to bag weeds and dispose of them properly to prevent spreading seeds to new locations.

D. Applying herbicides to control invasive alien plant species

Application of herbicides is effective for controlling many non-native species, especially for those species that are difficult or impractical to control with burning , grazing or hand pulling.

Spot herbicide treatment is highly recommended as a control option for some non-native species that are abundant in small patches and that are not susceptible to hand pulling, burning or burning. These species include Canada thistle (*Cirsium arvense*), bull thistle (*Cirsium vulgare*), hound's tongue (*Cynoglossum officinale)* and sulphur cinquefoil (*Potentilla recta*). This eliminates negative effects of repeated, annual, broad-scale herbicide applications, as this may cause elimination of certain native broad-leaved plant species. It is imperative herbicide applicators be licensed and able to identify key native and non-native species, especially thistles.

E. Biological control of invasive alien plant species

Biological controls should only be used for non-native species that greatly impact the native plants and animals and are very difficult to control with other methods.

Biological control has proven to be effective against some non-native species, often those that resist other control methods. Special care is necessary when importing non-native insects species (Lattin et al. 1994). Generally experiments are conducted to insure that the introduced insects do not impact desirable species but some insect species

do not differentiate between related native and non-native plants (such as Canada thistle and native thistles). Many insect species can shift and adapt to differences in their environment in a short time. This phenomena is referred to as 'microevolution", and in usually in response to short-term selection pressures such as insecticides, pollution, or availability of a different host plant (B. Kondratieff personal communication). Introducing non-native insects as biological controls may be similar to the past introductions of non-native plants. The species formerly thought to be beneficial could become a pest in the future.

F. New facilities

New facilities should be planned to have as little impact as possible on the surrounding natural habitat.

Locations for development of open space facilities and trails are obviously important and difficult concerns for land managers. In terms of habitat conservation and preservation, these facilities should be planned to have as little impact as possible on the surrounding habitat. We recommend that any new facilities be constructed east of Plainview Road to avoid impacting the better-condition grassland west of Plainview Road. We also recommend that new facilities be constructed outside of the riparian area along Coal Creek and outside of wetlands. The specific locations of facilities should be determined in consultation with a biologist. In some cases, the only way to lessen impacts to natural resources is to avoid impacting the most natural areas, minimize the number of trails in the area, and to hope that user education will help reduce creation of social trails. This will become more difficult as the demands for recreation increase.

New facilities are also effective locations for establishment of invasive alien plant species. Frequent weed control efforts need to occur after facilities are constructed.

VIII. Monitoring Program

A. Introduction

The monitoring approach that we have adopted was developed cooperatively by the Bureau of Land Management, the U. S. Forest Service and The Nature Conservancy. The approach is relatively new and is being refined continually. The version we used for this plan is found in Anonymous (1996).

The high-condition occurrence of the *Andropogon gerardii - Sporobolus heterolepis* plant community, the riparian forest / shrubland along Coal Creek (habitat for the Preble's meadow jumping mouse), the rare butterflies, the northern leopard frog, and the small, scattered seep wetlands are the most significant natural features of the Open Space. Thus, monitoring will focus on these features.

The Preble's meadow jumping mouse is also found along Coal Creek on the Open Space (R. Schorr, pers. comm.). The mouse was listed as a threatened species by the

U. S. Fish & Wildlife Service on May 1, 1998. Currently, the Colorado Department of Natural Resources is leading a collaborative planning effort under the pursuant to Section 10 of the federal Endangered Species Act. Habitat Conservation Plans for five sub-areas along the Front Range of Colorado are now being prepared. The focus of the Jefferson County sub-area is the area in and around Rocky Flats, including Coal Creek, because this area provides considerable high-quality jumping mouse habitat.

This plan does not address jumping mouse monitoring on Ranson – Edwards Homestead Park Open Space because such monitoring needs to be coordinated with the jumping mouse monitoring on nearby lands. The Jefferson County sub-area plan will include monitoring of the mouse, some of which will likely occur on Ranson – Edwards Homestead Park Open Space.

B. Monitoring Objectives

Monitoring objectives specify how one will assess success or failure in meeting management objectives (Anonymous 1996). Unlike a management goal, which sets a specific goal for a target or trend, a monitoring objective sets a goal for measuring a target or trend (Anonymous 1996). Thus, monitoring is driven by associated management objectives that are, in turn, driven by the management goal. The labeling of the monitoring objectives listed below refers to the management objectives presented in Table 2.

A1. Map locations and estimate areal extent (to a precision of $\pm$ 25%) of patches of priority noxious weeds, based on an annual survey of the entire Open Space, and prepare a summary report of the findings.

A2. Each year in permanent plots, detect a 25% change in the frequency of the respective high-priority alien weed species. We want to be 80% certain of detecting this change, and we will accept a 20% chance of concluding that a 25% change occurred when it really did not.

B1. Every five years, calculate the floristic quality index value (Taft et al. 1997) for the *Andropogon gerardii - Sporobolus heterolepis* grassland plant community using pooled presence / absence data from permanent plots located in the grassland.

C1. Every five years, count the number of native plant species using plant presence data from permanent transects.

D1. Every five – ten years, map and calculate the areal extent of riparian vegetation along Coal Creek, with a precision of $\pm$ 20%, using a supervised classification of remotely sensed false-color infrared data in a GIS environment.

E1. Every five – ten years, map and calculate the areal extent of isolated seep wetlands in the upland areas of the Open Space, with a precision of $\pm$ 20%, using a

supervised classification of remotely sensed false-color infrared data in a GIS environment.

F1. Every three years, survey the portion of the Open Space between permanent transect # 6 and the northern boundary of the Open Space along the east side of Plainview Road and count the number of leadplant individuals.

H1. Every year, detect the presence of the rare Ottoe skipper, Arogos skipper and regal fritillary butterflies in permanent sampling grids.

I1. Every two years, count the number of adult northern leopard frogs on the Open Space.

J1. Every five – ten years, determine the canopy cover of ponderosa pine, with a precision of $\pm$ 20%, using data from a low-level, true-color aerial photograph in a GIS environment; also, determine the area of the minimum polygon that encompasses 95% of the ponderosa pine trees using data from a low-level, true-color aerial photograph in a GIS environment.

IX. Monitoring Methodologies

A1. An observer who is able to identify the priority noxious weeds will search for and map weeds once annually. This person will use two approaches. First, the person will walk along temporary transects approximately 500 feet apart. About 10 – 15 such transects will be required for the entire Open Space property. Second, the person will walk along Plainview Road as well as the two two-track roads east of Plainview Road. In both situations, the observer will identify and map all weed patches that he or she can observe from the transects and the roads, respectively. Thus, weeds on the Open Space will be sampled and not truly censused. The observer will carry a copy of a low-level, true-color aerial photograph on which location of weed patches can be identified, mapped, and the patch area estimated. The annotated photograph and accompanying report will be delivered to appropriate Open Space staff responsible for weed control.

A2. Eleven permanent transects, each 50 meters long, have been established in August and September 1998 throughout the Open Space in a stratified-random manner, with two in the riparian corridor along Coal Creek, two in the ponderosa pine forest – savanna, one in an isolated seep wetland and six in the *Andropogon gerardii - Sporobulus heterolepis* grassland plant community (Figure 7). Along each transect, 20 permanent microplots, each 50 cm x 50 cm in size, have been established at 2.5 meter intervals using a random starting point. All plant species that are rooted within each microplot were listed. Priority noxious weed species frequencies have been calculated using the data from the 20 microplots along each transect. See section X. below for results of monitoring work conducted in 1998.

B1. Six permanent plots, each 50 meters long and 1 meter wide, were established within the *Andropogon gerardii - Sporobolus heterolepis* grassland plant community on the Open Space in August – September 1998. Three of the plots are situated in the higher condition areas west of Plainview Road while three are situated in lower-condition areas east of the road. These permanent plots lie along the permanent transects noted above in A2 for the *Andropogon gerardii - Sporobulus heterolepis* grassland plant community. All plant species rooted within each permanent plot were listed. See section X below for results of monitoring work conducted in 1998. In the future, a floristic quality index could be calculated for the entire the *Andropogon gerardii - Sporobolus heterolepis* grassland plant community on the Open Space using the plant species presence data from all plots as outlined in Taft et al. (1997).

