

Report on a Pilot Study of Investigations into Cultural- Natural Landscapes and Ecological Patch Islands in Forest Canyon Pass, Rocky Mountain National Park

**Robert H. Brunswig, Ph.D.
Department of Anthropology**

**James Doerner, Ph.D.
David Diggs, Ph.D.
Department of Geography**

**University of Northern Colorado
Greeley, Colorado**

**Jeffrey Connor
Leanne Benton
Karin Edwards**

**Rocky Mountain National Park
Estes Park, Colorado**

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Executive Summary

The University of Northern Colorado (UNC) has conducted extensive archeological research in Rocky Mountain National Park since 1998. From 1998 through 2002, the university engaged in a large-scale series of archeological surveys and test excavations throughout the park as part of a National Park Service-funded Systemwide Archeological Inventory Program (SAIP). Over five years of fieldwork, the university documented more than 1,000 prehistoric and historic sites within ~30,000 acres of designated survey research areas. Since 2002, UNC has continued smaller scale archeological investigations within the park, including a long-term Native American sacred landscape research program and the subject of this report, a pilot project to intensely study and document one of the park's most heavily occupied areas, Forest Canyon Pass. Long known for its extraordinarily artifact-rich Forest Canyon Pass site (5LR2), a dozen more sites were recorded in the Pass during the SAIP Project and, most recently, by a small pilot project survey of only 115 acres, documented in this report. The theoretical framework of the project associated with this report, a project entitled "A Pilot Study of Investigations into Cultural-Natural Landscapes and Ecological Patch Islands in Forest Canyon Pass, Rocky Mountain National Park", is based on a leading edge interdisciplinary research approach, cultural landscapes and patch ecology, which integrate modern and prehistoric studies of past ecological and climatic systems and archeological "settlement" pattern reconstructions. This report documents results of an initial phase of a larger, more comprehensive research program in Forest Canyon Pass and its upper headwaters. The program's goal is to determine the extent and time depth of past Native American utilization of the Pass and inventory the natural resources which made its use attractive and facilitated their success in living and thriving in the Park and its region for hundreds of generations. More importantly, the project was designed to test the hypothesis that Forest Canyon Pass, with its unusual geographic, topographic, hydrologic, and natural resource conditions constituted an unusually rich ecological (as well as physical) environment, in essence a resource-rich "patch island", in the midst of less well-endowed natural landscape terrains within the Park. Although the project is only just beginning, modern and prehistoric studies of the Pass' ecosystem and climate and of its archeological occupations strongly suggest it played an extremely important role in past Native American cultural systems and the human-habitation history of the Park. Despite the incompleteness of archeological survey coverage in a planned, long-term project research area of ca. 470 acres, site density within the Pass and the mountain slope to its north and northeast can now be calculated at a minimum of 24 sites per square kilometer, the heaviest concentration of prehistoric sites in the Park. Paleoclimate data, along with Paleoindian-era projectile points, dating back 9,000 years or more show the Pass has been habitable and inhabited since the end of the last Ice Age. A very early phase of paleoclimate/paleoecology reconstruction represented in this report shows promise of expansion into multiple fens and ponds within the project research, allowing an even greater body of evidence for past climate and ecological change for the Pass and the Park to be obtained and analyzed. An abundance of game animals and food and medicinal plants known to have been exploited by past Native American communities were documented by very brief botanical and faunal surveys and can only be expanded by future such field studies in the Pass'. Finally, not has the significant role of Forest

Canyon Pass in the lives of past native peoples been well-demonstrated, but its importance, preservation, and knowledge will need to be disseminated to current and future generations of Park visitors, including descendants of those native peoples. Just as importantly, efforts will need to be made to further document its natural and cultural resources for more effective preservation and management in the future. The Pass is traversed by a heavily used modern trail from the Alpine Visitor's Center to Milner Pass, but also a trail which parallels, and in part follows, the ancient Ute Trail which archeological research informs us has existed for more than 9,500 years. The trail directly transects several important archeological sites, including the Forest Canyon Pass site with its unbroken line of Native American use from 9,500 to 150 years ago. Opportunities for artifact collection and continued destruction of the Pass' cultural record, intentional or opportunistic, are extremely high. Archeological survey for this project (in 2008) determined the existence of even more sites off-trail which are vulnerable to disturbance and artifact-collecting. Mitigation of risks to the Pass' cultural heritage should involve continued and detailed field studies, regular monitoring of its sites for disturbance and "emerging" artifacts on site surfaces, and consideration of nominating the Pass for inclusion into the National Registry of Historic Places as an archeological district.

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Introduction

Forest Canyon Pass contains one of the highest concentrations of prehistoric archeological sites in Rocky Mountain National Park. Its largest site, the Forest Canyon Pass site (5LR2), is a series of closely spaced camps and special use activity areas representing all regionally known cultural traditions from 10,000 years ago to when native tribes were removed from the region 150 years ago (cf., Brunswig 2001: 49-50, 2005b; Mayer 1989). Surrounding alpine ridges and peaks contain the Park's greatest concentration of prehistoric sites associated with systematic, high altitude game hunting (e.g., game drives) and Native American religious activities (Brunswig 2003a, 2004a, 2005b, 2007; Brunswig, Diggs, and Montgomery 2009; Brunswig, McBeth, and Elinoff 2009; Diggs and Brunswig 2006).

Archaeological and historic evidence show the area served as a crossroads for migrating Native Americans over the past 11,000 years. Historic documentation, supplemented by 75 years of archaeological research, provides evidence that the Deer Trail branch of the Park's well-known Ute Trail passed directly through the top of Forest Canyon Pass (Brunswig and Lux 2004; Lux 2004, 2005; Toll 1962: 32-33). The Pass is strategically located adjacent (north and west) of several major game drives along Mount Ida Ridge and Trail Ridge and likely served as a base camp locality, particularly for the Mount Ida Ridge game drives, for summer and fall hunting parties who ascended to those drives throughout prehistoric and early historic times (Brunswig 2004a; 2005b: 257-267; 2007: 292-293).

Several limited-scope archaeological surveys have taken place in the Pass over the past 75 years, most confined to within 30 meters of the Ute Trail (Brunswig 2001;

Husted 1962, 1965; Mayer 1989; Yelm 1935). Previous to this project, no systematic survey had been conducted in the immediate Big Thompson headwaters section or on upper slope benches and basins of its northern and southern slopes at any distance east of the Ute Trail.

In July, 2005, a University of Northern Colorado survey crew working on a field project tasked with identification and mapping Native American sacred sites, noted the area's rich botanical diversity and high potential for productive archaeological and paleoenvironmental field studies during a short traverse of the Pass. Its sheltering broken sub alpine forest stands and open terrace benches were seen as closely matching environmental contexts elsewhere in the Park where prehistoric, high altitude, seasonal hunting base camps had been identified (cf., Brunswig 2004a, 2005b). Further, the Pass' observed diversity of edible and otherwise economically and medicinally useful plants, including two or more species of berry shrubs, were viewed as likely reflecting an important concentration of valuable natural resources for past Native American populations. Based on earlier Park ethnographic studies (e.g., Brunswig 2003a), the possibility was considered some of those species may have been deliberately transplanted to the area's protective micro-environments by Native Americans; a practice known to have existed among a number of western tribes (cf., Anderson 2005).

Environmental Setting

The Pass occupies a 3.9 km² (1.5 mile²) area encompassing three trans-continental divide passes (Forest Canyon, nearby Milner, and Fall River passes) and headwaters or contributing headwater drainages of three rivers; the Cache la Poudre River (Milner Pass), Fall River (Fall River Pass), and the Big Thompson River (Forest Canyon Pass)

(Figure 1). A secondary headwaters section of the upper Colorado River, the Deer Creek branch of the Colorado River, also initiates in Milner Pass on its northern side.



Figure 1. Satellite Image (GoogleEarth™) of the Three Passes and Rivers Headwaters Landscape Specific to Forest Canyon Pass. The red rectangle shows general boundaries of the Forest Canyon Pass Research area.

Core portions of Fall River Pass lies within the Park's upper sub alpine-alpine ecotone (cf. Beidleman, Beidleman, and Willard 2000; Brunswig 2005: 25-26; Carter 1988; Mutel and Emerick 1992; and Weber and Wittman 1996). Higher slope Pass sections on its northern side are situated in alpine tundra. Elevations with the Pass'

research area range between 3350 (10,990 feet) and 3550 meters (11,647 feet). Slopes vary between 10 and 40 percent. Annual precipitation, primarily arriving as winter snowfall, ranges between 720 mm (28.4 inches) and 960 mm (37.8 inches). Frost-free days vary between 10 and 30 days each year and average annual air temperatures range from -1 to +1 C°, with average summer temperatures ranging between 2.4° C. (36.4° F.) and 14.8° C. (58.7° F.) and winter temperatures averaging between 2.2° C. (-16.6° F.) and -5.1° C. (22.9° F.) (Brunswick 2005b: 27-30, Table 2).

The Pass' subalpine-alpine ecotone is characterized by a mosaic of small wet and dry grassy, shrubby meadows and interspersed "tree islands" (krummholz), the later consisting of short tree to shrub sized, dwarf Engelmann spruce (*Picea engelmannii*) and sub alpine fir (*Abies lasocarpa*). Fauna which annually or seasonally occupy the Pass' ecotone are described in a subsequent section and in Appendix C. Alpine tundra mountain slopes overlooking the main Pass are dominated by sedges and grasses such as alpine bluegrass (*Poa alpine*) and skyline bluegrass (*Poa cusickii*). Cushion plants and herbaceous forbs occur in open or lightly sheltered areas and include such species as alpine avens (*Acomastylis rossii*), alpine bistort (*Bistorta vivipara*), dwarf clover (*Trifolium nanum*), alpine forget-me-not (*Eritrichum aretioides*), alpine sunflower (*Rhydbergia grandiflora*), sky pilot (*Polemonium viscosum*), arctic gentian (*Gentianodes algida*), Rocky Mountain sedge (*Carex scopulorum*), elk sedge (*Carex geyeri*), moss campion (*Silene acaulis*), alpine phlox (*Phlox pulvenata*), alpine sandwort (*Lidia obtusiloba*), and alpine sage (*Artemisia scopulorum*) Several faunal species seasonally or annually occupy the alpine zone, including pika (*Ochotona princeps*), white-tailed jackrabbits (*Lepus townsendii*), marmots (*Marmota flaviventris*), pocket

gophers (*Thomomys talpoides*), and ptarmigan (*Lagopus leucurus*). Large herbivores such as elk (*Cervus canadensis*) and bighorn sheep (*Ovis canadensis*) graze on alpine grasses during summer and early fall when the alpine is largely snow-free and grasses are at peak productivity.

Geology and soils of the Forest Canyon Pass consist of generally shallow colluvial and alluvial sediments and marginally developed soils overlying Precambrian-age, metamorphic granite, gneiss, schist, and quartzite bedrock and bedrock-derived sands, gravels and boulders (cf., Braddock and Cole 1989; N.A. 2005; Raup 1996). Upper portions of the research area northeast of the pass incorporate rare lag-deposit-based welded tuff, andesite, and basalt sands and gravels originating from a higher, thick mantle of Cenozoic-age volcanic deposits on the western end of Trail Ridge (cf., Braddock and Cole 1989; N.A. 2005; Raup 1996; Wahlstrom 1941). The majority of soils in the research area's alpine and alpine-subalpine ecotone zones belong to the Archrock Series of the Trailridge-Archrock Soil Complex (Neve 2008: 110-111). Archrock soil is classified as a gravelly-loam, very well-drained, and alluvially (and colluvially) derived from, and overlying, local granite, gneiss, schist, and quartzite bedrock. The central (core) section of the Pass is sediment-overlaid glacial cirque, origin point of the Forest Canyon Glacier, last active in the Late Pleistocene during the most recent Pinedale IV Stadial (Brunswig 2005: 48-52; Richmond 1960). Limited sections of project of the research area, west and east of the Pass, occur within the subalpine environmental zone and are characterized by Hiamovi Series soils of the Fallriver-Hiamovi-Ypsilon Soil Complex (Neve 2008: 36-39, 125-126). Hiamovi soils are well-drained, very gravelly sand loams derived from glacial till, granite, schist, and gneiss bedrock materials.

**Project Description:
Theoretical Foundations, Research Design, Goals, and Methodologies**

A pre-project assessment of Forest Canyon Pass by this report's principal investigators hypothesized that the pass' headwaters represented what archeological and ecological researchers refer to as a high resource density island (ecological patch) within a larger local landscape of lower density natural and physical resources for past animal and human populations. The term "ecological patch" derives from contemporary patch ecology theory, referring to the existence of uneven distributions, expressed as higher or lower densities, of natural resources across a physiographic region or sub-region (cf., Levin and Paine 1974; White and Pickett 1985; Winterhalder 1981:26). Ecological patches, such as hypothesized for the Forest Canyon Pass upper headwaters area, are defined by the existence of physiographic and ecosystem variables which serve to enhance or inhibit biotic diversity and productivity within local landscapes and confer the capacity to accommodate (resist) or rapidly succumb longer or shorter term climatically-driven environmental changes; changes that, in patch theory, involve a suite of ecological characteristics collectively expressed as *productivity* or *patch dynamics* (Bamforth 1988:18; White and Pickett 1985). Such higher density (ecologically richer) patches exhibit traits referred to as persistence, stability, and resilience (Holling 1973, 1986:296; Winterhalder 1994: 34).

For past hunter-gatherer populations in Colorado's Southern Rocky Mountains, the presence and location of resource-dense (rich) patch islands represented enhanced advantages for assuring successful past human economic strategies within larger geographic landscapes of unevenly distributed lower and higher resource "patch islands". Application of patch theory for modeling prehistoric cultural systems and their associated

landscapes, while still in its infancy, represents an important theoretical framework for better understanding the complex interplay of prehistoric human and natural ecological systems. In 2003, a scholarly book on the topic, *Islands on the Plains* (Kornfeld and Osborn 2003), was dedicated to prehistoric cultures and ecological patch systems in the central and western plains (cf. Brunswig 2003b; Osborn and Kornfeld 2003; Wandsnider and Chung 2003; and Vehik 2003).

Within any natural landscape occur smaller areas of high resource density, or “island”, microenvironments (ecological patches) where animal and human populations concentrate during certain seasons of the year. The presence of high density ecological patches is dictated by differing combinations of natural variables such as topography, hydrology, soils, botanical and faunal habitats, and geology. Based on several years of fieldwork in Rocky Mountain National Park, the authors of this report have become well aware that the Park contains numerous such patch islands where rich biotic systems have thrived and presented high density and geographically-concentrated resources to past human populations, particularly during the warm seasons of the year.

In 2005, a full-scale multidisciplinary (cultural and natural resources) study of one such ecological patch in the Park’s Forest Canyon Pass area, was proposed to Rocky Mountain National Park but not funded. However, a scaled-down, pilot project version of the originally proposed research was funded by the National Park Service in 2007, and it is that more limited, exploratory investigation which is the subject of this report.

The main objective of our project, entitled “Pilot Study for Investigations into Cultural-Natural Landscapes and Ecological Patch Islands in Forest Canyon Pass, Rocky Mountain National Park”, was to conduct a pilot investigation to establish whether the

Forest Canyon Pass and originating headwaters section of the Big Thompson River constituted a high density patch island as defined above and what its role, ecologically and culturally, may have been throughout its span of human occupation, from Late Ice Age to recent historic times.

The project focused on collection and analysis of archeological and environmental/paleoenvironmental data to initiate field testing of the patch island hypothesis, utilizing several multidisciplinary components, including:

1) high resolution (sub-meter) Global Positioning System (GPS) surveys and mapping of the research area were done in order to initiate a long-term process of accumulating detailed spatial data layers of topography, hydrology, plant community and soil type distributions, and archeological site locations. This project initiated the process of assembling those spatial layers into a complete Geographic Information System (GIS) model designed to fully assess the area's relative physical, botanical, hydrologic, and cultural resources. The pilot project successfully supplemented the earlier existing archeological data base and began the process of increasing knowledge of the types and extents of natural and cultural resources within the Pass. Both GPS and GIS research components of the project drew on *apriori* knowledge and experience of its principal investigators who applied those technologies to past natural and cultural research programs in the Park and its nearby region (cf., Brunswig 2003a, 2004b, 2005b; Butler 2004; Rohe 2003, 2004)

2) A limited archeological survey of selected portions of the total Pass research area was conducted in order to locate additional camp and special activity (plant processing, etc.) locations related to past cultural activities. Documented archeological sites or isolated

artifact finds were recorded using standard field methods and mapped using a sub-meter GPS unit (see Brunswig 2005b for details). GPS spatial data on both physical and archeological phenomena were integrated into a preliminary GIS model.

3) Limited paleoclimate and paleoecological studies were conducted in a wet meadow on the north slope of the Forest Canyon Pass upper headwaters area. The studies utilized sediment core extraction and analysis of stratified sediment deposits and their inclusive pollen and organic materials. In the past, UNC has conducted coring research at five different sites within the Park and assembled a 10,400 year composite record of climatic and ecological change (cf. Doerner 2004, 2005; Doerner and Brunswig 2008). Data recovery and analysis methodologies employed in the project's paleoclimate/paleoecology research component are described in detail in UNC's current Park research permit for paleoenvironmental research first submitted in 2005 and updated each year since that date (Doerner and Brunswig 2009). Organic materials within the stratified core sediments were dated using high precision AMS radiocarbon technology.

Paleoclimate/paleoecological data (see below) were used to reconstruct long-term cycles of climatic and environmental change in the Pass and its immediate area for better understanding of climatic, paleoecological and cultural land use patterns in the Pass and its surrounding landscape.

Limited botanical sampling of modern Pass flora was done in the central, upper headwaters section in order to establish an initial plant ecology baseline for the project. The project's botanical survey, occurring only over a single day, was conducted by Park Ranger/Botanist Leanne Benton and Karin Edwards, Botanist. Botanical inventory of immediate Forest Canyon Pass headwaters area plant species and community classes by

Ms. Benton and Ms. Edwards provided important information on the presence of species known to have economic, medicinal, and/or spiritual value to past and present Native American populations. Similar botanical surveys have been conducted by UNC in its numerous Park research projects and have proved invaluable for revealing insights on Native American use of the Park's botanical resources (cf., Bach 2003; Werner 1999). The botanical inventory also began the process of establishing important baseline plant community data for use in interpreting the Pass' paleoclimate/paleoecological record.