C1. The list of native plant species was prepared using the plant presence data collected for monitoring objective B1 above; see section X for more information. No additional monitoring effort is required, beyond assigning each plant species encountered to either the native or alien category. This information is available from local sources, e.g., Weber and Wittmann (1992).

D1. Remotely sensed false-color infrared images of the Open Space are available from a variety of sources. Infrared images are particularly useful for identifying riparian areas and wetlands because actively growing wetland and riparian vegetation contrasts markedly with the relatively dry uplands in the infrared portion of the electromagnetic spectrum. Images can be classified relatively easily and field checked for accuracy. A GIS system can easily calculate the aerial extent of and map riparian vegetation along Coal Creek. The areal extent of riparian vegetation from these images can be compared over time.

E1. Remotely sensed false-color infrared images of the Open Spaces can also be used to determine the locations and sizes of isolated seep wetlands using the same procedure outlined for monitoring D1 above. The photograph needs to be exposed when the sun in high in the sky to minimize shadows cast by the trees; shadows could be erroneously interpreted as tree cover.

F1. Leadplant (*Amorpha nana*) is known from the northwestern corner of the Open Space. This plant is a shrub and is relatively easy to see and identify. An observer can walk along temporary north-south transects about 100 feet apart and look for leadplant. The transects would run from 500 feet on either side of permanent transect #6 to the northern Open Space boundary. Alternatively, a group of observers, e.g., volunteers from the Colorado native Plant Society, could spread out along parallel transect lines and search for leadplant in unison. A group search of the local habitat would require only a few hours.

H1. A sampling grid would be established over the area, and the three butterflies of interest would be noted as present or absent in each grid cell. We recommend thirty, permanent 30 x 30-meter grid cells randomly located in appropriate

habitat across the Open Space. Three site visits each year that bracket the known flight times should be adequate. Sampling visits would be standardized in terms of search time, time of day, and weather. Large changes in the extent of the area used by the butterflies could be used as a signal that more intensive monitoring or changes in management are needed.

I1. Leopard frogs live only in wet situations along the margins of streams or ponds. An observer would walk along the Coal Creek, around the two stock ponds on the Open Space and along the small streams that drain the stock ponds and count the frogs observed. Frogs are difficult to see if stationary but the jump when approached and are then easy to see.

J1. A low-level color photograph can be scanned and stored in a GIS. The canopy coverage of ponderosa pine trees can be calculated easily in a GIS because the tree canopies contrast sharply with the adjacent grassland and are, therefore, easy to classify. The photograph should be taken when the sun is high in the sky to minimize shadows form trees that could inflate estimates of tree canopy cover.

X. Results of Monitoring Conducted in 1998

A. Mapping of Selected Alien Weed Species

We noted the locations of patches of selected alien weeds as we conducted the field work during August and September 1998 (Figure 6). It is important to note that this mapping is not the result of a thorough survey, which we propose that the County undertake in 1999. We mapped patches of only those alien weed species that we preliminarily identified as priority species for control.

B. Frequencies of Alien Weed Species

Frequencies of alien weed species were calculated from data collected in permanent 50 cm x 50 cm microplots situated along 50-m long transects shown in Table 4. We listed all of the alien weed species that were rooted in each plot. The frequencies of respective alien weed species were calculated as the proportion of the total number of microplots along each transect (N=25) in which a particular weed species was found.

Twenty-six alien weed species were encountered in the microplots (Table 4). An additional 10 alien weed species were encountered on the Open space but not in any of the microplots. Thus, 36 alien weed species were found on the Open Space.

An average of 8.4 weed species was found in the permanent microplots along each transect (Table 4). The highest number of alien weed species was found along transect 9, which is located in the floodplain along Coal Creek. Riparian areas are subject to disturbance from floods and commonly have high weed abundance.

We calculated a weed frequency index to indicate the abundance of alien weed species along the transects (Table 4). This index was calculated by summing the frequencies for all weed species for each transect. Interestingly, one of the riparian transects (#2) had one of the higher index values (2.88) while the other riparian transect (#9) had one of the lowest values (1.96). There was no apparent geographic pattern of the weed frequency index values.

The frequencies of the alien weed species are presented in rank–order in Table 4. Using frequency as an index of abundance, Kentucky bluegrass (*Poa pratensis*), and Canada bluegrass (*Poa compressa*) were the most common alien weeds on the Open Space. This was borne out by our casual observation throughout the Open Space. These species were found along ten of the eleven transects.

The next most abundant alien weed species were smooth brome (*Bromposis inermis*), alyssum (*Alyssum minus*), and Japanese brome (*Bromus japonicus,* Table 4). Salsify (*Trapogon dubius*) was the only other alien weed species with an average frequency greater than 10%. All four of these species were widespread throughout the Open Space.

Fortunately, only two of the alien weed species that were preliminarily rated as priorities for management were common along the transects; they are Kentucky bluegrass (*Poa pratensis*) and Canada bluegrass (*Poa compressa*). The next-most common priority species were sulphur cinquefoil (*Potentilla recta*) and St. Johnswort (*Hypericum perforatum*), each of which had an average frequency of 2% (Table 4). The relatively low frequency of the priority alien weed species suggests that control of these species might be feasible at the Open Space.

C. Floristic Quality Index for the *Andropogon gerardii - Sporobolus heterolepis* Plant Community

The floristic quality index was not calculated using 1998 field data because the coefficients of conservatism for the respective species have not been determined. We recommend that the County sponsor a project to assign coefficients to the plant species of the Colorado Front Range, after which the floristic quality index values could be calculated. Such a project would be of interest to a number of public agencies, such as the US Forest Service, Boulder County Parks and Open Space, City of Boulder Open Space, and Larimer County Parks and Open Lands, that might be willing to share in the costs.

D. Count of Native Plant Species

A total of 149 plant species were encountered in the 11 permanent 50 m x 1 m plots (Table 5). Sally White kindly provided a kindly provided a computerized list of plant species that have been encountered on the Open Space by Dr. David Buckner. One

hundred-ninety plant species are known from the Open Space based on this monitoring work and on Buckner's work. Undoubtedly, more plant species have yet to be found.

Of the 149 species that were encountered along the permanent monitoring transects, 119 (79.9%) were native species and 30 (20.1%) were alien species (Table 5). Of the 190 species that are known from the Open Space, 155 (81.6%) were native species while 35 (18.4%) were alien species.

Contstancy is a measure of the degree to which a particular plant species is found throughout the Open Space (Table 5). The most widely distributed plant species at the Open Space are those with the highest constancy values. Plant species that were found in at least ten of the eleven transects (thus having constancy values of 0.91 or greater) include western wheatgrass (*Agropyron smithii*), blue grama (*Bouteloua gracilis*), Japanese brome (*Bromus japonicus*), Japanese brome (*Poa compressa),* Kentucky bluegrass (*Poa pratensis*), wild rose (*Rosa sayi*), and salsify (*Tapogon dubius*). Of these, four (Japanese brome, Canada bluegrass, Kentucky bluegrass, and salsify) are invasive alien species.

XI. References

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Table 1. Geologic Units Present on the Ranson – Edwards Homestead Park Open Space

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Qpa (Post-Piney Creek and Piney Creek Alluvium): These deposits of alluvial bedrock are not abundant on the property but can be found in small patches at the bottom of Coal Creek and its ephemeral tributaries.

Qc (Colluvium): This layer of bedrock consists of a thin deposit of locally derived debris over-lying older surficial deposits and bedrock (most likely Pierre Shale).

Qv (Verdos Alluvium): This layer of bedrock is characterized as reddish-brown gravelly sand with silt and clay layers, 15-35 ft thick.

Qr (Rocky Flats Alluvium): This layer of bedrock is characterized as a reddish-brown bouldery gravel with layers of clay, silt, and sand, 15-35 ft thick.

Qpr (Pre-Rocky Flats Alluvium): This bedrock is characterized as a reddish-brown, fine to coarse gravel, 10-30 ft thick.

Kp (Pierre Shale): this bedrock is characterized as a greenish-gray, bentonitic shale, mudstone, and poorly cemented sandstone, about 7,545 ft thick.

Kph (Pierre Shale, Hygiene Sandstone Member): This part of the Pierre Shale bedrock is characterized as a greenish-gray to light-gray calcareous sandstone and sandy siltstone, about 565 ft thick and about 1,665 ft from the base.

Table 2. Natural Heritage Elements Present at Ranson – Edwards Homestead Park Open Space.