Description of Project Field Investigations and Their Results

Fieldwork for the Forest Canyon Pass project took place from July 6-11, 2008. Project personnel moved into the RMNP Research Dormitory on July 5 and conducted an initial reconnaissance of the Pass on July 6. An in-depth archaeological reconnaissance and search for potential sediment coring locations in the immediate Pass headwaters area and on its south bordering, north-facing Mt Ida Ridge mountain slope was done on July 7th. The July 7th survey effort included a generalized survey up the Mount Ida Ridge mountain face, south of the main Pass, to its summit where an earlier UNC-documented sacred feature site (5LR9822) was located. On reaching that site, it was observed that a previously documented U-shaped vision quest feature had been seriously disturbed since its last survey visit in 2006. By end of the day, it was determined that the immediate Pass headwaters area and the north-facing slope of Mt Ida Ridge was a less than favorable environment for archaeological habitation and that the shallow stream and fen drainage in the Pass' upper drainage corridor was not a good candidate for deep coring. It was then decided to concentrate on the next higher, adjacent bench-lines on the mountain slope north of the Pass. At that time, two separate survey blocks, designated the South

and North survey areas, were selected for further investigation (Figure 2). Survey area polygons shown in Figure 2 consisted of ca. 70 acres (~480 m N-S x ~650 m E-W) in the North Survey Block and ca. 45 acres (~395 m N-S x 380 m E-W) in the South Survey Block.

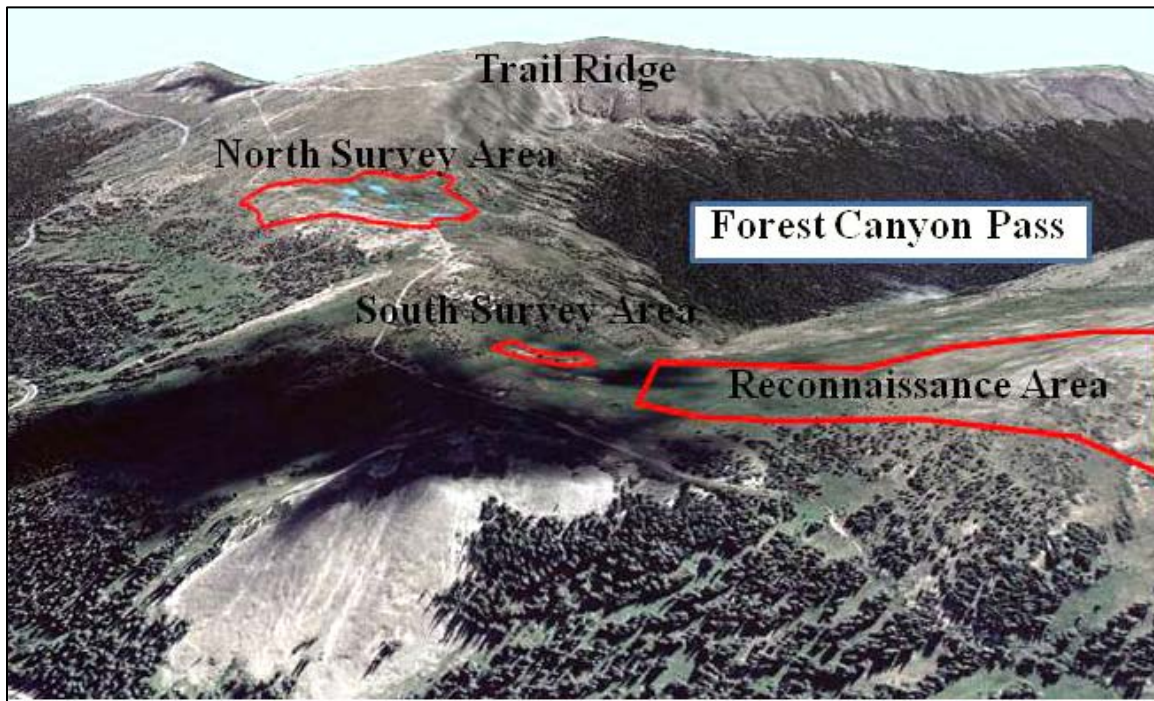


Figure 2. 3-D GIS image of the Forest Canyon Pass Research Area, facing to the northeast. The initial reconnaissance area and subsequent North and South survey areas are marked by solid red lines.

Botanical Survey of the Immediate Forest Canyon Upper Headwaters

On July 13, 2008, Leanne Benton, Park Ranger, and Karin Edwards, Park Botanist. Conducted a botanical inventory of the central Forest Canyon Pass area. The purpose of the inventory was to determine whether sufficient economic plant species in the Forest Canyon Research Area existed to support the hypothesis that the Pass represents a high density patch island and assemble a listing of economic plants likely to have been available to its prehistoric inhabitants. Primary data from the inventory may be found in

Appendix D at the conclusion of this report. As Benton and Edwards note in Appendix D, plant species were identified within the sampling area by either flowers or leaves and their inventory listing is arranged alphabetically by family, then by scientific names. The source used for the inventory's plant names is *Plants of Rocky Mountain National Park* by Beidleman, Beidleman, and Willard (2000).

Identified economic plants

A total of 27 economic plant species were identified by Benton and Edwards during a single day of botanical inventory. Table 1 shows a break-down of plant species known to have had economic utility for historic Native American tribes in the Intermountain West and western Plains. Of the 27 species, 6 are known to have been used for food only (edible), 8 were utilized for medicinal purposes, and 13 had both food and medicinal uses.

Table 1. Summary of Economic Plant Classes.

All Economic Plants	Edible Use Only Plants	Medicinal Use Only Plants	Edible & Medicinal Use Plants
27	6	8	13

Table 2 provides a listing (after Benton and Edwards in Appendix D) of economic plant species, providing information on their scientific and common names, their use (edible, medicinal or both), whether they are poisonous to humans, and were judged to be abundant, uncommon, common, or rare in the survey area. It should be pointed out that some poisonous plant species still had economic (edibility or medicinal benefits) value when taken in limited amounts (e.g. purgatives) or prepared in ways designed served to detoxify them for human consumption. Many of the plants or plant products, such as

berries, nuts, and leaves, could be consumed in their fresh states while others required cooking, drying, crushing, and/or grinding to achieve their maximum benefit. Some root plants, such as Bistort and Yarrow, were dried and ground into a flour form and added to stews and soups which also included meat or meat broth, other edible plant parts, marrow, and/or animal fats. Berries were frequently dried and transported for later use or crushed or ground and added to dried, powdered meat and animal fat to make the well-known Native American food product, pemmican.

Table 2. Listing of Economic (edible and medicinal) Plants from the 2008 Botanical Survey of the Upper Forest Canyon Pass Headwaters Area (after Benton and Edwards, Appendix D, this volume).

Scientific Name	Common Name	Species or genus Known Edible(E), Medicinal (M), Poisonous(P)	Abundant (a), Common (c), Uncommon (u), Rare (r) for site
<i>Stellaria longipes</i>	alpine starwort	genus E & M	u
<i>Angelica grayi</i>	Gray angelica	E, genus M	r
<i>Achillea lanulosa</i>	yarrow	E (roots)*, M	c
<i>Antennaria</i> spp	pussytoes	M	c
<i>Taraxacum officinale</i> (non-native)	common dandelion	E & M	r
<i>Mertensia ciliata</i>	tall chimingbells	E	u
<i>Clementsia rhodantha</i>	rose crown	E	u
<i>Rhodiola integrifolia</i>	kings crown	E	u
<i>Vaccinium cespitosum</i>	subalpine blueberry	E & M	c
<i>Vaccinium myrtillus</i> ssp <i>oreophilum</i>	myrtleleaf blueberry	E & M	c
<i>Vaccinium scoparium</i>	broom huckleberry	E & M	c
<i>Ribes montigenum</i>	red-fruited gooseberry	E, genus M	a
<i>Psychrophila leptosepala</i>	white marsh-marigold	E&M;P(in large amts)	locally c
<i>Luzula</i> spp	woodrush	E	u
<i>Lloydia serotina</i>	alplily	E&M	locally c
<i>Abies bifolia</i>	subalpine fir	E & M	a
<i>Picea engelmannii</i>	Engelmann spruce	E & M	a
<i>Deschampsia cespitosa</i>	tufted hairgrass	E & M	c
<i>Bistorta bistortoides</i>	American bistort	E & M	c
<i>Oreobroma pygmaea</i>	pygmy bitterroot	E & M	locally a
<i>Pyrola</i> spp (either <i>chlorantha</i> or <i>minor</i>)	pyrola	genus M	u
<i>Potentilla diversifolia</i>	blueleaf cinquefoil	genus M	c
<i>Salix arctica</i> ssp <i>petraea</i>	arctic willow	genus M	c
<i>Salix brachycarpa</i>	grayleaf willow	genus M	**
<i>Salix planifolia</i>	Nelson willow	genus M	**
<i>Pedicularis groenlandica</i>	elephantella	M	locally c
<i>Penstemon whippleanus</i>	Whipple penstemon	genus M	u
<i>Viola labradorica</i>	blue violet	genus E	c

*Yarrow roots are used for food by many Native American groups.
 **Note about willow. Either or both of the willow species, *Salix brachycarpa* and *Salix planifolia*, were abundant in the wetland area.

Wildlife (Faunal) Survey of Forest Canyon Pass

Jeff Connor, RMNP Natural Resource Specialist, conducted a one-day wildlife survey of upper Forest Canyon Pass on July 15, 2008, as part of the Forest Canyon Pass Pilot Project. The intent of the survey was to inventory Pass fauna in order to provide a basis for establishing its relative wildlife species richness and diversity relative to the project's high-density "patch island" hypothesis and establish a catalog of potential game species for the Pass' past human occupants. Connor's full report of the survey is provided in Appendix C at the conclusion of this document. He was able to identify a total of 14 bird species during a one-day transect of the Forest Canyon headwaters. Only one of the species, the white-tailed ptarmigan (*Lagopus leucurus*) was a game species known to have been utilized by native tribes in the Rocky Mountains. As noted by Connor, ptarmigan are more common in tundra rock fields and outcrops above the Pass, but some do nest in willow and krummholz areas in the Pass' subalpine ecosystem.

Mammals, particularly herbivores, would have provided meat, marrow, leather, sinew, and tool bone for Native American bands using the Pass. Jeff Connor's survey inventoried, through either direct observation or physical signs, e.g. animal spoor, the presence of such large game species as elk (*Cervus Canadensis*), mule deer (*Odocoileus hemionus*), and moose (*Cervus Canadensis*). Bighorn sheep (*Ovis Canadensis*) were observed just west of the Pass on Specimen Mountain, one of their primary grazing areas in the Park today. Smaller game animals recorded during the survey included snowshoe hare (*Lepus americanus*), yellow-bellied marmot (*Marmota flaviventris*), and pika (*Ochotona princeps*). Although not commonly used by most Native American groups in the past, two other species known to have been trapped or hunted, black bear (*Ursus*

americanus), wolverine (*Gulo gulo*), and porcupine (*Erethizon dorsatum*) are also known to frequent the Pass area. Black bears provided fur and hides, bear fat for rendering into grease for lubrication and as an insect repellent. Wolverines, valued for their rich pelts, were dangerous to hunt and probably not a common game animal. Porcupine quills were valued by many Native American tribes for decorating clothing and porcupine meat was occasionally eaten. Finally, three fur-bearing species, American martins (*Martes Americana*), ermine (*Mustela ermine*), and long-tailed weasels (*Mustela frenata*) had been previously observed in the Pass area and may have been trapped for their pelts by past visitors.

Another game species, now absent from the region, bison (*Bison bison*), is known to have frequented and even over-wintered in the Park. Bison remains have been found at alpine and subalpine locations in the Park and throughout the Southern Rocky Mountains (Armstrong 1975: 156; Brunswig 1995: 33-36, Table 3; Fryxell 1928: 131-135; Meany and Van Vuren 1993: 3-4). In 2002, bison remains radiocarbon dated between 2280 and 210 rcyrbp were recovered from retreating glaciers in the Indian Peaks area south of Rocky Mountain National Park (Lee, Benedict, and Lee 2006). While their former presence in Forest Canyon Pass may have been largely restricted to their migrating along the Ute Trail from the Kawuneeche Valley up and across Trail Ridge, bison would have presented an important game hunting opportunity for native hunters.

Based on a single-day wildlife survey and earlier observations of its fauna, it is clear that the Forest Canyon Pass headwaters likely offered abundant game opportunities for past Native American hunting bands. The presence of a relatively large herd of elk, consisting of “39 cows, 14 calves, and 8 bulls”, described by Connor (Appendix C), is of

particular interest. Elk were a primary game animal hunted in the prehistoric game drives adjacent to the Pass on Mount Ida Ridge and at Trail Ridge Game Drive, two miles to the west. One ethnographically and archeologically supported game drive scenario has elk herds bedding down at night in subalpine krummholz, then migrating up mountain-sides to alpine pastures in early morning where they are maneuvered into ambush locations (e.g. game drives) (cf. Brunswig 2004a, 2005b).

During the Forest Canyon Pass survey, the first part of the above scenario was observed, an early morning migration of the above noted elk herd up the south slope of Mountain Ida Ridge (Figure 3). It is noteworthy that the morning migration was clearly visible from the prehistoric camp site (5LR12138) on the north side of the Pass where hunters could have observed herd movements and potentially signaled other hunters on Mount Ida Ridge.

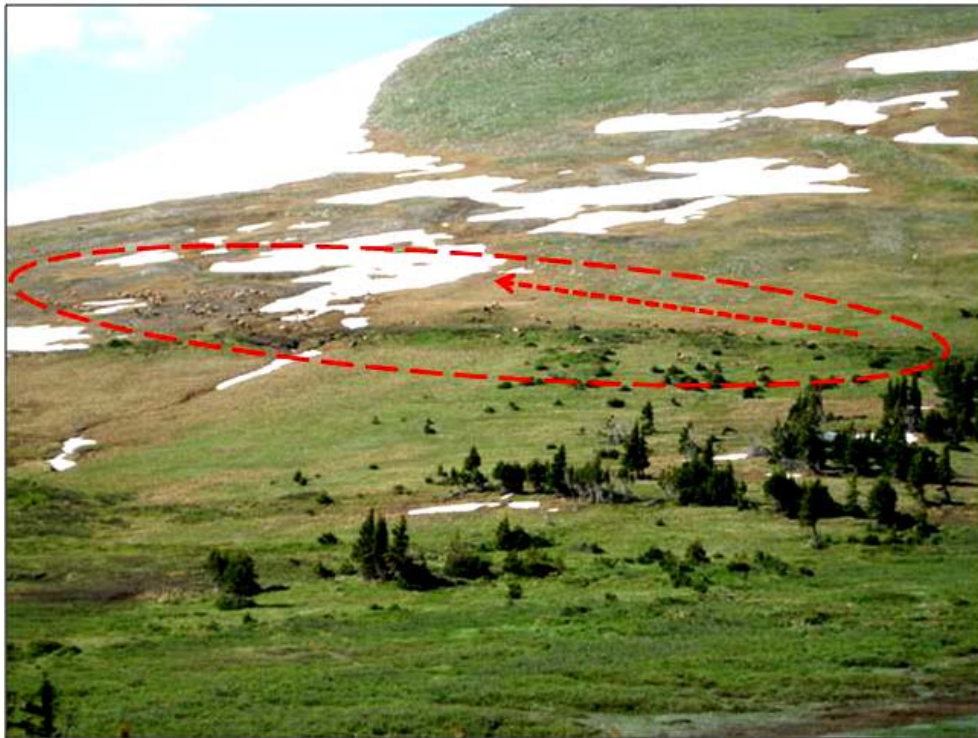


Figure 3. Photograph of the Forest Canyon Pass elk herd moving upslope along the

north face of Mount Ida Ridge to alpine tundra pasture. The view is from site 5LR12138 across the Pass. The physical location of the moving herd is within the red dashed oval and the line of movement is shown by the red arrow.

Hydrologic Topography and Resources of Forest Canyon Pass

The abundance of stable and easily accessible water sources is a critical prerequisite for creation and maintenance of a high-density, resource-rich patch island ecosystem. It is particularly important during the warm season (summer and early fall) in Rocky Mountain National Park when animal, plant, and human activity are at their height. During the winter and early spring, snow accumulates in large amounts throughout the Pass. Even in the summer, snow banks persist in protected, shaded areas of subalpine krummholz in the upper core sections of the Pass, their slow melting providing a continual reservoir of water for the small marshes, fens and drainage channels which constitute the uppermost headwaters of the Big Thompson River. The terminal extension of Mount Ida Ridge, a wide, steep mountain slope, marks the southern boundary of Pass area and project research area while a series of step-like benches, hummocky knolls, and drainage swales encompass the northern margins of the Pass. The North Survey Area's drainage basin (see Figure 2 above and Figure 4 below) contains several ponds, natural depressions, raised outcrop knolls and low ridges which trap and hold snow throughout the winter and spring. During the 2008 survey, the entire survey area, including the basin's natural features (ponds, snow banks...) were GPS mapped at a resolution of ~.5 m.

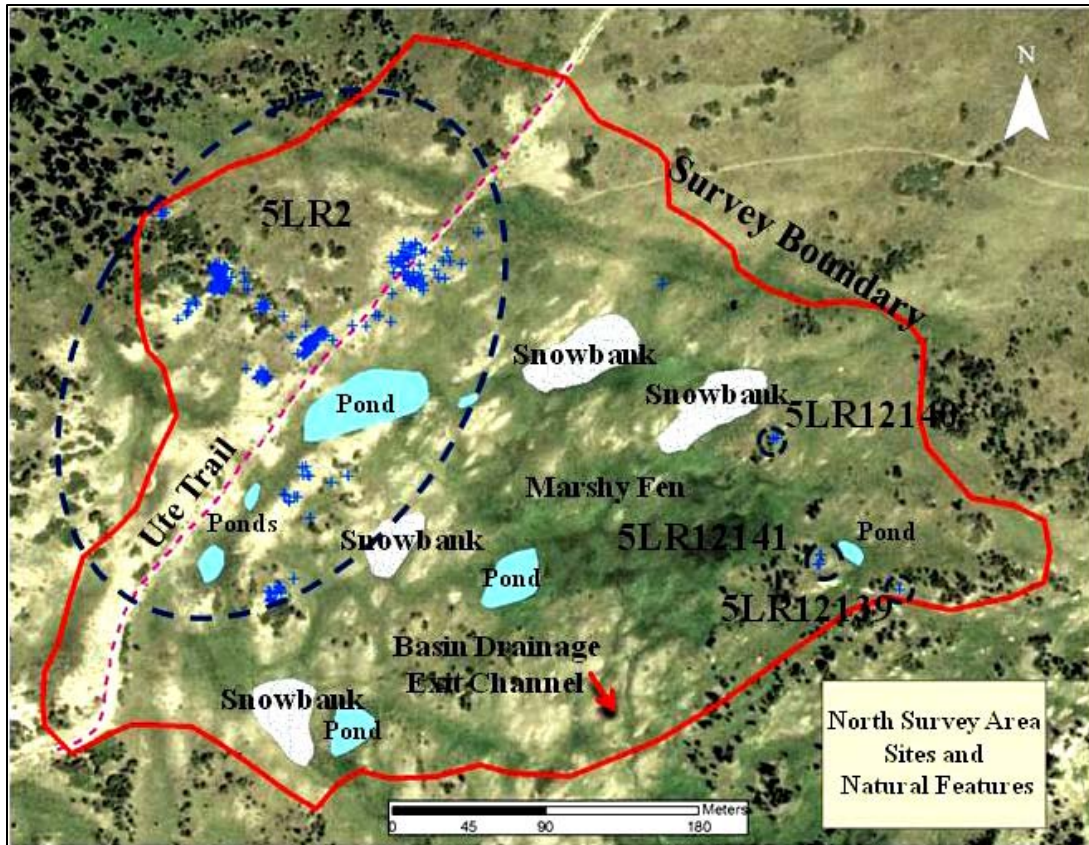


Figure 4. GIS map of the North Survey Area showing natural features (ponds, snow banks, its central marshy fen, and drainage exit channel) in reference to its archeological sites and the Ute Trail. GPS mapped natural features, recorded at a scale of <.5 m, are overlaid on a 1 m resolution aerial photograph map layer.

Cold season snowfields accumulating in the basin slowly melt throughout late spring and summer, releasing water which feeds several small shallow ponds or drains through water-saturated marsh and fens, exiting the basin in a deep erosion channel at its central southern boundary (Figures 5 and 6). The resulting micro eco- and hydrological system provides constant and easily accessible fresh water for both animals and humans throughout the warm season, helping, along with the presence of a major cross-continental divide trail, to explain an extremely high concentration of prehistoric sites on the south facing mountain slope above the main Pass, documented below.

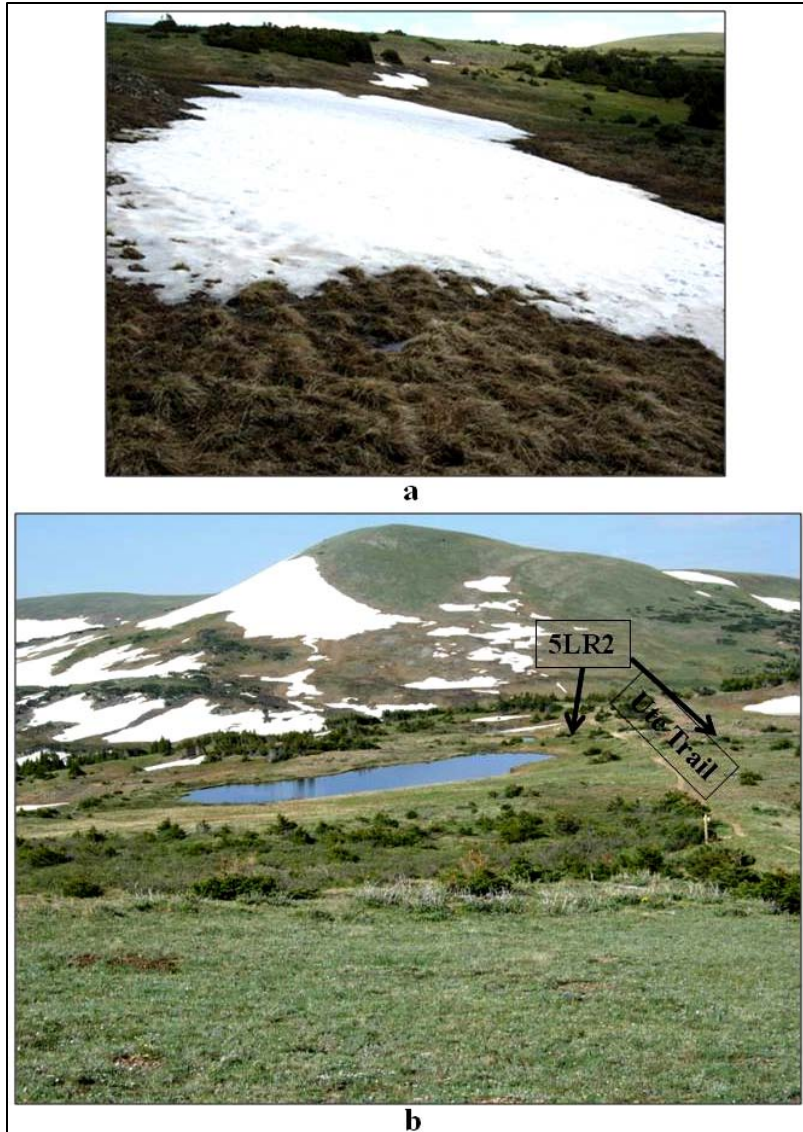


Figure 5. Photographs illustrating the abundant standing water sources in the 2008 North Survey Area. The top photograph (a) shows a slowly melting snow bank which recharges small ponds throughout the summer. The lower photograph (b), which faces toward Forest Canyon Pass to the south, shows a 30 m long melt water pond immediately adjacent (east of) to the Ute Trail and literally surrounded by lithic camp scatters belonging to the Forest Canyon Pass site (5LR2).



Figure 6. Overview (to the northeast) of the North Survey Area drainage basin, showing its melting snow fields. Snow field melt water feeds small ponds and marshy fens in the basin interior. Raised krummholz, or “tree island”, knolls, shown at the top of the photograph, contain small archeological sites described in the next section of this report.

Holocene Environmental Change in Forest Canyon Pass

Coring and analysis of sediments recovered from a Forest Canyon Pass wetland location allowed construction of a high-resolution paleoenvironmental record based on biogeochemical analyses of recovered sediments (see Figure 7 for the coring site location).



Figure 7: Map showing the coring locations (green circles with a central black dot) in the UNC/RMNP Forest Canyon Pass Study Area. The adjacent archeological site, discussed later in the report is shown within a red-lined polygon.

Literature Review for the Paleocology Study

A number of paleoecological studies have taken place in and around RMNP (e.g. Elias 1983, 1985, 1996, 2001; Short 1985; Doerner 2004, 2007; Doerner and Brunswig 2007). Based on Elias' (1996) reconstructions of Holocene July paleotemperatures, the postglacial Early Holocene (11,000 to 9,000 radiocarbon years before present.

Afterwards abbreviated as **rcyrbp**) was significantly warmer and possibly wetter than any other Holocene period, although this was followed by drier conditions during the Middle Holocene. Based on archaeological evidence the middle Holocene "Altithermal"

(Antevs 1945) from 7,500 to 5,000 rcyrbp (Benedict 1979) was not as warm as the early Holocene, although the lack of wetlands found in valley bottoms at this time suggests conditions were drier. Evidence from a low elevation RMNP dry meadow, Beaver Meadows (2,530 m), indicates effective moisture was low and erosion high during the middle Holocene (Doerner et al. 2001, Doerner 2004).

Fossil beetle assemblages from La Poudre Pass (3,103 m) and Lake Isabelle (3,310 m) have been used to estimate that mean July temperatures during the Middle Holocene were 0.2 to 2.2°C warmer than modern ones (Elias 1996). In particular, the La Poudre Pass middle Holocene subalpine coleopteran records dating from 5,360 to 3,485 BP have shown mean July temperatures were 1.7 to 3.7°C warmer than modern conditions. Rapid peat formation in Lawn Lake Fen (3,357 m) reflects a longer growing season and warmer temperatures (Doerner et al. 2002). Fall (1985) interpreted an upward shift of treeline from its modern boundary during these warmer conditions, while Short (1985) found that pine achieved maximum representation in the subalpine. Pollen data from Bear Lake (2,888 m) indicate that the climate at this time was warmer than the modern climate as tree pollen dominated and non-arboreal pollen (NAP) types have their lowest representation (Doerner 2008). Conifers were the dominant vegetation cover and a dense spruce–pine forest likely surrounded the lake.

Pollen and sediment records from Echo Lake (3230 m) south of RMNP shows that regional temperatures cooled during the transition from the middle to the late Holocene (Doerner 2007). The late Holocene is characterized by cooler-than-modern summers, followed by a warming during modern times. Short (1985) interpreted changes in pollen spectra from La Poudre Pass, Long Lake (3,210 m), and Lake Isabelle after

3,500 rcyrbp to be evidence of climatic cooling. Elias (1996) found that mean July temperatures were up to 2.5° C. cooler than modern around Longs Peak (2,732 m). Mean January temperatures remained low until the last 1,000 years (with the exception two short-duration warming pulses) due to changes in mid-latitude insolation, although summer temperatures were within a couple degrees of modern (Elias 1996). The Mount Ida bog was established after temperatures had declined and were beginning to increase again. Doerner (2004) found evidence that warming at RMNP occurred sometime after 2,550 rcyrbp. This warming resulted in increased peat formation in the Mt. Ida area in RNMP. Modern vegetation was established in RMNP ca. 1,750 rcyrbp. Several dendrological studies have found that upper treeline is related to favorable (warmer and wetter) climatic conditions since the end of the “Little Ice Age” (ca. 150 BP) (Hessl et al. 1996; Hessl and Baker 1997a, 1997b Buechling and Baker 2004).

Methods

In July 2008, multiple sediment cores were extracted from the wetland using a square-rod piston sampler (2.5 cm diameter, 1 m sampler). The cores, recovered in segments, were wrapped in plastic film and aluminum foil and transported to the Paleoecology Laboratory at the University of Northern Colorado. In the laboratory, the cores were examined and the most complete core (FC08-2) was selected for analysis. Sediment samples were collected for radiocarbon dating, sediment analysis (loss on ignition, bulk density, and magnetic susceptibility). Bulk samples of sediment were submitted for accelerator mass spectrometry (AMS) radiocarbon dating. Loss on ignition (LOI) and bulk density (BD) measurements were determined using techniques modified from those described by Dean (1974). Bulk density was calculated on oven-dried

samples; organic carbon content was determined using loss on ignition at 550°C for two hours. Magnetic susceptibility (MS) measurements were conducted using standard techniques (Thompson and Oldfield 1986). Magnetic susceptibility was measured at 1-cm intervals in the core using a Bartington meter and recorded in standard units (κ).

Sediment Core Description and Chronology

Sediments in the Forest Canyon cores (FC 08-1, FC 08-2, and FC 08-3) were composed of peat, soft gyttja (a fine-grained organic-rich lake mud), and coarse sand and gravel. The FC 08-2 sediment core analyzed was 75 cm in length (Fig. 8). The upper 55 cm of the core is peat. Between 55 and 75 cm the core was composed of gyttja. The sediment below 75 cm was a mix of coarse sand and gravel which was not retained in the barrel of the corer upon retraction. There was no evidence of a depositional hiatus in the core.

Three accelerator mass spectrometry (AMS) radiocarbon ages were obtained on organic materials in the core (Table 3; Fig. 8). The upper two dates were derived from bulk peat samples. The sample from 20 cm depth was determined to be modern (102.2 ± 0.4 pMC, the term “pMC” stands for “percent modern carbon”). This sample may have been contaminated by roots from the surface vegetation thus this age may be unreliable. An age of 4210 ± 40 ^{14}C rcyrbp was obtained at a depth of 48 cm. The lowermost age was obtained from a bulk sample of gyttja (organic-rich sediment) at a depth of 65 cm and its age was $6,520 \pm 40$ ^{14}C rcyrbp.

Table 3. Uncalibrated and calibrated AMS ^{14}C Ages for Forest Canyon Pass wetland.

Depth (cm)	Material Dated	Laboratory Number	Dating Method ^a	^{14}C rcyrbp	Calibrated Calendar Age	2 Sigma Calibrated Age Range (yrs BP) ^b
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(yrs BP)						
20	Peat	Beta 251004	AMS	Modern	--	--
48	Peat	Beta 249014	AMS	4,210 ± 40	4,830	(4,620 to 4,760) and (4,790 to 4,850)
62	Gyttja	Beta 249015	AMS	6,520 ± 40	7,430	(7,340 to 7,350) and (7,410 to 7,490)

^a Accelerator mass spectrometry method.

^b Calendar age used in the age-depth model. Ages are derived from CALIB 5.1.2 calibration curves (Stuiver et al., 1998) with the 2 sigma calibrated results given in parentheses.

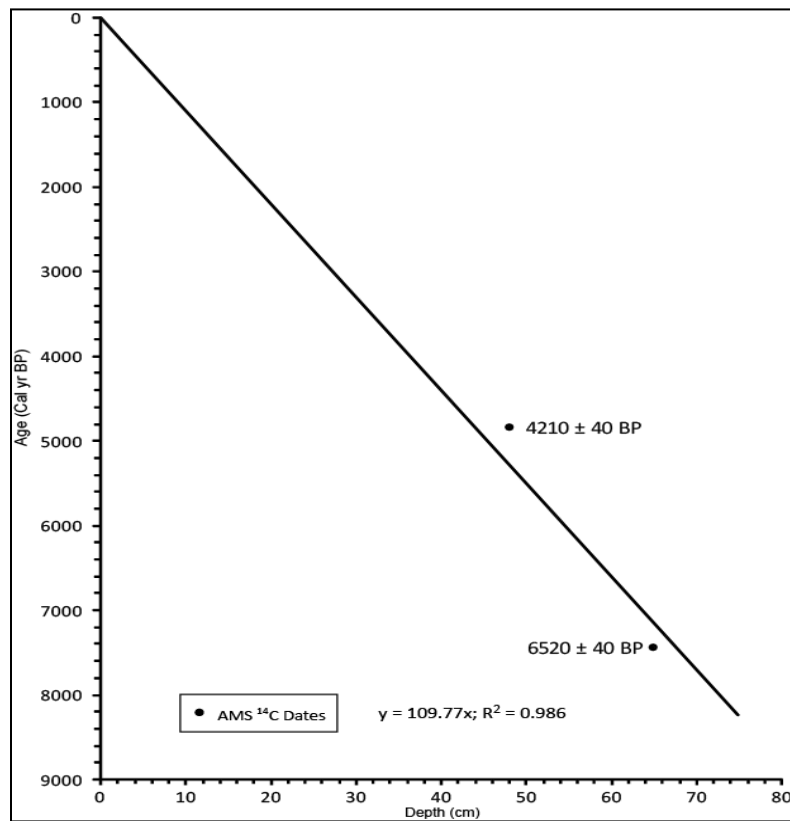


Figure 8. Age-versus-depth model and deposition time for Forest Canyon Pass wetland based on AMS ¹⁴C dates. See Table 3 for age information.

Results

Loss on ignition (LOI), bulk density (BD), and magnetic susceptibility (MS)

measurements on sediments retrieved from lakes, fens, and other wetlands often provide sensitive, high-resolution proxy records of environmental change. LOI is a measure of the build-up of organic matter which reflects biological productivity. When environmental conditions are more favorable (i.e. warmer and/or wetter) there is an increase in organic productivity (Andrews et al. 1975). Likewise, when conditions are more limiting (i.e. colder and/or drier) there is a corresponding decrease in organic productivity. Variations in BD values reflect changing inputs of mineral material into a depositional location (Sullivan and Doerner 2002). Increases in bulk density coincide with periods of greater influx of fine-grained sediments by aeolian and/or fluvial processes. Typically paired measurements of LOI and BD are inversely related, as one increases the other decreases. The MS curve tends to mirror the changes in the bulk density curve but it is more variable in its range. For comparison purposes, the core was divided into four sediment zones (Table 4; Figure 9) based on visual inspection and important changes in the sediment characteristics: LOI, BD, and MS. The sediment curves for the Forest Canyon site show moderate variability throughout the length of the core (Figure 9).

Table 4. Loss on ignition (LOI), bulk density (BD), and magnetic susceptibility (MS) mean values for intervals from the Forest Canyon Pass wetland. Radiocarbon and calibrated age ranges estimated from age depth curve (see Figure 9 below).

Depth (cm)	Zone	Mean LOI (%)	Mean BD (g/cc)	Mean MS (k)	Age Range (Cal Rcyrbp)	Age Range (¹⁴ C rcyrbp)
0-75	All Zones	49.0 ± 16.5	0.199 ± 1.236	0.395 ± 0.209	8,230-Present	7,880-Present
0-32	1	45.6 ± 12.8	0.357 ± 0.068	0.183 ± 0.613	3,500-Present	2,850-Present
33-69	2	57.7 ± 10.7	0.328 ±	-0.338 ± 0.528	7,575-3,500	7,130-2,850

			0.048			
70-75	3	13.5 ± 7.3	1.014 ± 0.318	3.600 ± 1.502	8,230-7,575	7,880-7,130

Zone 3 (7,880-7,130 ^{14}C rcyrbp; 8,230-,7575 Cal BP)

Zone 3 extends from the base of the core (75 cm) to 70 cm. LOI values show a steady increase in this zone. The mean value for this interval is 15.5% and ranges from 5.2 to 26.3%. BD values are highest in this zone with a mean of 1.558 g cm^{-3} and a range between 0.574 and 1.480 g cm^{-3} . MS also peak in this zone, with values ranging between 2.167 and 5.950 k and averaging 3.600 k .

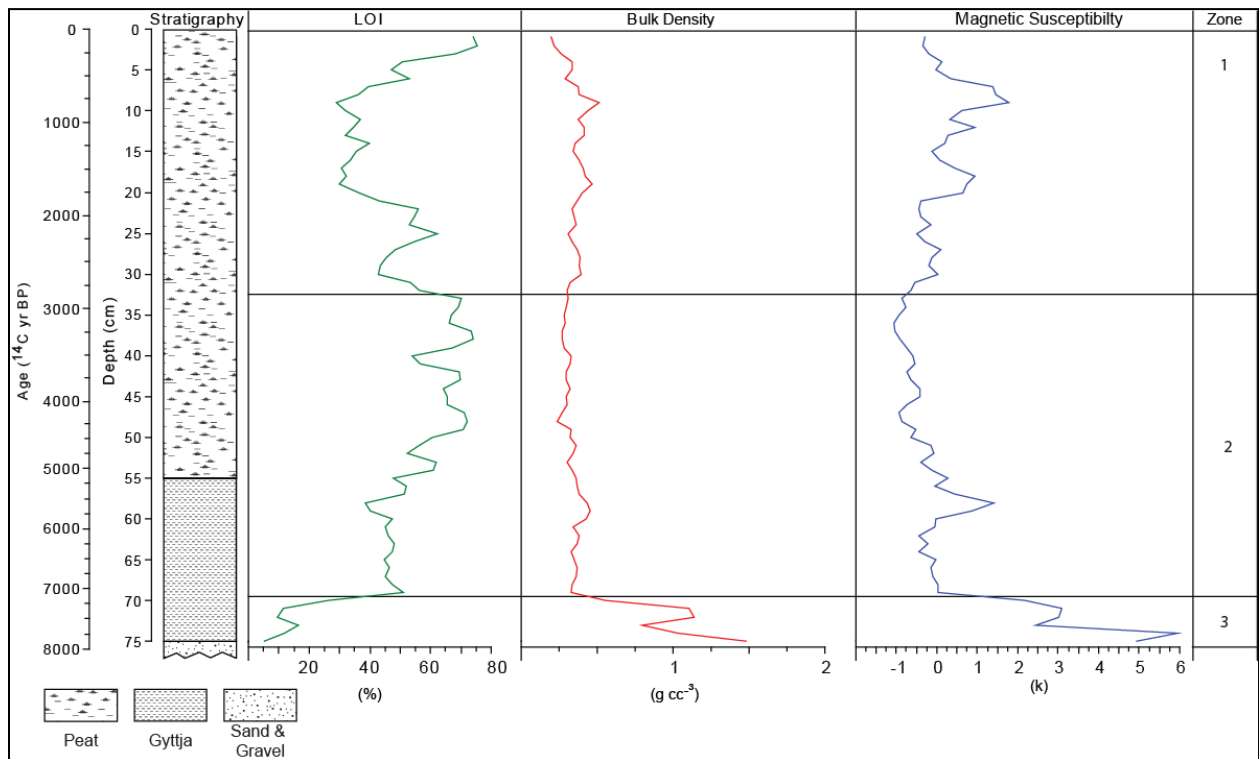


Figure 9. Stratigraphy, loss on ignition (LOI), bulk density (BD), and magnetic susceptibility (MS) curves from Forest Canyon Pass wetland.