Scientific Name	Common Name	Global Rank	State Rank
Andropogon gerardii-Sporobolus heterolepis	Xeric tallgrass prairie	G2	S1S2
Hesperia ottoe	Ottoe skipper	G3?	S2
Atrytone arogos	Arogos skipper	G3G4	S2
Speyeria idalia	Regal fritillary	G3	S1
Zapus hudsonius preblei	Preble's meadow jumping mouse	G5T2	S1
Rana pipiens	Northern leopard frog	G5	S3
Amorpha nana	Dwarf leadplant	G5	S2S3

Table 3. Management Objectives for Ranson – Edwards Homestead Park Open Space for the five-year period 1999 – 2003.

A) Reduce the number and abundance of alien weed species

B) Maintain or increase the floristic quality of the big bluestem – prairie dropseed (*Andropogon gerardii - Sporobolis heterolepis)* grassland plant community.

C) Maintain or increase the number of native plant species.

D) Maintain or increase the areal extent of the riparian area along Coal Creek.

E) Maintain the number and areal extent of seep wetlands that occur in the upland portions of the Open Space.

F) Maintain or increase the current size of the population of leadplant (*Amorpha nana*).

G) Maintain or increase the current size the population of Preble's meadow jumping mice along Coal Creek

H) Maintain the presence of populations of the rare butterflies Ottoe skipper, Arogos skipper and regal fritillary

I) Maintain or increase the current population of northern leopard frog.

J) Reduce the canopy of ponderosa pine and reduce the areal extent of ponderosa pine forest and savanna

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Table 4. Weed Frequencies for Eleven Transects at Ranson - Edwards Homestead Park Open Space.

File: Ranson_Edwards Allen Weed Data 1998 Summary Observers Alan Carpenter & Tom Murray
Data collected 8/25/98 - 9/2/98

	Transect Number												
Scientific Name	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**Mean**	**Standard Deviation**
Poa pratensis	0	0.68	0.56	0.8	0.84	0.76	0.68	1	0.16	0.4	0.88	0.62	0.31
Poa compressa	0.16	0.16	0.56	0.56	0.56	1	0.6	0.12	0.68	0.68	0.88	0.54	0.29
Bromopsis inermis	0.04	0.08	0	0.04	0	0	0	0	0.16	0.12	0.08	0.47	0.06
Alyssum minus	0.96	0.72	0.6	0.04	0.24	0.16	0.52	0.08	0	0.04	0	0.31	0.34
Bromus japonicus	0.52	0.6	0.36	0.08	0.2	0.2	0.32	0.52	0.08	0.12	0	0.27	0.21
Tragopogon dubius	0.2	0.08	0.32	0.12	0.32	0	0.32	0.32	0	0.04	0	0.16	0.14
Cerastium arvense	0	0	0.36	0.04	0.16	0.04	0.4	0	0	0	0	0.09	0.15
Bromus tectorum	0	0.52	0	0	0	0	0	0	0.12	0	0	0.06	0.16
Achillea lanulosa	0	0.04	0	0	0.04	0.08	0.08	0.12	0.08	0.12	0	0.05	0.05
Hypericum perforatum	0	0	0	0.08	0	0	0	0	0.08	0.08	0	0.02	0.04
Phleum pratense	0	0	0	0	0	0	0	0	0	0.16	0.08	0.02	0.05
Potentilla recta	0	0	0	0.04	0	0	0	0	0.16	0	0	0.02	0.05
Agrostis gigantea (alba)	0	0	0	0	0	0	0	0	0.12	0	0.04	0.02	0.04
Agropyron repens	0	0	0	0	0	0	0	0	0.12	0	0	0.01	0.04
Carduus nutans	0	0	0	0.04	0.04	0	0	0.04	0	0	0	0.01	0.02
Lactuca serriola	0	0	0	0	0	0.04	0	0.04	0.04	0	0	0.01	0.02
Acosta diffusa	0	0	0	0	0	0.08	0	0	0	0	0	0.01	0.02
Camelina microcarpa	0.04	0	0	0	0	0	0	0.04	0	0	0	0.01	0.02
Convolvulus arvensis	0	0	0	0	0	0	0	0.04	0	0.04	0	0.01	0.02
Cichorium intybus	0	0	0	0	0	0	0.04	0	0	0	0	0.00	0.01
Dactylus glomerata	0	0	0	0	0	0	0	0	0.04	0	0	0.00	0.01
Linaria dalmatica	0	0	0	0.04	0	0	0	0	0	0	0	0.00	0.01
Phalaris arundinacea	0	0	0	0	0	0	0	0	0	0	0.04	0.00	0.01
Saponaria officinalis	0	0	0	0	0	0	0	0	0.04	0	0	0.00	0.01
Thlaspe arvense	0	0	0	0	0	0	0	0	0.04	0	0	0.00	0.01
Unknown mustard	0	0	0	0	0	0	0	0	0.04	0	0	0.00	0.01
Aegilops cylindrica	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
Cirsium arvense	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
Cirsium vulgare	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
Cynoglossum officinale	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
Echinochloa crus-galli	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
Hordeum pusillum	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
Plantago lanceolata	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
Taraxacum officinale	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
Verbascum thapsus	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
Xanthium strumarium	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
Weed frequency index	1.92	2.88	2.76	1.88	2.40	2.36	2.96	2.32	1.96	1.80	2.00	2.29	0.42
Number of weed species	6	8	6	11	8	7	8	9	14	10	6	8.45	2.46

Note: Species with zero mean frequency were observed on the Open Space but not encountered along the transects.

Table 5. Plant Species Richness Data for Eleven Transects at Ranson - Edwards Homestead Park Open Space.

File: Ranson_Edwards species richness data 1998 summary								Observers	Alan Carpenter & Tom Murray				
Plant species richness data in all 11 macroplots								Data collected 8/25/98 - 9/2/98					
Macroplots are all 50.0 meters long and 2.0 meters wide, centered on the transect line													
Data refer to plant species present (=1) in each macroplot													
					Transect Number								
Scientific Name	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**Sum**	**Constancy**
Acer glabrum													0
Achillea lanulosa *		1	1	1		1	1	1	1	1		8	0.73
Acosta diffusa *						1						1	0.09
Aegilops cylindrica *													0.00
Agropyron cristatum *			1									1	0.09
Agropyron griffithsii					1					1		2	0.18
Agropyron repens *									1			1	0.09
Agropyron smithii	1	1		1	1	1	1	1	1	1	1	10	0.91
Agropryron trachycaulum				1								1	0.09
Agrostis gigantea (alba) *									1	1	1	3	0.27
Alisma plantago-aquatica													0.00
Allium cernuum		1				1						2	0.18
Allium sp.											1	1	0.09
Alyssum minus *	1	1	1		1	1	1	1	1	1		9	0.82
Ambrosia psilostachya			1	1	1	1	1	1	1	1		8	0.73
Amelanchier alnifolia													0.00
Amorpha fruticosa									1			1	0.09
Amorpha nana						1						1	0.09
Andropogon gerardii	1	1	1	1	1	1	1	1		1		9	0.82
Antennaria sp.			1	1	1							3	0.27
Apocynum cannabinum	1				1							2	0.18
Apocynum sibiricum													0.00
Arenaria fendleri	1		1	1	1		1	1		1		7	0.64
Argemone polyanthemos													0.00
Aristida longiseta					1	1	1			1		4	0.36
Arnica fulgens					1	1	1			1	1	5	0.45
Artemisia cana													0.00
Artemisia dracunculus													0.00
Artemisia frigida	1	1	1	1	1	1	1	1	1			9	0.82
Artemisia ludoviciana	1	1	1	1		1	1	1	1	1		9	0.82
Artemisia michauxiana						1						1	0.09
Artemisia sp.			1	1	1		1					4	0.36
Asclepias speciosa													0.00
Aster leavis						1						1	0.09
Aster porteri		1	1	1	1	1	1			1		7	0.64
Aster falcatus				1					1	1	1	4	0.36
Astragalus flexuosus	1			1			1	1				4	0.36
Astragalus missouriensis							1					1	0.09
Boechera retrofacta							1					1	0.09
Bouteloua curtipendula	1		1	1	1	1	1	1		1		8	0.73
Bouteloua gracilis	1	1	1	1	1	1	1	1	1	1		10	0.91
Bromopsis inermis *	1	1		1					1		1	5	0.45
Bromus japonicus *	1	1	1	1	1	1	1	1	1	1		10	0.91
Bromus tectorum *		1	1						1			3	0.27
Buchloe dactyloides													0.00
Calachortus gunnisonii							1	1				2	0.18
Camelina microcarpa *	1							1				2	0.18
Campanula rotundifolia		1										1	0.09
Carduus nutans *				1	1	1		1				4	0.36
Carex heliophila	1	1	1	1	1		1	1		1		8	0.73
Carex nebraskensis													0.00
Carex praegracalis											1	1	0.09

Table 5. Plant Species Richness Data for Eleven Transects at Ranson - Edwards Homestead Park Open Space.