Zone 2 (7,130-2,850 ^{14}C rcyrbp; 7,575-3,500 Cal BP)

In Zone 2 (69 to 33 cm), LOI values increase significantly with a mean of 57.5% and a range between 38.5 and 73.9%. BD values show little variation, averaging 0.328 g cm^{-3} and ranging from 0.236 and 0.451 g cm^{-3} . MS shows greater variability in this zone, with a mean of -0.338 k and a range between -1.050 and 1.4167 k .

Zone 1 (2,850-Present ^{14}C rcyrbp; 3,500-Present Cal BP)

In zone 1 (32 to 0 cm) the LOI values vary considerably with an average of 45.6% and a range from 29.1 to 75.3%. This zone is characterized by a pattern of decreasing then increasing LOI values. BD values increase slightly, averaging 0.357 g cm^{-3} , with a range between 0.1959 and 0.5074 g cm^{-3} . MS values show substantial variability in this zone, ranging between -0.633 and 1.783 k with a mean of 0.183 k .

Discussion and Summary

To better interpret the organic carbon signal (LOI, Figure 9) the LOI data from the Forest Canyon Pass Wetland were converted to z-scores and plotted against time (AMS dates were converted to radiocarbon years (BP) and to calibrated years (AD/BC). These results are provided in Figure 10. If the z-score is positive this is interpreted as an increase in temperature whereas a negative z-score is interpreted as a decrease in temperature.

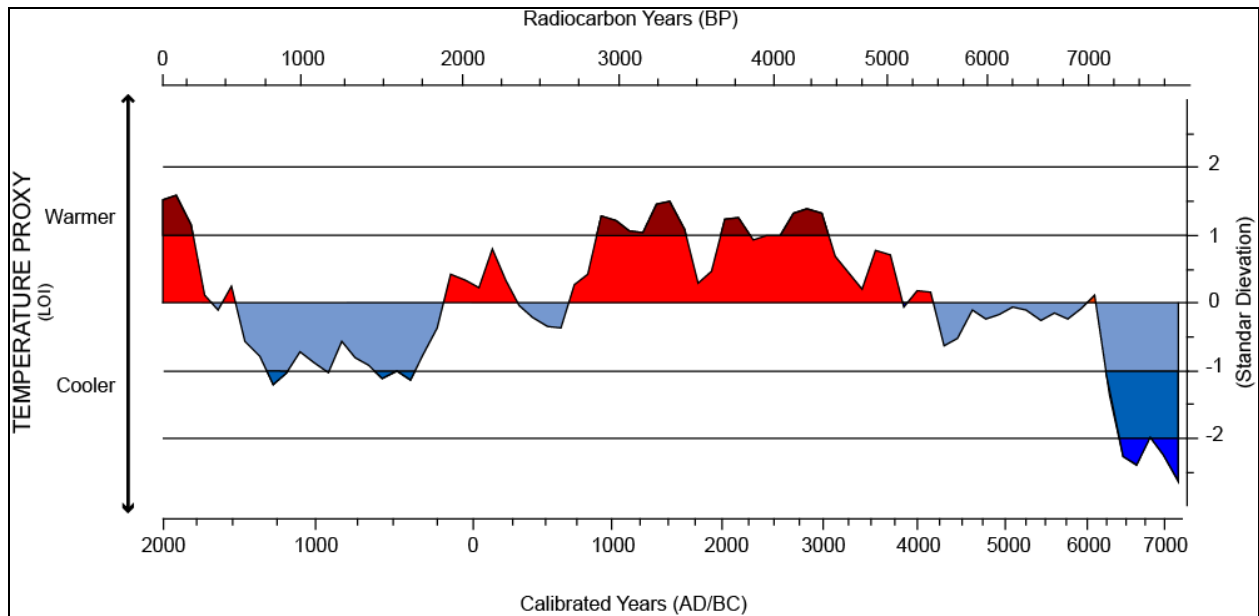


Figure 10. Reconstructed Temperature Proxy Curve for the Forest Canyon Pass Wetland.

Proxy data from the Forest Canyon Pass wetland provide a high-resolution record of Holocene environmental change in Rocky Mountain National Park (Fig. 4). During the middle Holocene (ca. 7,130 and 5,400 ^{14}C rcyrbp) warming is indicated by increasing LOI and decreasing BD values (Fig. 9). Beginning ca. 5,400 ^{14}C rcyrbp, increasing LOI values and a stratigraphic change from gyttja and to peat suggest the climate was warming and was therefore more favorable for the build-up of organic matter (peat) in the wetland. Higher temperature persisted until ca. 2,850 ^{14}C rcyrbp when regional cooling occurred (Fig. 10). The late Holocene is characterized by fluctuating temperatures but overall temperatures were cooler relative to the middle Holocene. This interpretation is supported by declining LOI values and increasing BD values (Table 4; Figure 9). The climate during the most recent centuries is characterized by higher temperatures. However, insufficient chronological control in the upper portion of the core precludes assigning definitive dates in this period. The findings are consistent with results from

previous paleoenvironmental studies along the Northern Front Range (e.g. Elias 1983, 1985, 1996, 2001; Short 1985; Doerner 2004, 2007, 2008).

Archeology of the Forest Canyon Pass South Survey Area

Survey of the project's South Survey Area, north of the main Pass headwaters, involved both UNC and RMNP personnel and began on July 7th. It revealed a well-developed fen and a low, lightly forested, north-south ridge-line ca. 250 m southeast of the Ute Trail. Pedestrian survey transects, run from the Ute Trail east to the low ridge line, immediately uncovered stone tools, tool manufacturing waste flakes, and stone features (hearths) in two main concentrations at the southern end of the ridge-line (Figure 11). The site was subsequently assigned Colorado State site number 5LR12138.

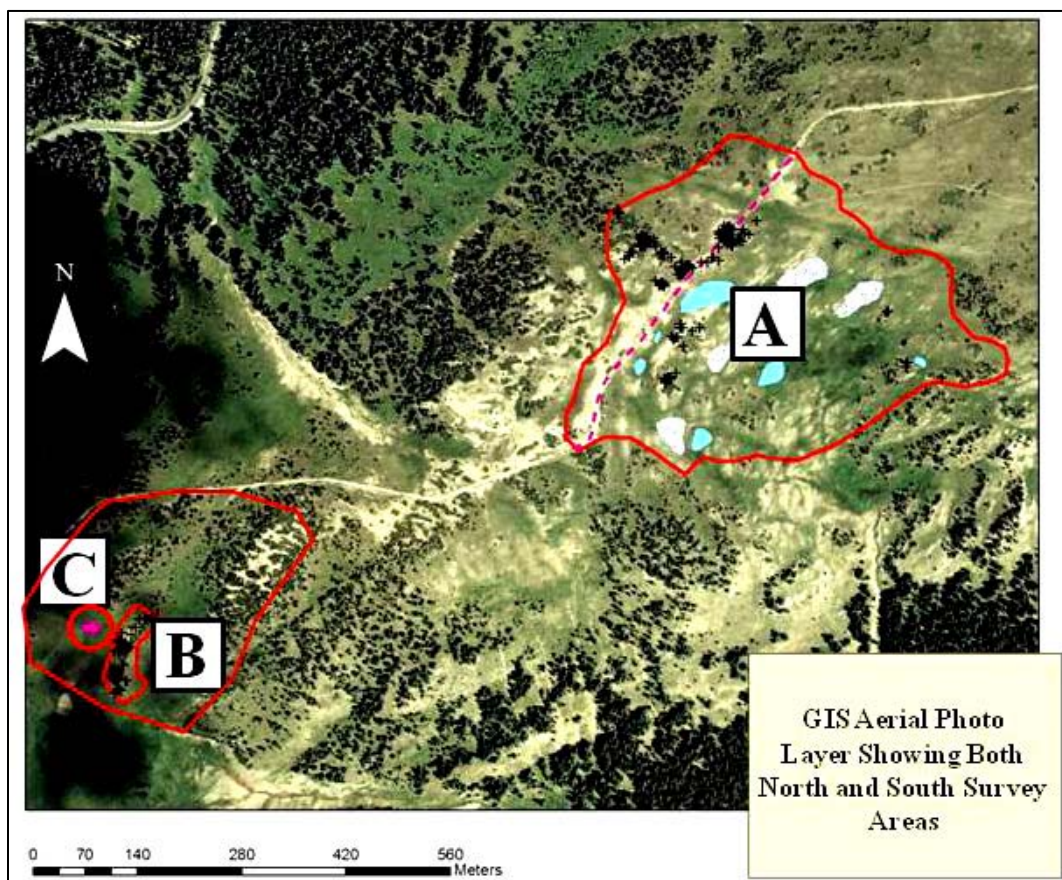


Figure 11. Project Survey Areas superimposed over a GIS 1 m scale Aerial Photo Map Layer: A-North Survey Area; B and C are within the South Survey Area (red

line) and represent, respectively the north-south ridge bench site (B/5LR12138) and C, the sediment coring locality, discussed below. The light line running diagonally from the upper right to the lower left of the image is the Ute Trail.

Figure 12 shows survey flags marking artifacts at the southern end of the low ridge bench just prior to where it ended in grassy wetland. All artifacts were mapped using a survey grade (sub-meter) Global Positioning System (GPS) unit and contouring locations for the ridgeline section with artifacts were also GPS mapped.



Figure 12. Lithic artifact scatter, marked by fluorescent pin flags which show the location of a small prehistoric camp site at the southern end of 5LR12138, situated on a low north-south ridge-line in the South Survey Area.

Artifacts and features on 5LR12138 extended 120 m NNE-SSW and 36 m NWW-SEE, covering an area of $\sim 4300 \text{ m}^2$. The only culturally/chronologically diagnostic artifact recovered from the site was a tapered projectile point base (Figure 13) belonging to the Late Paleoindian Period, probably of the Angostura point type, dated in other North

American contexts to between 9,700 and 7,550 rcyrbp (cf. Brunswig 2007: 278-283). Several butchering and hide-working/wood-working tools (cf. examples in Figure 4) were recorded along with 79 tool manufacturing/retooling flakes. Details on the artifact inventory of this and other sites are described at the end of this report section.

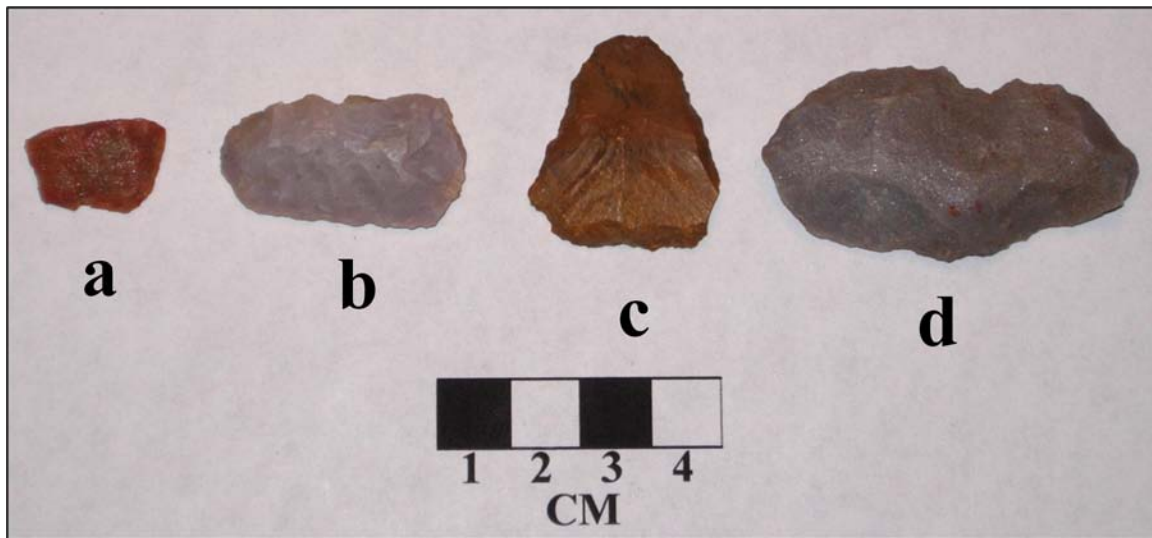


Figure 13. 5LR12138 formal tool artifact examples: a-artifact # 001, Late Paleoindian point base; b-003, flaked knife; c-004, side/end scraper; and d-014, multi-purpose knife-scraper/graver/spokeshave.

Four dispersed, ephemeral hearth feature outlines were recorded in the northern concentration 2 area along with associated fire-cracked, fire-reddened rock (FCR) (Figure 14). FCR was also noted in concentration, but not in feature-defining clusters.



Figure 14. Rock ring hearth feature (No. 1) at 5LR12138, Concentration 2. Small cobbles and fire-reddened rock mark the 70 cm diameter surface hearth. Note the small boulders forming the hearth rim at the upper top left of the photo.

The single culturally diagnostic artifact from 5LR12138, noted above, was the base of a Late Paleoindian projectile point, having traits associated with the Angostura projectile point type. Although stone tool production and re-tooling waste materials were generally found scattered throughout the entire 120 meters of the north-south site line, two particularly high-density artifact scatters were evident early in the survey mapping process and confirmed with subsequent GIS cluster analysis (Figure 15).

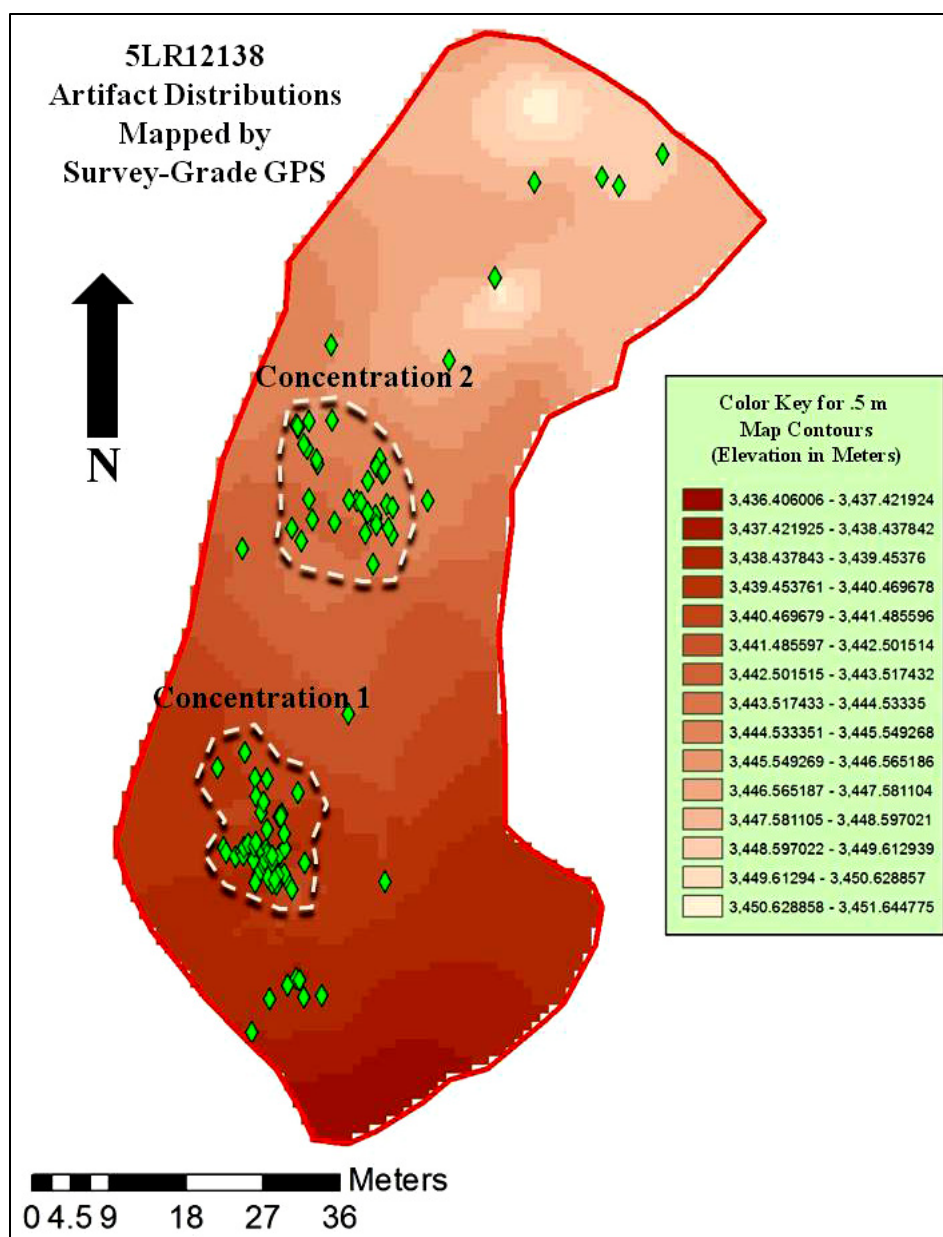


Figure 15. GIS cluster map of artifact distributions on 5LR12138. Two high density clusters are labeled concentrations 1 and 2 and are believed to represent at least two separate camp occupations or different, separate activity areas of the same occupation. Graded contour intervals are shown occurring from deep red to white and represent GPS-based contour resolutions of >.5 meters.

During the site's archaeological investigations, two sediment cores were extracted from an adjacent swale fen immediately to the west. The cores, described in a following paleoenvironment-paleoclimate section, penetrated .73 cm of accumulated peat layers,

ending in a basal sterile sand and gravel layer. Radiocarbon dated organic samples, from -.64 m and -.48 m below surface provided dates of 6540 ± 40 radiocarbon years before present (rcyrbp) (Beta-249015) and 4240 ± 40 rcyrbp (Beta-249014), respectively. The older, lower date of 6540 rcyrbp, situated ~9 cm about a peat/gyttja contact with the sand/gravel layer, suggests the fen may have begun its formation as long ago as ~9,000-8,000 rcyrbp and indicated it was at an initial stage of formation during the site's Paleoindian occupation.