File: Ranson_Edwards species richness data 1998 summary								Observers	Alan Carpenter & Tom Murray				
Plant species richness data in all 11 macroplots								Data collected 8/25/98 - 9/2/98					
Macroplots are all 50.0 meters long and 2.0 meters wide, centered on the transect line													
Data refer to plant species present (=1) in each macroplot													
					Transect Number								
Scientific Name	1	2	3	4	5	6	7	8	9	10	11	Sum	Constancy
Carex stenophylla		1	1									2	0.18
Cerastium arvense			1	1	1	1	1			1		6	0.55
Chamaesyce serpyllifolia													0.00
Cichorium intybus *											1	1	0.09
Cirsium arvense *	1					1				1		3	0.27
Cirsium undulatum			1	1	1		1	1				5	0.45
Cirsium vulgaris *										1		1	0.09
Clematis hirsutissima			1	1	1		1					4	0.36
Comandra umbellata	1	1	1					1		1		5	0.45
Convolvulus arvensis *								1				1	0.09
Coryphantha missouriensis	1											1	0.09
Crataegus erythropoda									1	1		2	0.18
Crepis sp.											1	1	0.09
Cynoglossum officinale *				1								1	0.09
Dactylus glomerata *				1					1			2	0.18
Dalea purpurea						1				1		2	0.18
Echinocereus viridiflorus													0.00
Echinochloa crus-galli *													0.00
Eleocharis macrostachya													0.00
Erigeron flagellaris	1	1	1	1	1		1	1		1		8	0.73
Eriogonum alatum	1				1	1	1					4	0.36
Eriogonum divergis		1					1					2	0.18
Eriogonum flavum	1	1	1						1			4	0.36
Erysimum capitatum							1	1	1			3	0.27
Euphorbia robusta													0.00
Euphorbia sp.							1					1	0.09
Frasera speciosa				1	1		1					3	0.27
Gaillardia aristata				1	1	1						3	0.27
Galium septentrionale		1										1	0.09
Gaura coccinea	1											1	0.09
Gayophytum sp.									1	1	1	3	0.27
Gentiana sp.				1								1	0.09
Geranium fremontii	1	1	1	1		1			1	1		7	0.64
Glycyrrhiza lepidota													0.00
Grindelia squarrosa	1		1	1	1			1		1		6	0.55
Gutierrezia sarothrae	1			1	1	1	1	1		1		7	0.64
Harbourea trachypleura				1								1	0.09
Helianthus pumilus	1	1						1		1		4	0.36
Heterotheca villosa	1	1	1	1	1		1		1			7	0.64
Heuchera parviflora													0.00
Hordeum pusillum *													0.00
Hypericum perforatum *			1	1	1	1	1	1	1	1		8	0.73
Ipomopsis spicata					1							1	0.09
Iris missouriensis										1	1	2	0.18
Juncus arcticus ssp. ater						1				1	1	3	0.27
Juncus sp.											1	1	0.09
Koeleria macrantha	1	1	1	1	1	1	1	1		1		9	0.82
Lactuca serriola *		1		1		1	1	1	1	1		7	0.64
Liatris punctata			1	1		1	1	1		1		6	0.55
Linaria dalmatica *		1		1								2	0.18
Linum lewisii							1					1	0.09
Lupinus argenteus	1	1						1				3	0.27

Table 5. Plant Species Richness Data for Eleven Transects at Ranson - Edwards Homestead Park Open Space.

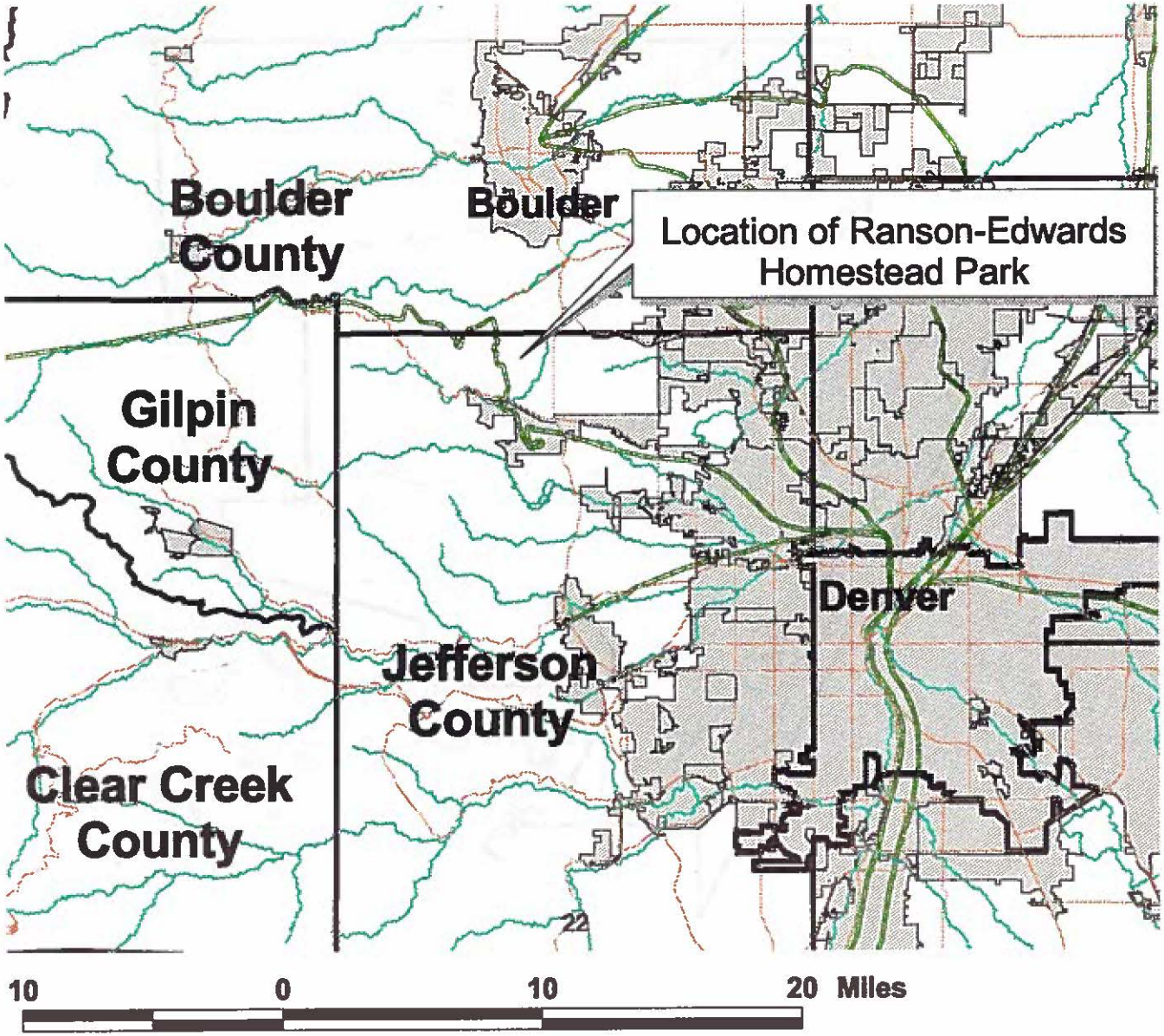
File: Ranson_Edwards species richness data 1998 summary								Observers	Alan Carpenter & Tom Murray				
Plant species richness data in all 11 macroplots								Data collected 8/25/98 - 9/2/98					
Macroplots are all 50.0 meters long and 2.0 meters wide, centered on the transect line													
Data refer to plant species present (=1) in each macroplot													
					Transect Number								
Scientific Name	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**Sum**	**Constancy**
Mahonia repens		1										1	0.09
Mentha arvensis													0.00
Mirabilis sp.		1										1	0.09
Muhlenbergia montana			1	1	1	1		1		1		6	0.55
Muhlenbergia wrightii													0.00
Oenothera sp.						1						1	0.09
Oligosporus campestris							1					1	0.09
Onosmodium molle													0.00
Opuntia compressa	1	1	1	1	1		1	1	1	1		9	0.82
Opuntia fragilis		1	1						1			3	0.27
Oryzopsis hymenoides													0.00
Oxybaphus nyctagineus	1	1							1			3	0.27
Oxybaphus sp.									1			1	0.09
Oxytropis lambertii	1			1	1		1					4	0.36
Panicum virgatum													0.00
Paronychia jamesii					1							1	0.09
Penstemon secundiflorus	1											1	0.09
Penstemon virens			1	1						1		3	0.27
Persicaria maculata													0.09
Phacelia heterophylla		1										1	0.09
Phalaris arundinacea *											1	1	0.09
Phleum pratense *						1			1	1	1	4	0.36
Physalis hederaefolia		1										1	0.09
Physocarpus monogynus									1			1	0.09
Pinus ponderosa			1	1								2	0.18
Plantago lanceolata *													0.00
Pneumonanthe affinis					1	1		1				3	0.27
Pneumonanthe parryi			1							1		2	0.18
Poa compressa *	1	1	1	1	1	1	1	1	1	1	1	11	1.00
Poa pratensis *	1	1	1	1	1	1	1	1	1	1	1	11	1.00
Poa secunda	1				1							2	0.18
Poa glaucifolia											1	1	0.09
Polygonum sp.									1			1	0.09
Populus angustifolia													0.00
Potentilla hippiana										1		1	0.09
Potentilla pensylvanica	1		1		1	1	1					5	0.45
Potentilla recta *				1		1			1	1		4	0.36
Potentilla sp.						1			1			2	0.18
Prunus americana													0.00
Prunus virginiana		1		1					1			3	0.27
Psoralea tenuiflora	1		1	1	1	1	1	1		1		8	0.73
Ratibida columnifera				1	1	1	1					4	0.36
Rhus trilobata									1			1	0.09
Ribes aureum									1			1	0.09
Rosa sayi	1		1	1	1	1	1	1	1	1	1	10	0.91
Rubus deliciosus									1			1	0.09
Rudbeckia hirta													0.00
Rumex crispus *									1		1	2	0.18
Sagittaria latifolia													0.00
Salix amygdaloides													0.00
Salix exigua													0.00
Salix sp.									1			1	0.09

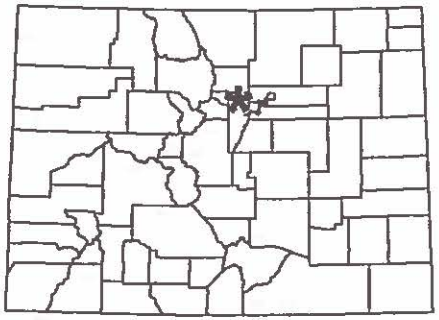
Table 5. Plant Species Richness Data for Eleven Transects at Ranson - Edwards Homestead Park Open Space.

File: Ranson_Edwards species richness data 1998 summary								Observers	Alan Carpenter & Tom Murray				
Plant species richness data in all 11 macroplots								Data collected 8/25/98 - 9/2/98					
Macroplots are all 50.0 meters long and 2.0 meters wide, centered on the transect line													
Data refer to plant species present (=1) in each macroplot													
	Transect Number												
Scientific Name	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**Sum**	**Constancy**
Saponaria officinalis *									1			1	0.09
Schizachyrium scoparium	1			1	1	1	1	1				6	0.55
Sedum lanceolatum													0.00
Senecio sp.													0.00
Sisyrinchium montanum						1						1	0.09
Sitanion hystrix	1		1	1	1	1	1	1		1		8	0.73
Solidago nana					1							1	0.09
Solidago rigida				1	1	1	1	1		1		6	0.55
Solidago sp.				1			1					2	0.18
Sorghastrum nutans				1	1							2	0.18
Spartina pectinata											1	1	0.09
Sphaeralcea coccinea													0.00
Sporobolus asper													0.00
Sporobolus cryptandrus	1	1							1			3	0.27
Sporobolus heterolepis				1	1	1		1		1		5	0.45
Stipa comata	1	1	1		1	1	1	1		1		8	0.73
Stipa robusta													0.00
Stipa spartea													0.00
Stipa viridula								1	1			2	0.18
Symphoricarpos occidentalis				1					1			2	0.18
Talinum parviflorum		1		1					1			3	0.27
Taraxacum officinale *											1	1	0.09
Thermopsis divaricarpa				1	1	1	1					4	0.36
Thlaspe arvense *							1		1	1		3	0.27
Toxicodendron rydbergii		1							1			2	0.18
Tragopogon dubius *	1	1	1	1	1	1	1	1	1	1		10	0.91
Typha latifolia													0.00
Unknown forb		1	1			1						3	0.27
Unknown mustard									1			1	0.09
Unknown yellow comp.				1		1		1				3	0.27
Verbascum thapsus									1			1	0.09
Vitis riparia													0.00
Xanthium strumarium *													0.00
Yucca glauca		1	1									2	0.18
Total Number of Species	43	44	45	61	52	53	53	44	51	52	22		
* denotes alien plant species													
Note: species with zero constancy were reported from the Open Space by David Buckner but were not observed along the eleven transects.													

Ranson-Edwards Homestead Park

Figure 1.