North Area Archeological Survey Results

On completion of transect surveys in the South Survey block, archaeological investigations were moved upslope to the North Survey block on July 8th. The North Survey block was known to contain the majority of one of the Park's largest and archaeologically complex sites, the Forest Canyon Pass site (5LR2). The Forest Canyon Pass site is "strung" along, and either side of, the Ute Trail over a distance of ca. 580 m. It had been extensively surveyed by Colorado Archaeological Society avocational archaeologists in 1987 (Mayer 1989) and less intensively re-surveyed by UNC archaeologists during the Park's 1998-2002 Systemwide Archeological Inventory (SAIP) project (Brunswig 2001: 49-57).

Over a 2 ½ day period, a 70 acre area extending on either side of the trail from the Gore Overlook Trail junction with the Ute Trail to 650 m down-slope (south-southwest), incorporating most of the known Forest Canyon Pass site area, was surveyed, the majority of that area being located in a small drainage basin east of the Ute Trail. The basin itself consisted of several sub-alpine ponds in a rugged landscape of knolls, small ridge-lines and hollows, bordered by a higher "rim" of ridges on its north, east and south,

broken only by a steep drainage channel at the basin's southeastern corner. (Figure 16).

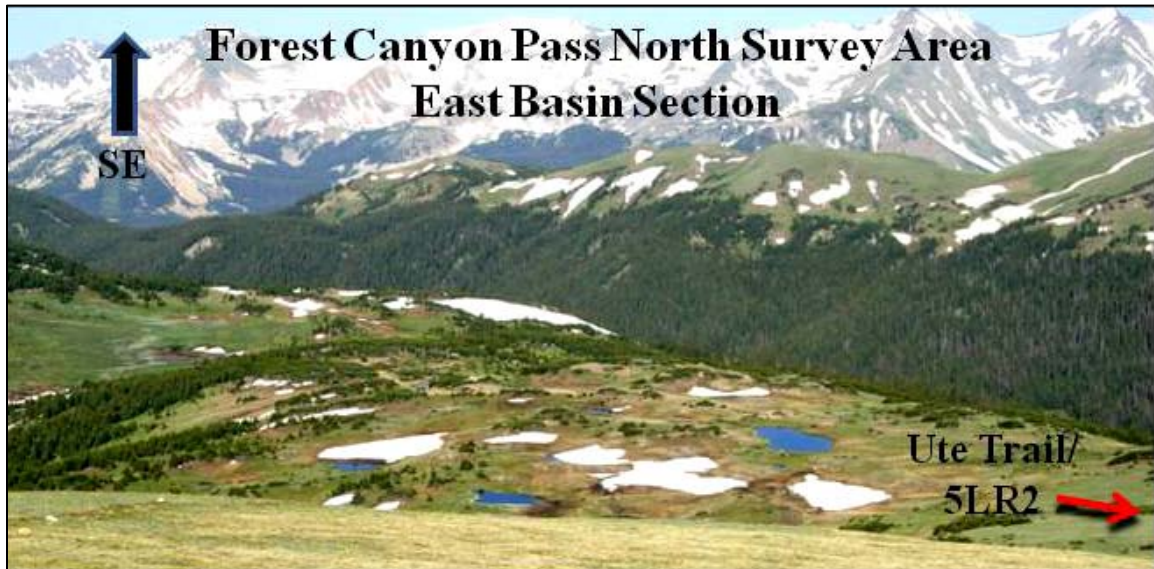


Figure 16. Overview (to the southeast) of the Drainage Basin, east of the Ute Trail and the Forest Canyon Pass site.

A corridor extending 30-40 m west of the Ute Trail and the entire basin west of the trail were surveyed. The survey re-documented several earlier recorded lithic tool and waste debris concentrations of the Forest Canyon Pass site (5LR2) and recorded three new sites in the drainage basin's northeast quadrant, east of that site (see Figure 17).

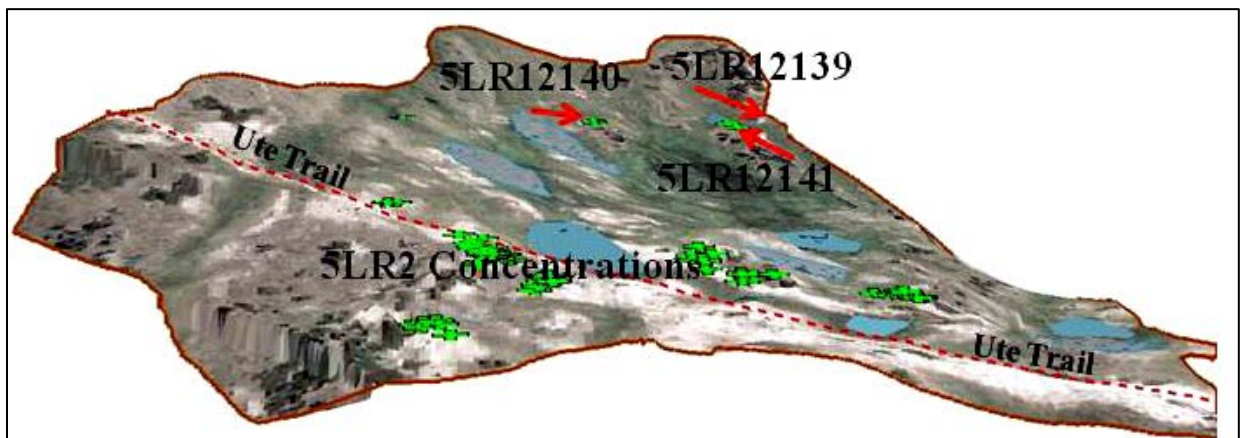


Figure 17. 3-D GIS image of the North Survey area showing lithic artifact concentrations of 5LR2 along the Ute Trail and newly discovered sites in adjacent basin. The view is to the northeast.

5LR2 (the Forest Canyon Pass Site): Background and General Survey Results

As noted earlier, the Forest Canyon Pass site is one of the Park's most extensive prehistoric sites. It was first recorded in 1935 by Mary Yelm (Site Y6) as part of an archeological site inventory of selected plains, foothills and mountain localities for her University of Denver M.A. thesis (Yelm 1935). Later, in 1960, a University of Colorado graduate student, Wil Husted, conducted a short one-reconnaissance, publishing a brief description of his findings in his University of Colorado Master thesis on the Archeology of Rocky Mountain National Park (Husted 1965). The site was more formally surveyed by the Colorado Archaeological Society (CAS) in August, 1987 (Mayer 1989). Analysis of site artifacts recovered by Husted and Colorado Archaeological Society avocational archaeologists was conducted by one of the authors (Brunswig) as part of the university's 5-year archaeological inventory of Rocky Mountain National Park between 1998 and 2002 (Brunswig 2005b). During the UNC inventory program, sections of the Ute Trail running through the site were re-surveyed along with areas to its north and south.

Studies of RMNP Museum collections from the site and its various research publications established it as one of the most prolific, multi-component sites in the Park. Culturally diagnostic projectile points documented as coming from 5LR2 include Paleoindian projectile points from the Folsom Complex (10,750-10,100 rcyrbp), Late Paleoindian Period (Frederick, James Allen, and Great Basin Stemmed types) 9,350-7,000 rcyrbp; Early Archaic Period (Mount Albion (ca. 6,500-4,500 rcyrbp); the Late Archaic Period (3000-1900 rcyrbp), the Early Ceramic Period (1,850-900 rcyrbp) and the latter Late Prehistoric/Early Historic periods (900-150 rcyrbp) periods.

The 1987 survey, although a substantial effort, produced maps and artifact

descriptions with insufficient detail to document its full extent and complexity. The CAS survey did succeed in identifying locations of the site's more prominent artifact concentrations which we were able to broadly correlate with artifact scatters mapped during our 2008 re-survey. Figure 18 shows a GIS map reconstruction of 5LR2's main lithic concentrations documented in 1987 and their relationship with other sites in the Pass recorded during the 2000 UNC inventory survey.

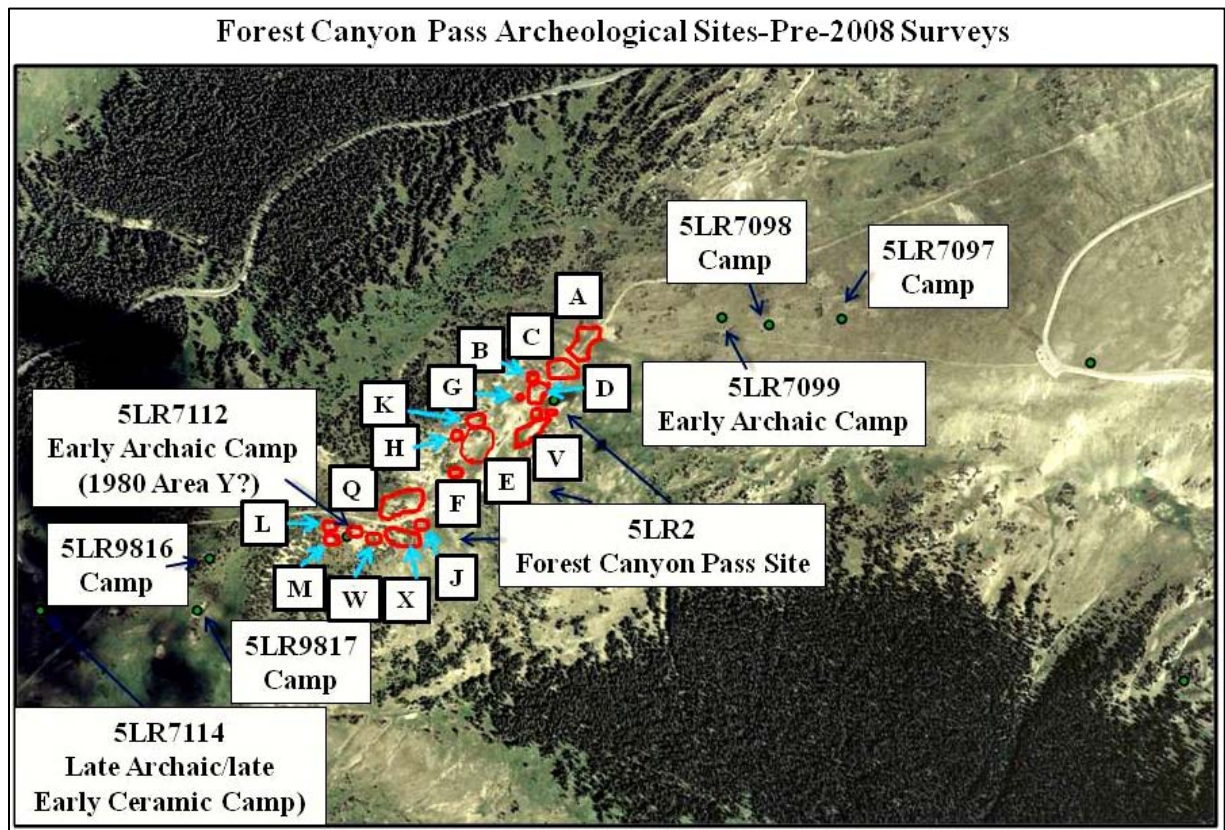


Figure 18. GIS map of 1987 mapped lithic artifact concentrations for 5LR2 (designated by capital letters). Other associated sites, recorded by a 2000 UNC survey, are also shown. One of the UNC sites, 5LR7112, possibly represents the 1987 CAS artifact cluster Y although maps from that survey are insufficiently imprecise enough to leave that correlation in doubt.

Nine distinct artifact clusters were identified during UNC's 2008 re-survey of 5LR2's northern section. All artifacts, including individual flakes as well as tools, were marked with pin flags and recorded using a well-tested UNC GPS survey. And artifact

recording procedure. That procedure involves use of a Trimble survey grade (sub-meter) GPS unit capable of logging spatial positions of individual artifacts within X-Y Universal Transverse Mercator (UTM) coordinate accuracies under .5 m (1.5 feet). Each artifact or very closely spaced (within .15 m/6 inches) artifact clusters (normally flakes) were logged on the GPS computer's database along with identifying-descriptive information. An accompanying GPS survey paper form was used to record more detailed information which was "tagged" to the GPS log and field digital photographs were taken of each tool. Only diagnostic tools (projectile points, etc.), well-made formal tools, and unusual tool material samples were recovered for later study and curation. All other artifacts were left *in situ* on site. Figure 19 shows a GIS plot map, based on survey-grade (sub-meter) location data, of artifacts and contour points. A total of nine concentrations were mapped, although random artifacts were frequently recorded outside the more cohesive artifact clusters.

During post-survey analysis, GIS-mapped artifact concentrations 1, 2, 3, 4, 5, 7, and possibly 6, were correlated with equivalent 1987 CAS identified artifact areas. Two artifact concentrations from 2008, 8 and 9, do not appear to have been identified in the 1987 survey. While the 1987 survey maps were relatively imprecise, generalized locations of that survey's artifact cluster areas, mapped with reference to local natural features (e.g., ponds) and undulations of the Trail, could be reasonably correlated with UNC's GPS-based GIS map of artifact concentrations. Resulting co-locations of the 1987 and our 2008 lithic concentrations are shown in Figure 19. It should be noted that one of the 2008 concentrations, no. 6, appears to be either a previously undocumented cluster or an outlier of the 1987 CAS area V.

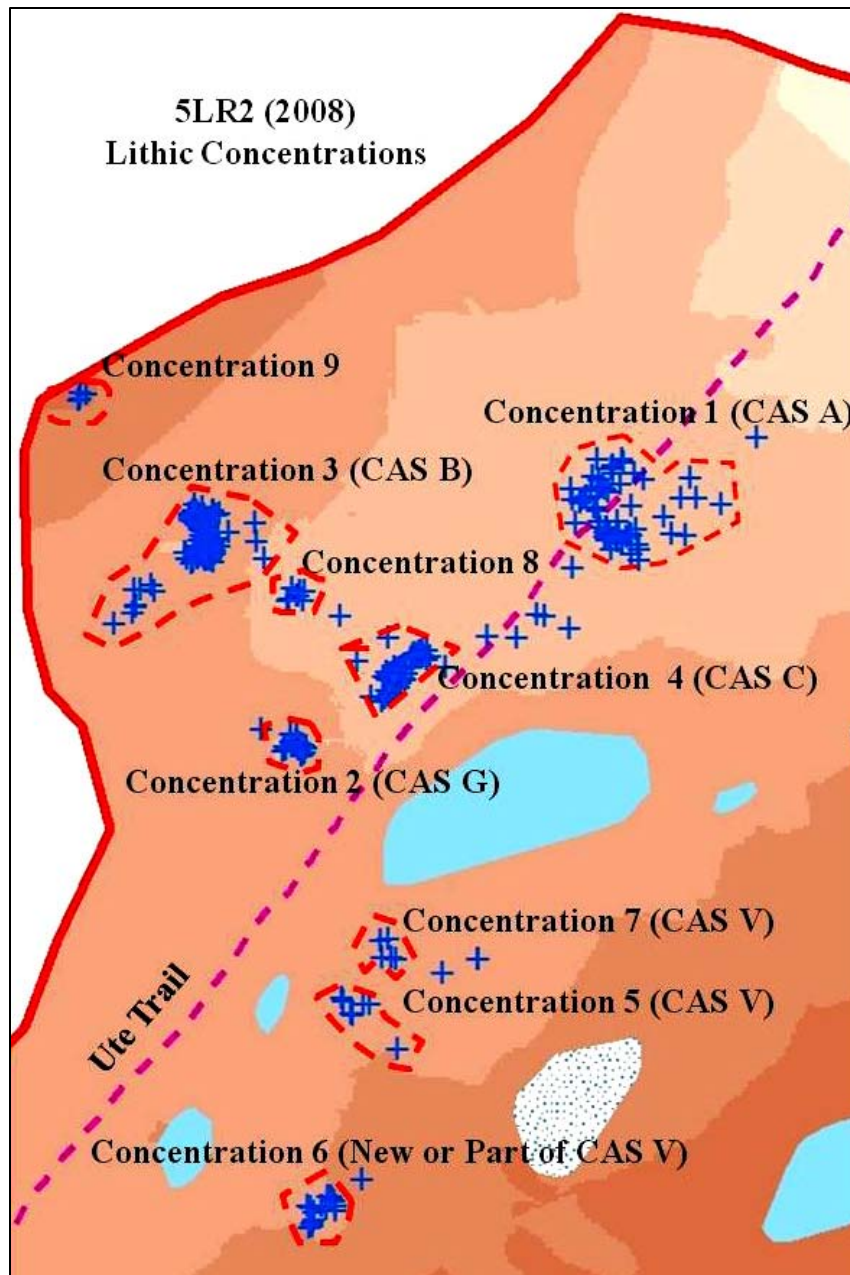


Figure 19. 5LR2 lithic concentrations GPS mapped in the 2008 survey. Individual artifacts are marked by blue plus signs. Equivalent CAS 1987 artifact areas, designated by capital letters, are also noted.

Artifacts recorded from Forest Canyon Pass site concentrations were primarily secondary and tertiary stage manufacturing flakes associated with stone manufacture and re-tooling activities (see Appendix B for a complete catalogue listing all site artifacts). However, three projectile points and a probable projectile point mid-section were also

recovered. These included two nearly complete Late Archaic/Early Ceramic points (Figure 20a and b), a lower, corner-notched point section, also believed to be Late Archaic/Early Ceramic in origin (Figure 20c), and a badly fractured tool mid-section (Figure 20d), considered likely to have come from a projectile point. The mid-section, also described a following artifact analysis sub-section, has an elongated, ovate cross-section and a hint of parallel-oblique flaking, the latter characteristic of Late Paleoindian projectile point types.

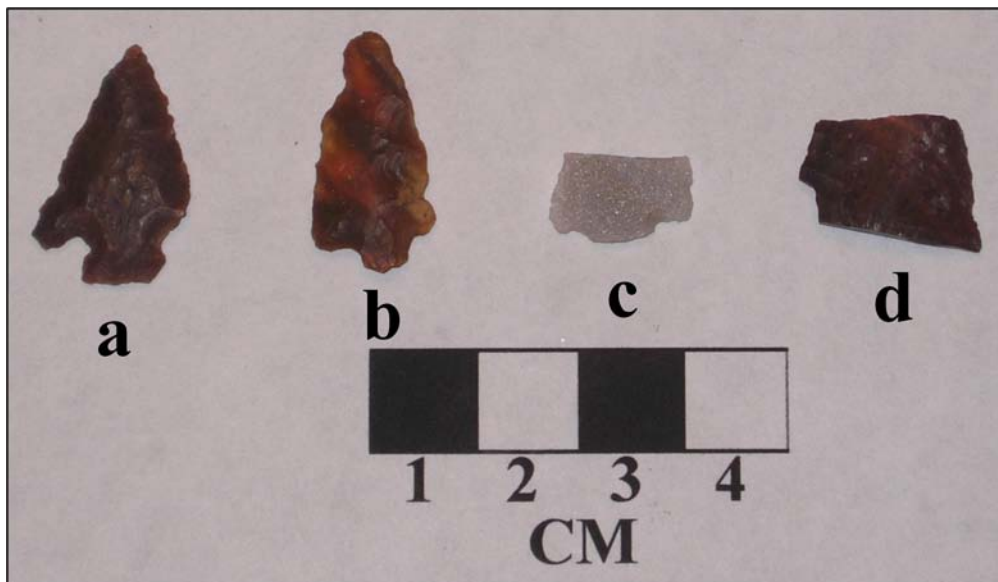


Figure 20. Projectile points recovered from the 5LR2 (Forest Canyon Pass site) survey: a-Late Archaic/Early Ceramic corner-notched point, concentration 1; b-a and b Late Archaic/Early Ceramic corner-notched point, concentration 1; c- Early Ceramic corner-notched point, concentration 7; and d-probable Late Paleoindian mid-section, concentration 4.