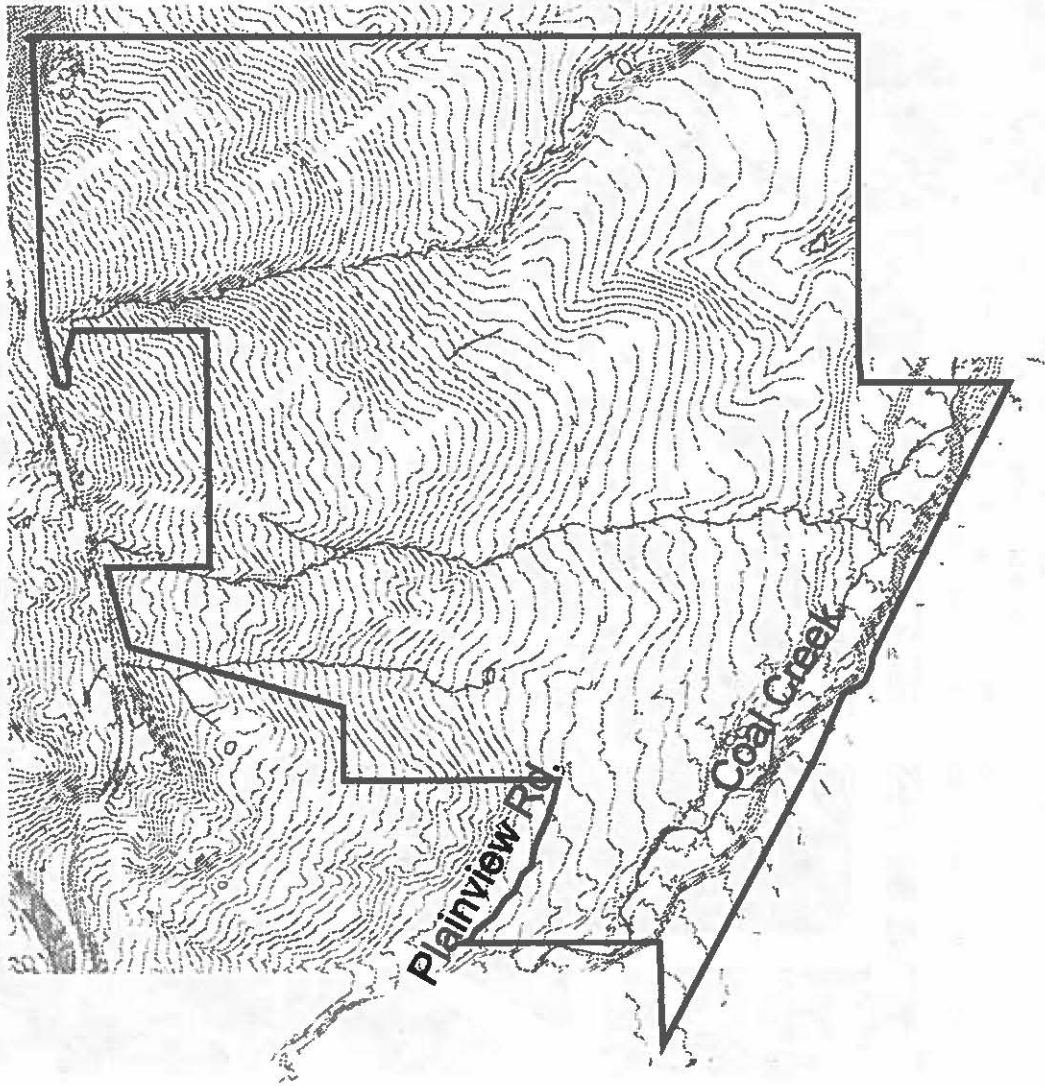


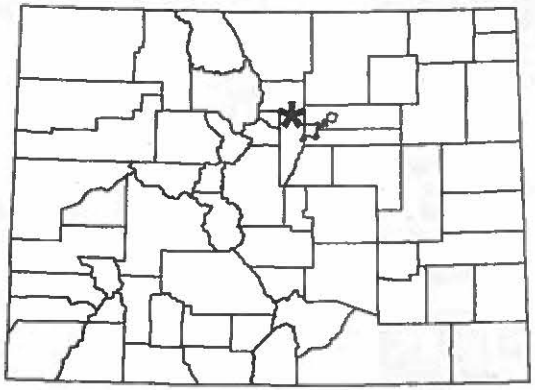
Highways
Streams
Railroads
Counties
Municipal Boundaries

N
W E
S

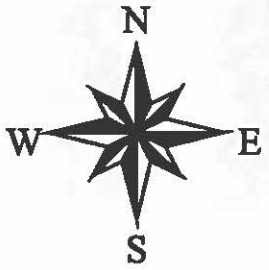
Ranson-Edwards Homestead Park

Figure 2.





10 Ft. Contour



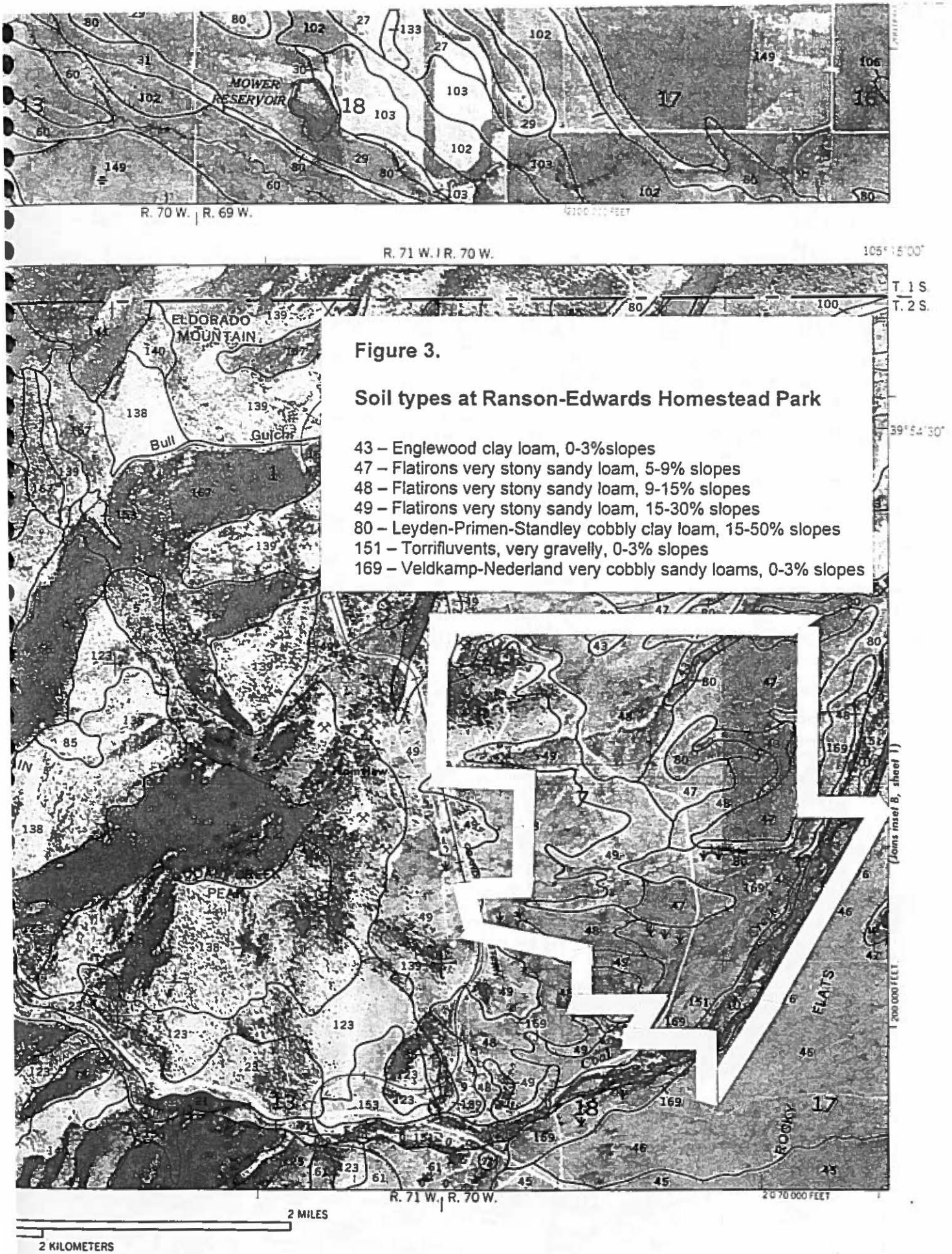


Figure 3.

Soil types at Ranson-Edwards Homestead Park

43 – Englewood clay loam, 0-3%slopes
47 – Flatirons very stony sandy loam, 5-9% slopes
48 – Flatirons very stony sandy loam, 9-15% slopes
49 – Flatirons very stony sandy loam, 15-30% slopes
80 – Leyden-Primen-Standley cobbly clay loam, 15-50% slopes
151 – Torrifluvents, very gravelly, 0-3% slopes
169 – Veldkamp-Nederland very cobbly sandy loams, 0-3% slopes

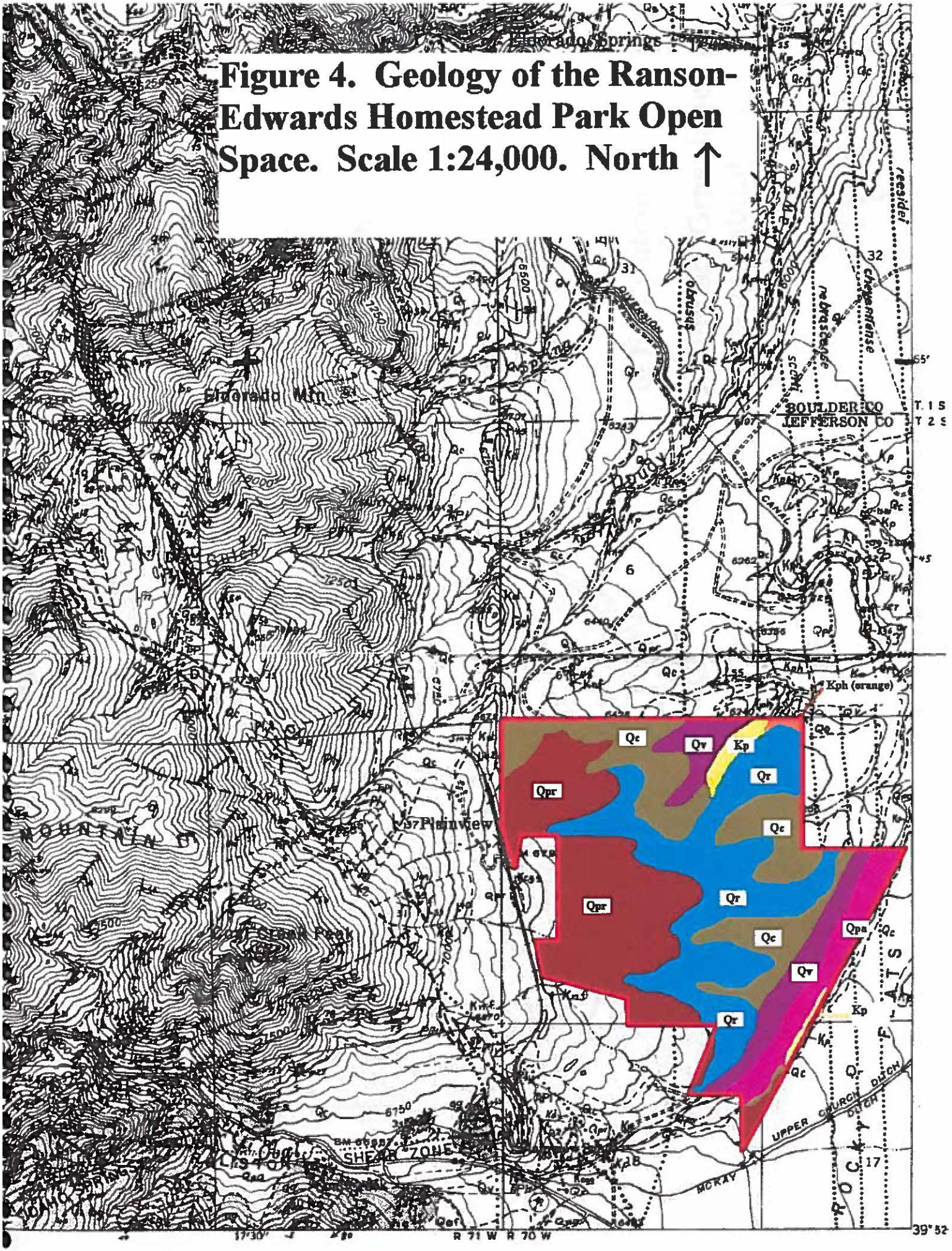
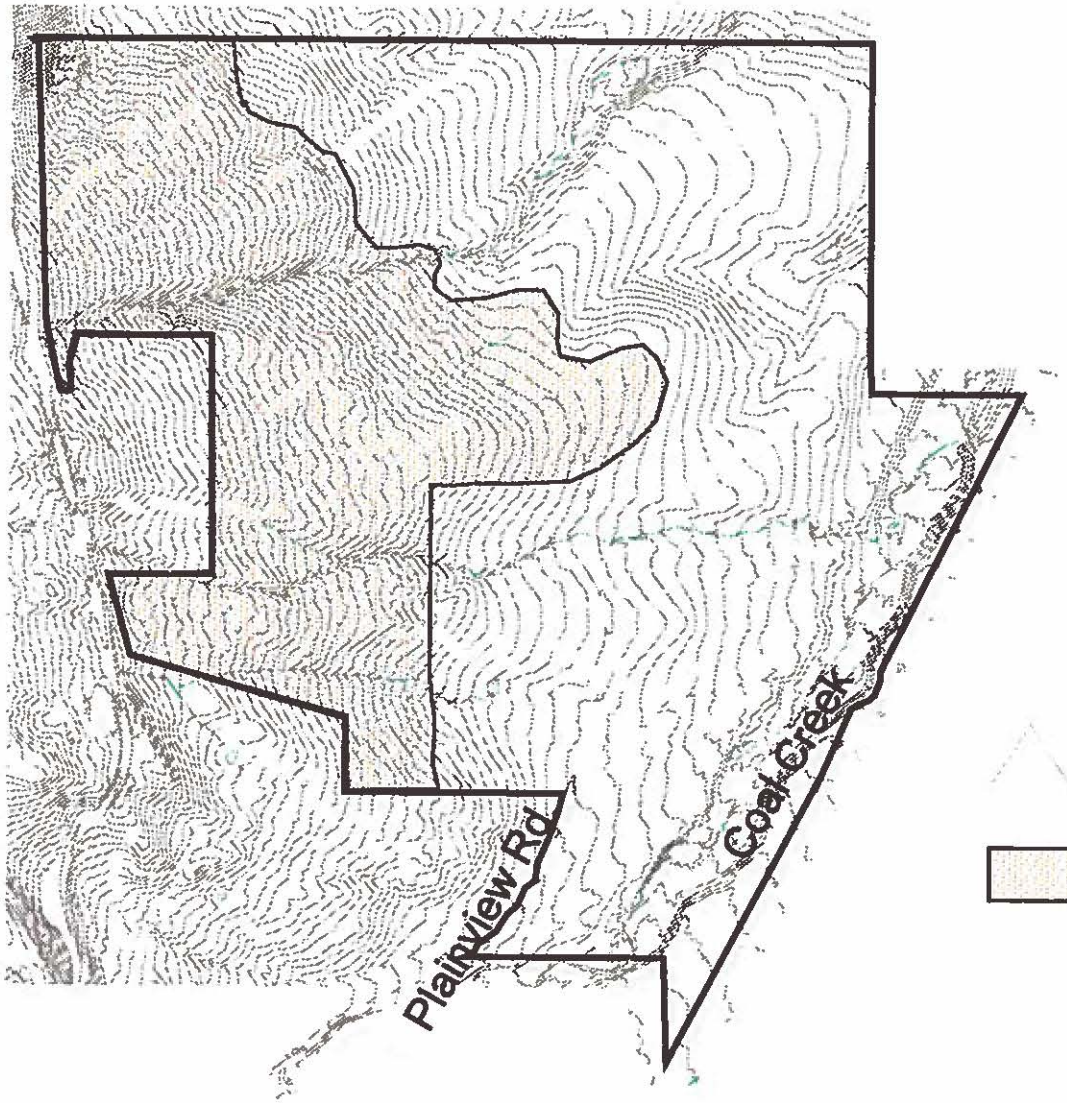
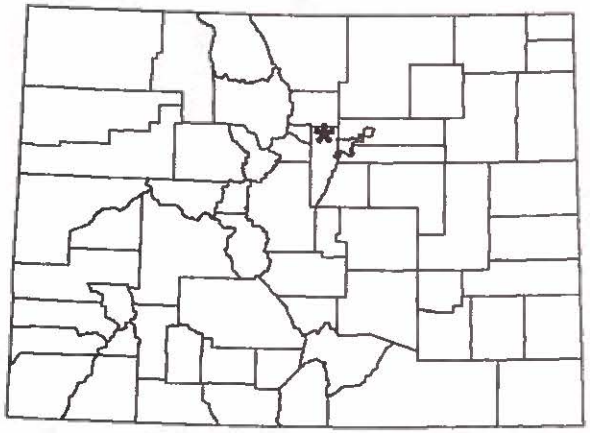


Figure 4. Geology of the Ranson-Edwards Homestead Park Open Space. Scale 1:24,000. North ↑
Eldorado Springs
Eldorado Mtn
BOULDER CO
JEFFERSON CO
T. 1 S
T 2 S
Kph (orange)
Qc
Qv
Kp
Qr
Qpr
Qpa
Plainview
SHEAR ZONE
R 71 W
R 70 W
39°52'

Ranson-Edwards Homestead Park

Figure 5.