Non-diagnostic artifacts included multiple scrapers, flake and biface knives, and a hafted knife. A partial core was recorded as was abundant fire-cracked rock, the latter scattered within most of the concentrations. Four features were also noted, included a historic trail cairn, a historic hearth, and two hearths thought to be prehistoric in origin based on their physical condition and partial burial (cf. Figure 21).



Figure 21. Eroded surface hearth (Feature 1) in concentration 1 east of the Ute Trail. The hearth is believed to be prehistoric in origin.

Descriptive details and analysis of the 5LR2 artifacts are provided along with those for all the Forest Canyon sites in a separate sub-section below.

North Survey Block East Basin Sites: General Field Results

Three individual sites, consisting of a plant processing locality (5LR12140), a small hunting camp site (5LR12141), and a cache of stone tools (5LR12139), were identified in the northeastern basin quadrant (Figure 22).

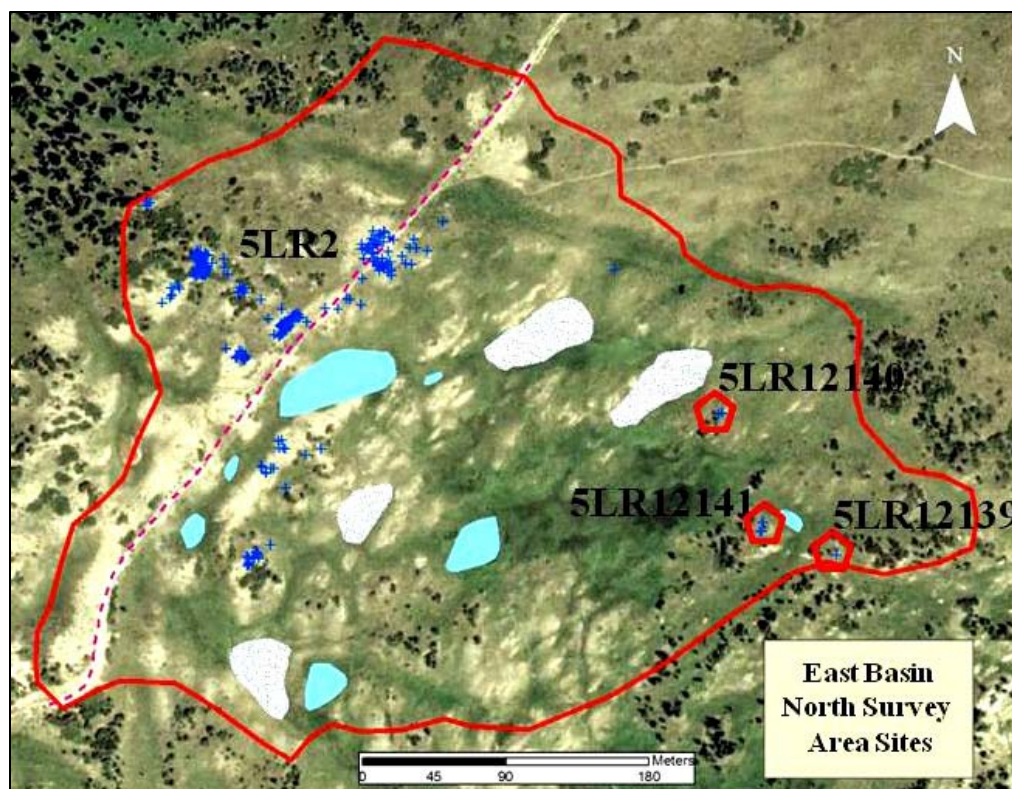


Figure 22. GIS map image of the east basin site locations in the North Survey Area. The Ute Trail is marked by a dashed line.

All three sites were undoubtedly related to prehistoric use of the nearby Ute Trail and the two special activity (plant processing and tool cache) sites were likely associated with one or more of the camp (artifact) concentrations on or near that trail. 5LR12141, the hunting camp site, if it did not once serve as a specialized activity area (hunting/game processing), produced a projectile point mid-section with transverse, parallel flaking patterning, consistent with earlier Late Paleoindian types and known elsewhere to occur between ca. 9,500-8,500 years ago.

During the basin survey, all archaeological finds, as well as the entire basin terrain, were GPS surveyed for Geographic Information System (GIS) mapping and geographic modeling.

Figure 23 shows a rock outcrop knob with shallow soil and subalpine vegetation where seven flake tools were discovered. All seven artifacts were located within 30 cm of each other (note flags in Figure 23).



Figure 23. Orange and blue pin flags mark the location of seven stone tools on the southeast slope of a small rock outcrop at the northeast corner of the north survey area basin. The Ute Trail is visible in the upper left hand corner (above the snow banks).

All of the site's tools were manufactured of Kremmling chert/chalcedony, found in abundance in the Middle Park and North Park valleys to the west and northwest. Two of the artifacts are formal tools; one a well-made discoidal scraper and the second a wedge-shaped chopper (Figure 24: a and b). Three of the flakes are informal knife-scrapers (Figure 24c) while the remaining two flake artifacts were used as informal tools without significant modification. The artifacts represent a tool-kit for processing game for

meat and preparing hides for use in making clothing, leather pouches, and other portable domestic items. Both formal and informal (expedient) tool types are represented in the tool-kit. The fact they were found in such a tight physical cluster suggests they had been “cached” for later use and their owners failed to return to recover them.

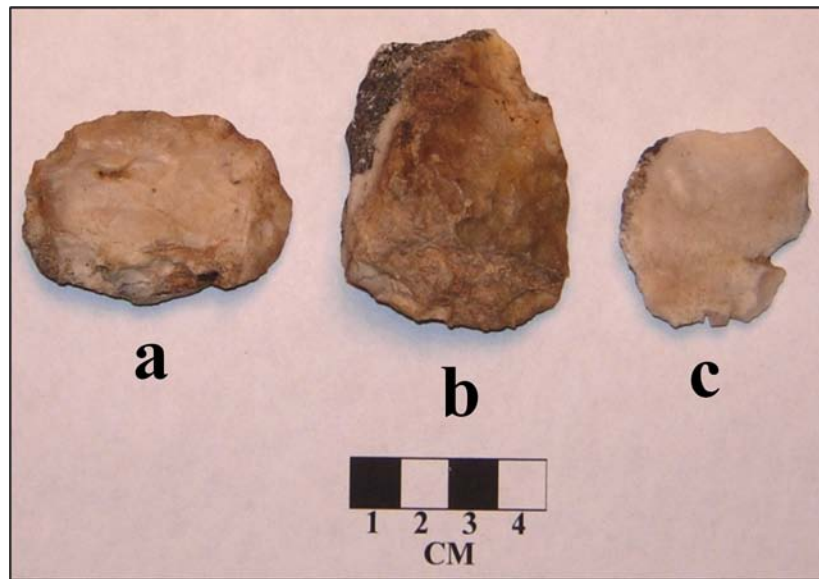


Figure 24. Tools from 5LR12139: a (001)-discoidal (formal tool) scraper; b (002)-wedge chopper (formal tool); c (003)-utilized flake knife-scraper with edge wear and minimal edge retouch (informal tool).

5LR12140

This site represents a special activity area dedicated to processing dried plant products (berries, roots, or even dried meat) through grinding those products between a flat base stone, or metate, and a smaller hand-held stone, referred to as a mano. Only the metate (artifact no. 001) was evident during survey and its accompanying mano may have been removed for other purposes or remains buried or hidden in vegetation at the site (Figure 25). The metate, described more fully in a later section, is a natural, flat, oblong stone slab of biotite schist. The only other artifact found on the low subalpine knoll was a single tertiary, tan Kremmling chert flake.

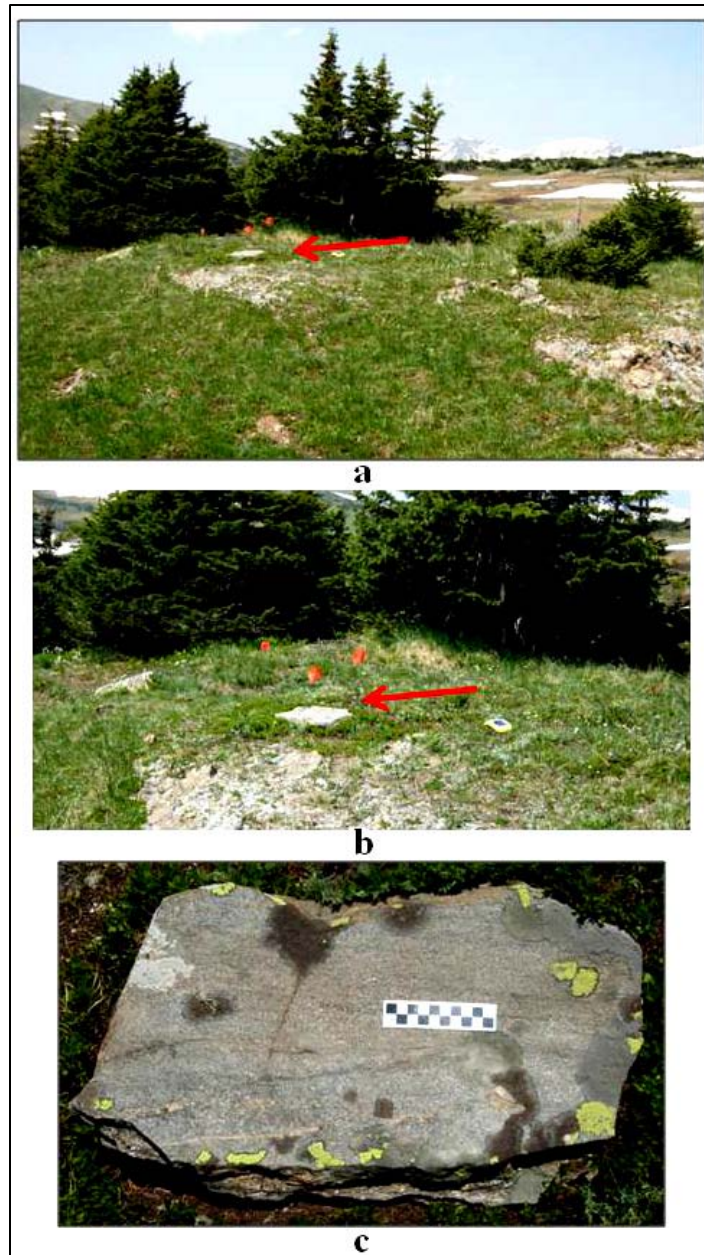


Figure 25. Three photos showing 5LR12140 site in overview (a), close-up of the metate and its immediate location (b) and a close-up view of the metate. The two pin flags nearest the metate mark that artifact while the more distant flag to its upper left indicates the location of the site's only other artifact, a small tertiary flake.

It is informative that many of the plant species recorded in the Forest Canyon Pass botanical survey (described earlier) are suitable for processing by drying and grinding. One of the 2008 recorded archeological sites, 5LR12140, is a limited purpose (special

activity) plant processing area, consisting of a single large base grinding stone, usually referred to as a metate by North American archeologists. Typically, metates are paired with a hand-held stone known as a mano (Spanish for hand), and softer materials are ground from coarse to very fine physical states between the two tools. As described elsewhere (cf. Brunswig 2005b: 196-205), grinding usually involves dried foods, e.g., roots, berries, seeds, dried meat..., for easier storage and transport or immediate cooking or mixing with other foods for later consumption. Common ground plant food uses are grinding of grass seeds or starchy roots for baking flat (unleavened) breads or as thickeners in stews and soups, pulverizing dried berries for adding them to stews and soups or mixing them with chopped and dried meat and animal fat and/or bone marrow, resulting in a well-known, long-lasting, light-weight food known as pemmican. Dried meats themselves were often pounded or ground into coarse powders as part of the preservation process, later to be rehydrated in soups and stews. A second, less common, use of grinding tools was to reduce certain minerals to powders for use in making paints. One mineral, iron hematite (e.g., red ocher), was used in religious rituals as a body or ritual artifact coloring agent and as an abrasive and water-proofing material used for the finishing of animal hides (e.g., Roper 1989; Schmandt-Besserat 1980). In the past, botanical, ethnographic, and archeological researchers in the Park have compiled lists of economic plant species amenable to ground stone tool processing (cf. Bach 2002; Beidelman, Beidelman, and Willard 2000; Brett 2002: Table 4, 62-64; Werner 1999).

Table 5 shows a listing of Forest Canyon Pass plant species which, based on Native American ethnographic sources, were known to have been processed with ground stone tools such as described above for site 5LR12140.

Table 5. Plants from the Forest Canyon Pass Botanical Survey known to have been used by Native Americans in Food Preparation Using Ground Stone Technology.

Scientific Name	Common Name	Species or genus Known Edible(E), Medicinal (M), Poisonous(P)	Abundant (a), Common (c), Uncommon (u), Rare (r) for site
<i>Achillea lanulosa</i>	yarrow	E (roots)*, M	c
<i>Vaccinium cespitosum</i>	subalpine blueberry	E & M	c
<i>Vaccinium myrtillus ssp oreophilum</i>	myrtleleaf blueberry	E & M	c
<i>Vaccinium scoparium</i>	broom huckleberry	E & M	c
<i>Ribes montigenum</i>	red-fruited gooseberry	E, M	locally c
<i>Bistorta bistortoides</i>	American bistort	E (roots) & M	c

5LR12141

The final site recorded in the North Survey Area is a small camp located in subalpine krummholz on a low north-south ridgeline in the northeast corner of the survey area's basin (Figure 26).



Figure 26. View of 5LR12141 to the west-northwest. The location of the Late Paleoindian point base is marked by the blue pin flag in the foreground.

Only a few artifacts were noted, but those included three formal tools: a stem base from a Late Paleoindian projectile point, a fragment of a biface knife, and a lunate knife/scrapper (Figure 27). Three secondary stage tool production (or re-tooling) flakes were also noted. The artifact assemblage reflects a small, very limited occupation hunting camp dating, based on the projectile point type, between 9,400 and 8,300 rcyrbp.



Figure 27. Formal tools from 5LR12141: a-Late Paleoindian (Cody Complex) base and stem (catalog no. 001), b-biface knife fragment (002), and c-lunate knife/scrapper (003).

Description and Analysis of Artifacts Recovered in the Forest Canyon Investigations

The following sub-section describes all lithic tools recorded from sites in 2008 Forest Canyon Pass survey areas. The sub-section has two parts: the first dealing with all culturally and chronologically diagnostic artifacts, all regionally well-known projectile point (spear or arrow) types (cf. Brunswig 2005b: 64-136), and second describing all formal and informal tools which lack distinctive traits known to character specific archeological cultures and radiocarbon-dated time periods. Information is also provided, if known, on raw material sources for the tools. Two decades of field studies in the Colorado Front Range, plains, and Southern Rocky mountains, including the 1998-2002 UNC/RMNP archeological (SAIP) inventory project and on-going studies in North Park

valley, have resulted in creation of an extensive lithic source reference collection and material identification experience that allows high confidence identification of archeological tool material sources for the Park and region. More complete artifact data for each site is provided in their formal artifact catalogues in Appendix B at the conclusion of this report.

Diagnostic Artifacts: All Forest Canyon Research Area Sites

Seven stone artifacts with physical traits indicative of specific cultural-chronological affiliations (all projectile points) were identified during the 2008 survey. Photographs of the artifacts were shown as figures accompanying descriptions of their respective sites in an earlier sub-section. Figure 28 (below) shows line drawing illustrations of the projectile points (mostly in fragmented conditions). Those illustrations will be individually referenced below in descriptive analyses of the artifacts which follow.

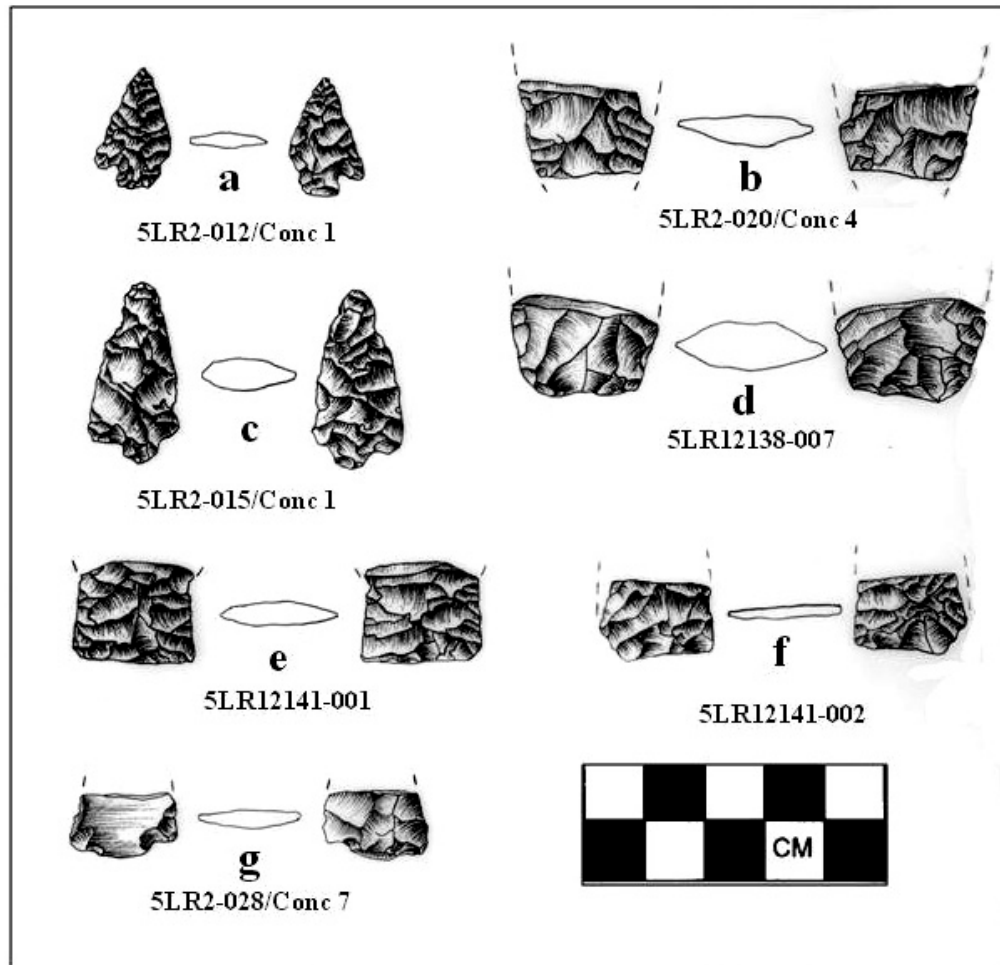


Figure 28. Line illustrations of 2008 Forest Canyon Pass Diagnostic (Projectile Point) Artifacts.

The first site recorded during the 2008 survey was 5LR12138, in the south survey area. The only diagnostic artifact from the site (catalogue No. 007) was a yellow-brown to red quartzite, down-tapered, flat to convex-based projectile point base found in the site's southern (no. 1) concentration area (see Figure 28d). On examination, the point base was found to have impact fracture scars on both blade faces, resulting from impact with a solid object, either a game animal or the ground, while the point was hafted in its weapon's shaft. The base has a lenticular cross-section and shows evidence of parallel-oblique flake-thinning. Both characteristics, combined with its tapering lower part and

flat to convex base, allows its classification as a Late Paleoindian Period Angostura type (cf. Brunswig 2005b: 74-77; 2007: 278-283, Table 9.3; Pitblado 2007: 315-318), ca. 9,700-7,550 rcyrbp. The raw material source for the artifact, despite its comparison with samples from UNC's extensive lithic materials collection, is uncertain and will require further investigation.

Prior to the 2008 partial re-survey of 5LR2, a total of 40 diagnostic projectile points had been recorded from the site and curated in the Rocky Mountain National Park Museum (see Appendix B). Of that number, 14 (35%) were Paleoindian (10,400-7,300 rcyrbp) in cultural type and period, 8 (20%) were Early Archaic (7,300-4,500 rcyrbp), 2 (5%) were Middle Archaic (4,500-3,000 rcyrbp), 8 (20%) were Late Archaic (3,000-1,850 rcyrbp), 6 (15%) were Early Ceramic (1,850-900 rcyrbp), and remaining points, 2 (5%) were latter Late Prehistoric through Early Historic (900-150 rcyrbp) in origin. The 2008 survey added one Late Paleoindian point and three Early Ceramic points to the site's inventory.

The single Late Paleoindian projectile point (catalog no. 020), was recovered from lithic concentration 4 and is a yellow-brown, Table Mountain jasper mid-section (Figure 28b). Its actual type was indeterminate due to its partial, fragmented condition, but its Late Paleoindian affiliation (ca. 9,000-7,500 rcyrbp) was determined based on its lenticular cross-section and a surviving section of parallel-oblique flaking on one blade edge. Its Table Mountain jasper material comes from either Middle Park valley to the west or the North Park valley to the northwest.

The two Early Ceramic projectile points were found in lithic concentration 1. One (catalog no, 012) is a dark brown chert, triangular, corner-notched point with a flat to

convex base (Figure 28a). It is complete except for one missing tang. Early Ceramic Period, ca. 1,850-900 rcyrbp cf. (Brunswig 2005b: 84-85). We were unable to ascertain its raw material source, except to note that its material traits are consistent with brown cherts observed at Northeastern Colorado Plains sites and quarries. The second Early Ceramic point (catalog no. 015) is made from a yellow-brown to medium brown, opaque, petrified wood. It is triangular in shape, corner notched, and has a convex, rounded, stemmed base. Its raw material closely matches samples from the Eastern Colorado Plains in the UNC lithic comparative collection.

The final 5LR2 projectile point (catalog no. 028) is from lithic concentration 7 (Figure 28g). It is made of a light gray, very fine-grained Dakota orthoquartzite (aka Windy Ridge quartzite). The point is made on a medium-size flake, is corner-notched, and has a lightly convex base. The upper half of the point is missing. As with the concentration 1 projectile points, it is attributable to the Early Ceramic Period, ca. 1,850-900 rcyrbp (Brunswig 2005b: 84-85). The artifact's raw material source is considered to be located in the nearby Middle Park or North Park valleys, although there is an outside possibility it may have come from the Colorado Front Range foothills as well.

A final possible projectile point (5LR2 033) is a very fragmentary base recovered from lithic concentration 4 of the Forest Canyon Pass site (5LR2). Due to the condition of the artifact, it is impossible to tell whether it was part of a projectile point or a hafted knife. It has an indented (incurvate) base and was made of a dark brown chert, consistent with cherts recovered in secondary gravel deposits on ridgelines in North Park Valley by the author.

Projectile points from the Forest Canyon Pass site have been recovered by Park

staff, visitors, and visiting researchers and placed in curation facilities since at least the 1930's. Including above described points documented in the 2008 survey, a total of 61 culturally/chronologically diagnostic projectile points, ranging in age from the Early Paleoindian Period (ca. 10,500 rcyrbp) to historic (ca. 150 rcyrbp) times have been recovered from the site. Most had been identified through an inventory of Park museum artifacts conducted by this report's senior author (Brunswick) during the SAIP research program. An updated version of the Forest Canyon Pass site portion of that inventory is provided in Appendix A and the conclusion of this report. It is also likely dozens more points have been removed by earlier park staff and earlier and contemporary visitors and not recorded or turned in for Park museum curation. Table 6 is a tabulation of 21 Paleoindian projectile point types dating from ca. 10,500-7,500 rcyrbp. Due to the fact that most of the site's projectile points were recovered from the site over many decades and exact find locations seldom reported, only one Paleoindian age artifact recovered during the site's 1987 Colorado Archeological Society survey has a known provenance within the identified artifact concentrations discussed above.

Table 6. Tabulation of Forest Canyon Pass Site Paleoindian Projectile Points by Cultural Period and Type.

Area/ Concen.	Early Paleoindian Folsom	Late Paleoindian Cody	Late Paleoindian Angostura	Late Paleoindian James Allen- Frederick	Late Paleoindian Lovell Constricted	Late Paleoindian Concave Base Stemmed	Late Paleoindian Great Basin Stemmed	Late Paleoindian Type Indet.
C/4	-	-	-	-	-	-	-	1
Unknown	1	5	2	2	1	1	2	-
Totals n=21	1	5	5	5	1	1	2	1

Table 7 provides a similar tabulation of 40 additional projectile point types representing all known cultural periods in the region from the end of Paleoindian (ca. 7,500 rcyrbp)

through early Historic periods (ca. 150 rcyrbp).

Table 7. Tabulation of Forest Canyon Pass Site Projectile Points from the Early Archaic through Early Historic Periods.

Area/ Concen.	Early Archaic Mt Albion	Early Archaic Northern Plains/ Cent. Rockies	Middle Archaic	Late Archaic	Early Ceramic	Late Prehistoric- Early Historic	Period/Type Indet.
A/1	-	-	-	1	1	-	-
	-	-	-	-	-	-	-
B/3	1				1	-	-
E	-	1	-	-	1	-	1
6	-	-	-	-	1	-	-
H	-	-	-	-	1	-	-
7	-	-	-	-	-	-	-
M	-	-	-	-	1	1	-
Q	-	-	-	-	1	-	1
Unknown	10	-	3	5	7	2	-
Totals n=40	11	1	3	6	14	3	2

5LR12141, located in the northeastern corner of the North Survey Area drainage basin, was the only other site with a diagnostic artifact found in 2008. That artifact (catalog no. 001) is a reddish brown, with reddish tan inclusions, Hartville chert projectile point stemmed base section with a flat base. The base is thinned with fine retouch flaking and has parallel-oblique flaking, and blade edge (stem) grinding. It represents the stem of a Late Paleoindian Cody (Scottsbluff) projectile point type, ca. 9,400-8,300 rcyrbp (cf. Brunswig 2005b: 74-77; 2007: 278-283, Table 9.3). Its raw material source, identified as Hartville chert, is in South Central Wyoming. Its reddened appearance is believed attributed to deliberate heat treatment done to enhance its flaking qualities for manufacturing.

A second artifact, catalog no. 002, is less confidently assigned to status as a projectile point. It consists of a dark brown chert, heavily fractured, on tool section with

an intact area of fine quality, parallel flaking on one edge. Its parallel-flaking pattern suggests the artifact fragment came from a heavily shattered Late Paleoindian projectile point. Alternatively, the artifact is provisionally classified here as a bifacially worked (at least the portion that has visible flake-patterning, knife-graver, keeping in mind its possible projectile point identification. Its brown chert material is closely comparable with tool and native quarry materials found by the lead author in UNC North Park archeological investigations.

Non-Diagnostic Artifacts from the Archeological Survey

Aside from the single Late Paleoindian projectile point described above, seventeen formal and information tools were recorded at 5LR12138 in the South Survey Area. Most (14) were recorded in the site's lithic concentration 1. Only two tools came from the more northerly lithic concentration 2. Table 8 provides a summary of the primary traits and functions of each of the site's non-diagnostic tool assemblage.

Table 8. Data on Formal and Informal Tools from 5LR12138

Cat No.	Lithic Concentration #	Tool Class	Tool Type	Material Type	Material Source	Local (L) Non-Local (NL)*
001	1	formal	graver	chert	unknown	UK
002	1	informal	flake knife	jasper	MP/NP**	L
003	1	formal	biface knife	chert	FT***	NL
004	1	formal	end scraper	chert	HV****	NL
005	1	core	non-tool	chert	unknown	UK
006	1	informal	chopper	quartzite	unknown	UK
008	1	informal	flake knife	chert	unknown	UK
009	1	informal	blade knife	chert	unknown	UK
010	1	formal	knife frag.	chert	MP/NP**	L
011	1	formal	biface knife (tip)	quartzite	MP/NP**	L
012	1	formal	flake knife	quartzite	MP/NP**	L
013	1	formal	biface knife	quartzite	NP	L
014	1	formal	scraper-graver-	quartzite	MP/NP**	L

			spokeshave			
015	1	informal	flake knife	jasper	MP/NP**	L
016	2	formal	biface knife (tip)	quartzite	MP/NP**	L
017	2	formal	blade knife	chert	NP	L
018	2	informal	blade knife	chert	MP/NP**	L

* Lithic material sources are, based on Brunswig 2005b : 177- , classified as local (L), occurring within 60 kilometers (37 miles) of any of the Park's boundaries or within the Park itself while non-local (NL) sources occur outside that range, e.g. beyond 60 km/37 miles.

** MP/NP refers to either adjacent basin valleys to the west and northwest of the Park, both of which contain sedimentary and volcanic materials used extensively by past native populations for stone tool manufacture. NP refers to North Park only, although it is considered likely Middle Park is also a source for the same material.

*** Refers to Hartville chert, a well-known tool material found primarily in South Central Wyoming, north of the Colorado state line and Rocky Mountain National Park.

The relatively high number of both formal and informal tools, particularly in 5LR12138's southern lithic concentration (1), suggests it served as a medium-stay (2-5 days) camp. Its location, overlooking Forest Canyon Pass, makes it an ideal place to observe game movements in the Pass and on the opposite (north-facing) mountain slope, the latter forming the northern termination of Mount Ida Ridge, home to several large multi-component game drives. Existence of a Late Paleoindian projectile point base (Angostura type) at the site shows it has at least occupation phase dating as early as 9,500 rcyrbp, the maximum known-age of that point type.

Camp activities represented by tools occurring on the surface of both lithic concentration areas of the site include those expected of a hunting camp, game butchering and meat-processing, hide preparation, and bone-wood working. A multi-purpose, formal tool represented by one of the artifacts (catalog no. 014), with its knife, scraper and spokeshave (edge notch) elements indicates it was used not only meat and hide processing, but preparation of spear shafts using the tool's spokeshave (shaft-cutting/smoothing) notch.

Excluding the above described diagnostic projectile points, a total of twenty one tools were recorded from seven of the nine Forest Canyon Pass site (5LR2) lithic concentrations. Table 9 summarizes data for each of those artifacts.

Table 9. Summary Data on Lithic Tools from 5LR2 Lithic Concentrations.

Cat No.	Lithic Concentration #	Tool Class	Tool Type	Material Type	Material Source	Local (L) Non-Local (NL)*
011	1	formal	hafted scraper	chert	NP	L
013	1	formal	knife-scraper	chert	unknown	UK
014	1	formal	flake knife	chert	MP/NP**	L
016	2	formal	flake knife	chert	MP/NP**	L
017	2	formal	knife fragment	quartzite	MN/NP**	L
018	2	informal	flake knife	chert	unknown	UK
019	2	informal	flake scraper	chert	unknown	UK
021	4	non-tool	core	jasper	MN/NP**	L
022	4	informal	scraper-knife	rhyolite	RMNP****	L
023	5	formal	flake scraper	chert	unknown	UK
024	5	formal	hafted flake knife	chert	unknown	UK
025	6	informal	flake knife	rhyolite	RMNP****	L
026	6	informal	flake knife	chert	EP#	NL
027	7	formal	biface knife fragment	chert	MP/NP****	L
029	7	formal	knife-graver	chert	unknown	UK
030	7	informal	knife-scraper	chert	unknown	UK
031	8	informal	knife-scraper	rhyolite	RMNP****	L
032	8	informal	knife-scraper	chert	MP/NP**	L
032	4	formal	hafted knife/ projectile pt base?	chert	MP/NP**	L
033	4	informal	flake knife	petrified wood	EP#	NL
034	4	informal	flake knife	petrified wood	EP#	NL

* Lithic material sources are, based on Brunswig 2005b : 177- , classified as local (L), occurring within 60 kilometers (37 miles) of any of the Park's boundaries or within the Park itself while non-local (NL) sources occur outside that range, e.g. beyond 60 km/37 miles.

** MP/NP refers to either adjacent basin valleys to the west and northwest of the Park, both of

which contain sedimentary and volcanic materials used extensively by past native populations for stone tool manufacture. NP refers to North Park only, although it is considered likely Middle Park is also a source for the same material.

*** Refers to Hartville chert, a well-known tool material found primarily in South Central Wyoming, north of the Colorado state line and Rocky Mountain National Park.

****RMNP. Local volcanic rhyolite, most commonly found on Specimen Mountain immediate west and northwest of Forest Canyon Pass and on the western end of Trail Ridge to the north and northeast.

#EP Refers to materials known or suspected to have come from the Colorado Front Range Piedmont and Eastern Plains.

Following a working, and likely, hypothesis that each of the site's 2008 surveyed lithic concentrations and their respective tools represent individual short-term camps, tool types represented in each concentration (camp) should reflect short-term camp activities; butchering (knives), hide-preparation (scrapers), and working bone, antler and wood (scrapers and a graver).

Artifacts from 5LR12139, found in a small tight scatter (within 60 cm (1.5 feet) of each other), are believed to represent a tool kit cached at that location by a single individual or hunting group. That hypothesis is supported by the fact that all seven artifacts were made of Kremmling chert and the material is virtually identical in all cases. As shown by Table 10, only two of the artifacts are formal tools (001 and 002), although the scraper (001) is extremely well-made. The remaining tools are informal knives and one unmodified graver-awl (used in working bone or puncturing hides). It is easy to surmise that all were prepared ahead of time at their material quarry source in nearby Middle Park or North Park, wrapped in a hide and carried to the site for use.

Table 10. Data for 5LR12139 "Cached" Artifacts.

Cat No.	Tool Class	Tool Type	Material Type	Material Source	Local (L) Non-Local (NL)*
001	formal	scraper	chert	MP/NP**	L
002	formal	chopper	chert	MP/NP**	L

003	informal	flake knife	chert	MP/NP**	L
004	informal	flake knife	chert	MP/NP**	L
005	informal	flake knife	chert	MP/NP**	L
006	informal	graver-awl	chert	MP/NP**	L
007	informal	flake knife	chert	MP/NP**	L

* Lithic material sources are, based on Brunswig 2005b : 177-182, classified as local (L), occurring within 60 kilometers (37 miles) of any of the Park's boundaries or within the Park itself while non-local (NL) sources occur outside that range, e.g. beyond 60 km/37 miles.

** MP/NP refers to either adjacent basin valleys to the west and northwest of the Park, both of which contain sedimentary and volcanic materials used extensively by past native populations for stone tool manufacture. NP refers to North Park only, although it is considered likely Middle Park is also a source for the same material.

The primary artifact recorded at 5LR12140 was a large, intact gray to dark gray biotite-schist, unifacial slab metate (artifact No. 001). The metate's dimensions were 53 cm (L) x 33 cm (W) x 2.7 cm (Th). Its exposed surface, although heavily weathered, retained evidence of smoothing from grinding plant products or dried meat. Eleven distinct lichen colonies noted on its exposed surface, ranged from 4-12 cm in diameter. Based on the authors' previous experience with lichen growth patterns and lichen-age estimations in the Park (cf. Brunswig, Diggs, and Montgomery 2009: 34-37; Cassells 2005), sizes of the largest colonies suggest ages greater than 2,000 years. A return to the site in the future is planned in order to scientifically measure the lichen colonies and determine a probable age using lichenometry age-curve statistics.

Although local biotite-schist was not an ideal grinding material for past Native American occupants of the Park (based on the much higher frequency of sandstone metates at Park sites, cf. Brunswig 2005b: 188-195), biotite-schist ground stone did constitute 7.6% of the study specimens documented during the 1998-2002 SAIP project (Brunswig 2005b: 196; Shropshire 2003: 2). While not an ideal grinding material, the use of local biotite-schist gneiss for metates, derived from Pre-Cambrian formations in the Park, has also been noted at the Bode's Draw site (5LR1370) north of Estes Park

(Benedict 1993: 22-27) and at Big Rock Shelter (5LR2170), the latter an unpublished site excavated by the author at the Estes Park, Colorado, YMCA. Two metate specimens were identified as coming from one of several sandstone formations (Owl Canyon, Fountain, Lykins...) found in the Front Range foothills and along the western slope of Colorado's Rockies. One artifact is believed derived from a local welded volcanic tuff (rhyolite) common to igneous and meta-igneous formations at Specimen Mountain west of Trail Ridge. Four other single specimens were provisionally identified as coming from sources in Middle Park or North Park (one of volcanic sandstone, one of sedimentary sandstone, and a third of siltstone) and from southern Wyoming's Medicine Bow Mountains.

In addition to the grinding stone, a single secondary Dakota orthoquartzite flake was found two meters to its west.

5LR12141, suspected as having served as a hunting camp, has a sparse tool assemblage (see Table 11). Aside from a Late Paleoindian (Cody) projectile point stem-base, only three tools, two scrapers and a knife-graver were recorded. Tool-refurbishment or manufacturing waste materials were equally sparse, consisting only of a single Dakota orthoquartzite secondary flake. It is considered likely the site represents a very short-term butchering and hide-processing locality which may have been occupied for only a few hours or for a single day before and after a local game kill.

Table 11. Data for 5LR12141 Lithic Tools.