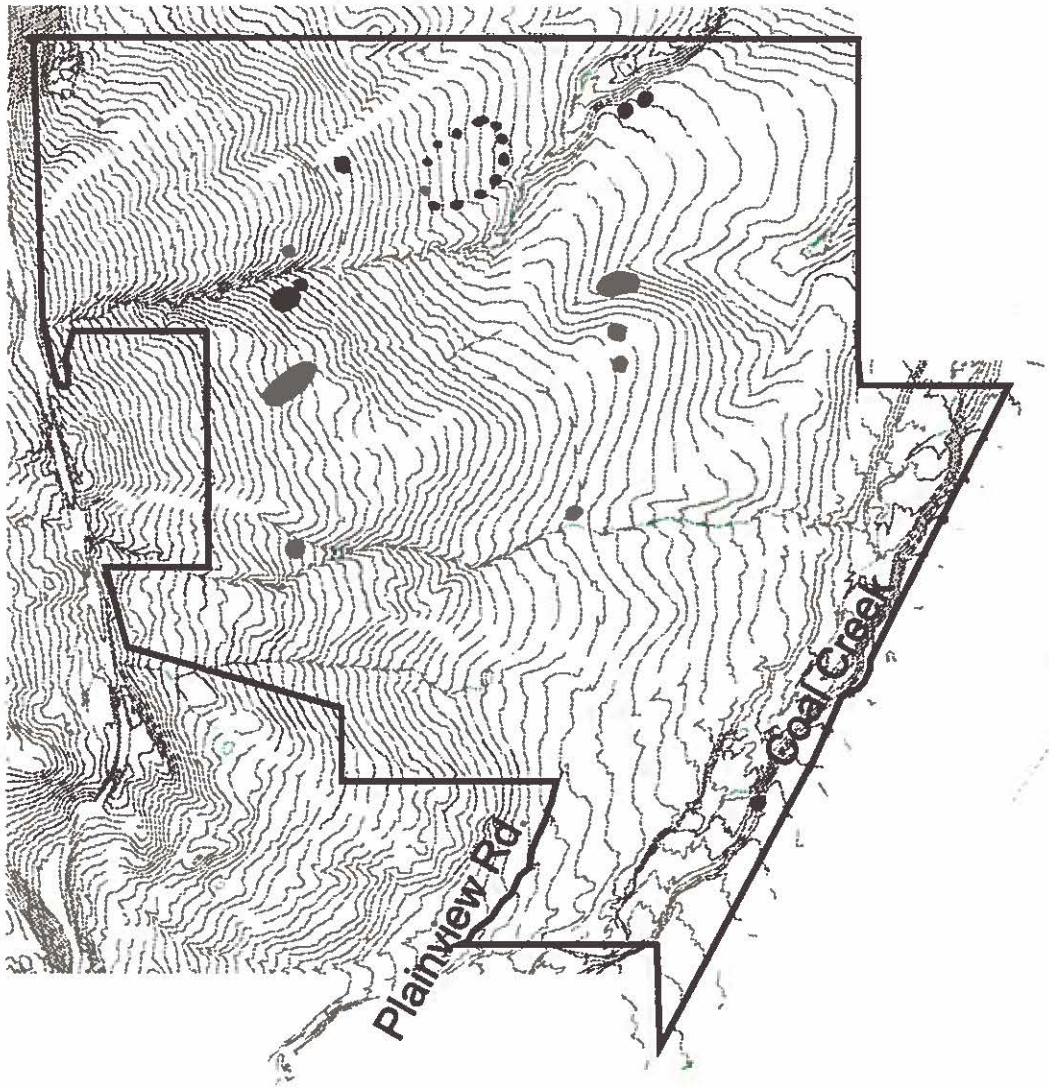
10 Ft. Contour

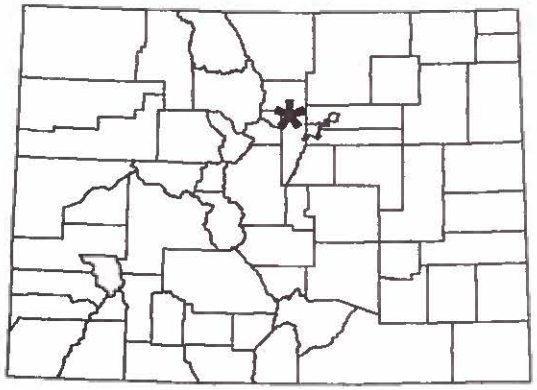
Significant Grasslands & Butterfly Habitat

N
W
E
S

Ranson-Edwards Homestead Park

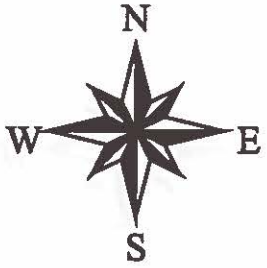
Figure 6.





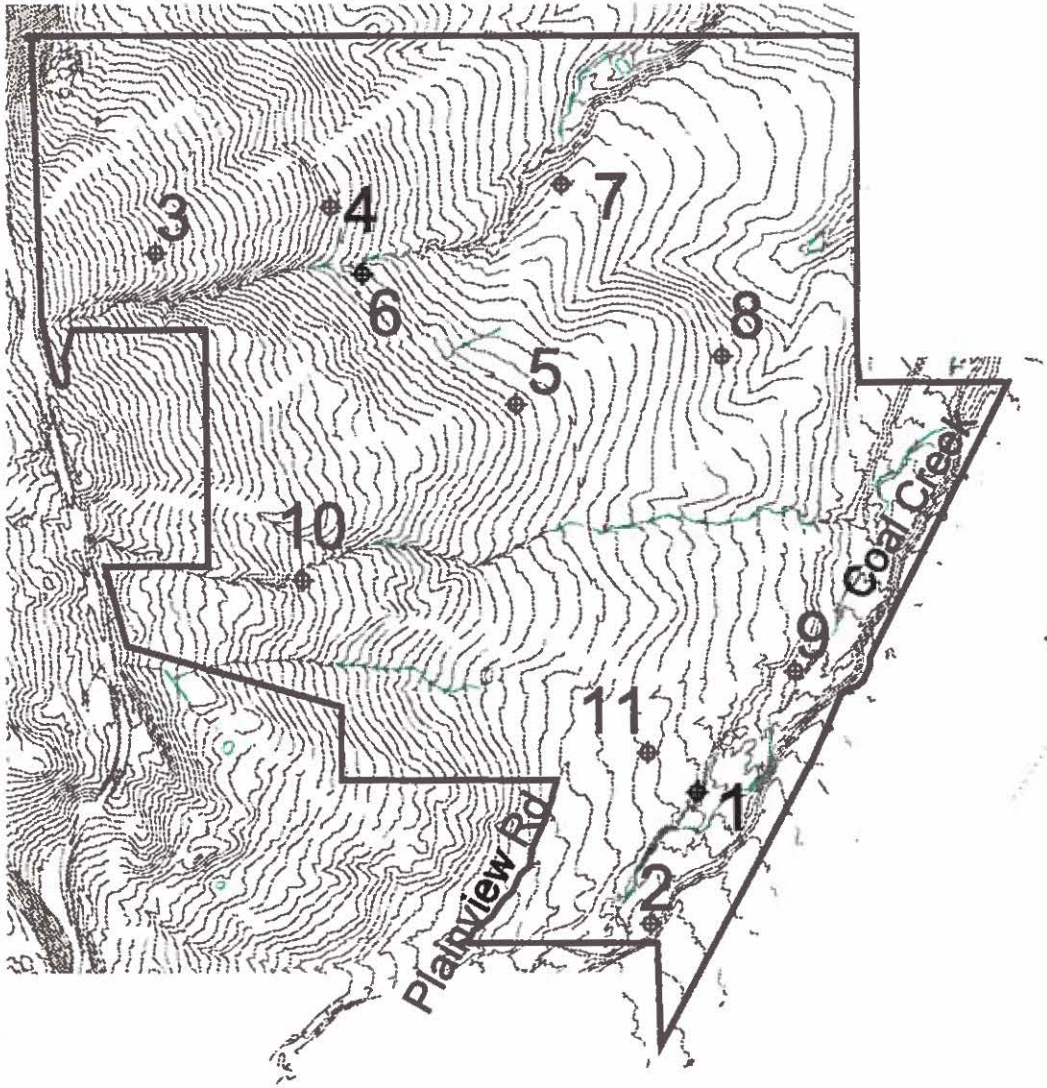
Locations of Patches of Weeds

10 Ft. Contour



Ranson-Edwards Homestead Park

Figure 7.



Monitoring Transects

10 Ft. Contour

N
W
E
S

Appendix

Contacts List
Explanation of Colorado Natural Heritage Imperilment Ranks
Copy of Aerial Photograph of Open Space

Contacts List

Alan Carpenter, Land stewardship Consulting, 2941 – 20th Street, Boulder, CO 80304, (303) 443-8094.

Alicia Doran, Jefferson County Weed Supervisor, 700 Jefferson County Parkway, Suite100, Golden, CO 80401, (303) 271-5989

Steve Kettler, Colorado Natural Heritage Program, 254 General Services Building, Colorado Sate University, Ft. Collins, CO 80523, (970) 491-2998.

Chris Pague, The Nature Conservancy of Colorado, 1244 Pine Street, Boulder, CO 80304, (303) 444-2985 x 105.

Phyllis Pineda, Colorado Natural Heritage Program, 254 General Services Building, Colorado Sate University, Ft. Collins, CO 80523, (970) 491-2998.

Rob Schorr, Colorado Natural Heritage Program, 254 General Services Building, Colorado Sate University, Ft. Collins, CO 80523, (970) 491-3763.

Explanation of Colorado Natural Heritage Imperilment Ranks.

Global imperilment ranks are based on the range-wide status of a species. State imperilment ranks are based on the status of a species in an individual state. State and Global ranks are denoted, 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 (5 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 (6 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 species or subspecies 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 reliable 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.

Notes: Where two numbers appear in a state or global rank (e.g., S2S3), the actual rank of the element falls between the two numbers.