Cat No.	Tool Class	Tool Type	Material Type	Material Source	Local (L) Non-Local (NL)*

001	formal	scraper	chert	MP/NP**	L
002	?	knife-graver	chert	NP	L
003	formal	knife	chert	HV***	NL

* Lithic material sources are, based on Brunswig 2005b : 177-182, classified as local (L), occurring within 60 kilometers (37 miles) of any of the Park's boundaries or within the Park itself while non-local (NL) sources occur outside that range, e.g. beyond 60 km/37 miles.

** MP/NP refers to either adjacent basin valleys to the west and northwest of the Park, both of which contain sedimentary and volcanic materials used extensively by past native populations for stone tool manufacture. NP refers to North Park only, although it is considered likely Middle Park is also a source for the same material.

*** Refers to Hartville chert, a well-known tool material found primarily in South Central Wyoming, north of the Colorado state line and Rocky Mountain National Park.

Conclusion: Research Results and Recommendations for Future Research and Management

Archeological and paleoenvironment field studies in Forest Canyon Pass by the University of Northern Colorado proved highly productive. They established excellent time depth for cultural occupations and climatic and environmental change as far back as ca. 9,500 rcyrbp. Sediment cored fen deposits and discovery of two new prehistoric sites with Cody Complex (ca. 9500-8800 rcyrbp) diagnostic artifacts support earlier finds of a similar cultural affiliation and age at the previously recorded Forest Canyon Pass site. The archeological survey increased the number of known sites in the research area by 50% (4), acquired new information on the nature of the large and complex Forest Canyon site, recorded two prehistoric camp sites with Paleoindian occupations, and documented two special activity sites related to plant game processing. Archeological finds supported the project hypothesis that the Pass' unique topography and unusually abundant natural resources constitutes a high-density patch island, making it an ideal location for use by past Native Peoples as a stopover camp during migratory travel, as a camping locality for longer-term hunting and gathering local plant and animal resources and, given its ready access to nearby Mount Ida Ridge and Trail Ridge game drives, as a probable base camp

location to support forays onto the tundra for high altitude hunting. Although less than 30% of the originally proposed project area of 1.82 km² (450) acres (Brunswig 2005c) has been surveyed, with conclusion of the 2008 pilot project (and including coverage by earlier surveys), calculated site density in the designated project research area is now at 24 sites per square kilometer, highest in the Park. Presence of the heavily used Ute Trail in the Pass, with its direct traverse of the large and rich Forest Canyon Pass site and close proximity to a dozen other sites on either side of the trail, present a preservation and protection challenge to Park managers. While it is true that portions of the Forest Canyon Pass site were physically disturbed by road building and use of a now-abandoned section of the Fall River Road (replaced by the present Trail Ridge Road) in the early to mid 20th Century, most of that site remains intact and its prehistoric contents are extremely abundant.

Wildlife and botanical surveys of the project, while limited in time and scope, documented the modern, and by inference, prehistoric presence of unusually abundant natural resources essential to supporting past human hunter-gatherer populations, particularly during mid-late summer and early fall when the Pass becomes habitable after the melting of its snow pack.

Field observations of ponds and fens in the basin east of 5LR2 suggest they may contain equally early fen and pond deposits as those sampled in the South Survey Area wetland fen, potentially increasing our knowledge of the Pass' paleoecology and paleoclimate history if they can be sampled in later planned project phases. Increasingly dense survey coverage of the Pass, if forthcoming, will continue to yield even greater knowledge about the Pass' prehistory and paleoclimate/paleoecology records. Currently

available archeological and paleoenvironmental data, greatly supplemented by information gained by this pilot project, and further advanced by the project's recent modern faunal and floral studies, have gone far in substantiating the hypothesized dense resource, patch island, nature of Forest Canyon Pass and helping to explain its apparent attraction for past prehistoric groups. We now know that both natural and cultural resources in the Forest Canyon Pass headwaters area are as concentrated as any area in the Park. Further, systematic, field studies are expected to increase our knowledge of those resources even more in the future.

We have initiated, through the use of high resolution sub-meter GPS data and available natural resource GIS layers, creation of Geographic Information System (GIS) maps and a GIS project model of Forest Canyon Pass. This report contains a number of maps produced through an early version of that modeling and ARCGIS shape and data files of that project are included with this report. GIS modeling, along with further field investigations, provides a powerful tool with which to continue testing our working hypothesis that the Pass area represents an unusually rich cultural and natural resource "island" within the wider Rocky Mountain National Park landscape.

The significance of Forest Canyon Pass in the historical record of past native peoples is well-demonstrated, but that significance needs to be communicated to current and future generations of Park visitors, including descendants of those native peoples. In terms of future cultural heritage and natural resource management and stewardship, efforts need to be made to further accumulate documentation of those resources for more proactive preservation and management efforts in the future. The Pass is resident to a heavily used modern trail which runs from the Alpine Visitor's Center to Milner Pass, but

that trail also parallels, and in part follows, the ancient Ute Trail which archeological research tells us has been in existence for more than nine thousand millennia. The Ute trail transects several important archeological sites, including the Forest Canyon Pass site with its unbroken line of Native American use from 9,500 to 150 years ago.

Opportunities for artifact collection and continued destruction of the Pass' cultural record by Park visitors, intentional or opportunistic, are extremely high and certainly have occurred in the past. Archeological survey for this project (in 2008) determined the presence of, and yet unidentified, even more sites off-trail which are vulnerable to disturbance and artifact-collecting. Future mitigation of risks to the Pass' cultural heritage should involve continued and detailed field studies, regular monitoring of its sites for disturbance and "emerging" artifacts on site surfaces, and consideration of nominating the Pass for inclusion into the National Registry of Historic Places as an archeological district.

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Appendix A

Forest Canyon Pass Pilot Project Site Description Catalogue

5LR2

Site Description This prehistoric site, known as the Forest Canyon Pass site, was first recorded in 1935 by Mary Yelm (Site Y6) and again in 1965 by Wilfred Husted. The site was surveyed by the Colorado Archaeological Society in August, 1987 (see report by Mayer 1989 on file at the Rocky Mountain National Park library). An inventory and analysis of artifacts recovered by Wil Husted in 1960 documented the presence of seven Apachean Ocate Micaceous potsherds, including a rim sherd (ca. AD 1525-1725/425-225 b.p.), two Apachean (Dismal River) Lovitt Stamped sherds, a single Pueblo III-IV corrugated grayware potsherd, several Fremont Utility ware sherds, a Table Mountain jasper formal tool (knife/scraper), two gray sandstone (Morrison or Dakota formation source) metate fragments, and a river quartzite cobble mano. The site is one of the most prolific multi-component sites in the park and, among the artifacts placed in curation in the Rocky Mountain National Park Museum since the 1930's, are diagnostic projectile points from the following cultural periods: Early Paleoindian-Folsom Complex (likely a "curated" example brought to the site at a later date) (10,750-10,100 b.p.), Late Paleoindian Frederick, James Allen, and Great Basin Stemmed types (ca. 9350-7000 b.p.), Early Archaic-Mount Albion (ca. 6500-4500 b.p.), Late Archaic (ca. 3000-1900 b.p.), Early Ceramic (ca. 1900-1000 b.p.) and Late Prehistoric/Mid-Late Ceramic (ca. 1000-450 b.p.) periods. In addition, three protohistoric/historic Ute Uncompahgre Brownware sherds in the RMNP Museum are recorded as having originated from the site. Re-survey of the site was completed in the summer of 2000 by UNC/RMNP archaeologists. It is located at the western head of Forest Canyon 3524 m southwest of from Gore Range Overlook on Trail Ridge road. Historic remains, associated with the now-abandoned Trail Ridge Road segment, were also identified in the earlier survey, but were not noted in the UNC survey. Artifacts found during the 2000 UNC survey included a Table Mountain jasper formal tool (biface scraper), Table Mountain jasper formal tool (bifacially-flaked knife), a local Specimen rhyolite informal tool (flake knife) and five local rhyolite and Table Mountain jasper primary, secondary and shatter flakes. There is no doubt there has been substantial collecting due to the site since it is traversed by the prehistoric/historic Ute Trail and lies along a segment of the old, now abandoned Trail Ridge (western) segment of Fall River road. The site lies on a 5-7 degree slope and is open in all directions, being located in an alpine-subalpine ecotone. The nearest water is an unnamed alpine pond located 15 m due east of one of the main lithic scatter concentrations. This site is found in the subalpine-alpine ecotone, at an elevation of ca. 3473 m

5LR7097

Site Description: This prehistoric isolated find of four lithic tools is located on a steep (ca. 17 degrees) mountain slope descending into Forest Canyon Pass from Trail Ridge. The tools include one light brown chert flake knife, a light brown chert scraper, a very

light brown with a red tint (heat-treated) chert flake knife, and a light brown chert blade with a small scraper extension on one end. All four tools were made of Kremmling chert. The IF was located 37 m north of the Ute Trail and 474 m west northwest of the Gore Range Overlook on Trail Ridge Road. Local subalpine vegetation suggests that this site is found in the subalpine-alpine ecotone, at an elevation of ca. 3586 m

5LR7098

Site Description: A prehistoric isolated find of a gray andesite flake scraper (local Specimen Mountain/Lava Cliffs material), a white Kremmling chert graver, and a brown (Hartville) chert second stage reduction flake located on a steep subalpine mountain slope some 10 m north of the Ute Trail and 623 m west northwest of Trail Ridge Road's Gore Range Overlook. Local subalpine vegetation suggests that this site is found in the subalpine-alpine ecotone, . at an elevation of ca. 3568 m

5LR7099

Site Description: This prehistoric site is a lithic scatter with secondary and tertiary manufacturing stage flakes, stone tools, and a large Early Archaic (Plains Early Plains Archaic type) side-notched projectile point (ca. 7000-6500 b.p.). Lithic waste flakes from the site included seven reddish-brown to brown cherts, 22 flakes of local Lava Cliffs/Specimen Mountain andesite and two gray Kremmling chert secondary and tertiary flakes. Lithic tools included an andesite blade knife, a light brown chert graver, a local (Specimen Mountain?) mixed jasper-chert knife/scraper, a banded quartzite knife/scraper, a banded quartzite awl/drill, an andesite awl/drill, and a yellowish brown, a retouched scraper, and a light brown andesite scraper. The site is located on a mountain slope break (5-6°) 10 m north of the Ute Trail where it descends into Forest Canyon Pass and ca. 735 m west northwest of Gore Range Overlook on Trail Ridge Road. Local subalpine vegetation suggests that this site is found in the subalpine-alpine ecotone, at an elevation of ca. 3550 m

5LR7112

Site Description: This prehistoric site, located in a alpine-subalpine ecotone saddle between two Forest Canyon mountain knolls, includes 24 chert and quartzite flakes, a chert flake scraper, and one projectile point base. The base is a Table Mountain jasper corner-notched Early Archaic (ca. 6500-4500 b.p.) type. The site is located 1.545 km west southwest of the Gore Range Overlook on Trail Ridge Road, immediately off the Ute Trail in Forest Canyon Pass. The site is just 15m north of the trail. A segment of the now-abandoned Old Fall River Road is located only 30 m west of the site. It is located at an elevation of ca. 3473 m

5LR7113

Site Description: This prehistoric site is an extensive lithic and ground stone scatter of 60 chert quartzite, and rhyolite secondary and tertiary stage manufacturing flakes, nine sandstone metate fragments, four bifacially flaked tools (three of chert and one of rhyolite), a chert flake knife, a chert side/end scraper, one utilized chert flake tool, and a quartzite projectile point base. The point is a Dakota orthoquartzite Early Archaic (Mount Albion Complex (6500-4500 b.p.) type. The site also includes two deflated, likely prehistoric hearths and a rock cairn. The site is located on a subalpine knoll immediately west of Forest Canyon Pass and overlooking Milner Pass (1.658 km to the southwest) and the headwaters of the northeast flowing Cache La Poudre River. A section of the Ute Trail passes 40 m east of the eastern margins of the site. It is located in the subalpine-alpine ecotone at an elevation of ca. 3383 m.

5LR7114

Site Description: This large multi-component site has both historic and prehistoric artifacts. The prehistoric component includes two chert Avonlea side-notched (ca. 1200-900 b.p.) projectile points, a chert Late Archaic corner-notched point (ca. 3000-1900 b.p.), two Kremmling chert bifacial knife/scrapers, six utilized flake tools, a flaked core and 54 flakes (ranging from primary through tertiary manufacturing stages and including chert, quartzite, andesite, and crystal quartz-the latter two being local in origin) and a small historic trash scatter. Historic artifacts consisted of a .30 cal Winchester rifle cartridge brass end (ca. 1879-1965), an automobile glass signal light cover (ca. 1920-1950), and assorted rusted metal can and broken clear glass fragments. The site is located in an alpine-subalpine ecotone saddle bench between two subalpine mountain knolls at the southwest corner of Forest Canyon Pass. Both the Ute Trail and the now-abandoned Old Fall River Road run through the site. This site is located in the subalpine-alpine ecotone at an elevation of ca. 3464 m.

5LR7115

Site Description: This historic trash midden is located on a subalpine mountain ridge slope 92 meters northwest of the Ute Trail and 660 m northeast of Forest Canyon Pass. Remnants of the now-abandoned Old Fall River Road are discernible nearby. Much of the historic trash includes heavily rusted vehicle parts (a drive shaft, engine parts, a drive belt, etc.), a riveted sheet metal box, a solder-dot sanitary can, and milled boards with round nails embedded in them. Most of the artifacts lie within an oblong depression believed to have served as a rock and earth borrow pit for local road construction early in the 20th Century. Analysis of some of the metal artifacts indicates that most date from ca. 1920-1950. Vegetation at the site denotes the subalpine-alpine ecotone at an elevation of ca. 3473 m

5LR9816

Site Description: A prehistoric open camp and lithic scatter site that consists of one secondary chert flake, a chert end scraper, a bifacial flake knife, and two sandstone metate fragments. The site is located 2.06 km from the Gore Range Overlook along the Ute Trail and sits on a small subalpine finger ridge 50 m south of that trail. Vegetation at the site locality typifies that found in the subalpine-alpine ecotone at an elevation of ca. 3435 m.

5LR9817

Site Description: This prehistoric site, consisting of twenty-one chert, chalcedony, jasper and petrified wood flakes, a jasper biface knife tip, a Kremmling chert core scraper, and a cobble hearth, is located in Forest Canyon Pass some 2.06 km from the Gore Range Overlook and 124 m southeast of the Ute Trail. The site, on a mountain slope bench, is situated in the subalpine-alpine ecotone at an elevation of ca. 3427 m.

5LR9818

Site Description: A prehistoric site consisting of a dark brown chert flake scraper, a gray chert flake knife, two chert (one yellowish brown and the other light brown) awls, and two primary/secondary manufacturing stage flakes. The flake knife, one awl, and one of the flakes were identified as coming from the Kremmling chert quarries in Middle Park, Colorado. The site is located in the sub-alpine ecotone on a mountain bench slope overlooking a southern tributary valley of the upper Big Thompson River (Forest Canyon). Its locality is ca. 2.707 km southwest of the Gore Range Overlook (on Trail Ridge) and across upper Forest Canyon. at an elevation of ca. 3543 m.

5LR9819

Site Description: This historic isolated find is a single hearth measuring .75 m in diameter and partially ringed by cobble-size granite rocks. It is located on a protected subalpine finger ridge overlooking upper Forest Canyon and an unnamed southern Big Thompson River tributary valley to the south and southeast. The site is located on a tundra mountain bench slope overlooking a southern tributary valley of the upper Big Thompson River (Forest Canyon). The best way to reach the site is to descend the Ute Trail from Gore Range Overlook for a distance of 2.522 km, then climb the mountain to the left (southeast) and walking over the top of the mountain promontory to the southeast and descending its south southeast slope to the site (a straightline distance of ca. 1693 km. Local vegetation indicates that this site is located in the subalpine-alpine ecotone at an elevation of ca. 3536 m.

5LR12138

Site Description: This site consists of two prehistoric lithic concentrations at the southern central sections of a north-south “finger” ridge bench on the north mountain slope

overlooking upper Forest Canyon Pass. Located in the subalpine ecotone, the bench contains scattered stands of alpine-subalpine ecotone, dwarf spruce-based krummholz with intervening open areas. The southern part of the site has a moderately heavy concentration of stone tool manufacturing-retooling flakes (secondary and tertiary stage) and seventeen weapons, butchering, hide processing, and bone-wood working tools, including a Late Paleoindian Angostura spear point base which dates that part of the site to at least 9,300 rcyrbp. Several of the tools, scrapers, knives..., are extremely well-made and one, an ovate, fully shaped artifact is a multi-purpose tool (scraper, knife, and spokeshave). The northern lithic concentration is lighter, but produced more than a dozen flakes and an informal blade knife. Both concentrations contained fire-cracked rock from earlier, dispersed hearths, but concentration 2 also had three discrete fire-cracked rock clusters with larger perimeter rocks which defined them as relatively intact surface hearths. Raw material sources for the site's artifacts were primarily from local park and local regional (North Park and Middle Park) sources, although some of the tools were made of stone from more distant non-local sources in South Central Wyoming or the Northeastern Colorado plains. The site is located in the subalpine ecotone at an elevation of 3445 m.

5LR12139

Site Description: This site consists of seven flake tools located on the southeast facing mid-slope of a rock outcrop island in the northeastern quadrant of a small erosion basin north of Forest Canyon Pass. The knoll has exposed granite, a shallow soil cover, and subalpine (krummholz) vegetation. The tools, considered a game processing, activity area, were found situated within a 30 cm oval. The tools were all manufactured of Kremmling chert/chalcedony, possibly from the same source core-nodule, is regionally local and occurs in Middle Park and North Park valleys to the west and northwest. Two artifacts are formal tools (having 50% or more of their total area or working edges flaked). These include a well-made discoidal scraper and a wedge-shaped chopper. The remaining flake tools consist of two informal (expedient) knife-scrapers and two large flake believed to have been used as informal cutting and scrapping tools, but with limited physical evidence of edge use wear or edge retouch. The artifact assemblage is believed to represent a tool-kit for processing game for meat and preparing hides for use in making clothing, leather pouches, and other portable domestic items. It is noteworthy that both formal and informal (expedient) tool types are represented and the fact they were found in such a tight physical cluster suggests they had been "cached" for later use and their owners failed to return to recover them. It is even considered possible the tools may have originally been stored in a hide carrying bag and were dispersed outward from their cache location by natural elements when the bag disintegrated over time.

5LR12140

Site Description: This site is a special activity area located on a small alpine-subalpine ecotone "island" knoll in the northeast quadrant of an eroded drainage basin north (upslope) from Forest Canyon Pass. The activity dedicated to processing dried plant products (berries, roots, or even dried meat) by grinding those products between a flat

base stone (metate) and a smaller hand-held stone (mano). Only the metate portion of the grinding system was noted during survey. Its accompanying mano may have been removed for other purposes or remains buried or hidden in vegetation at the site. The metate is a natural, flat, oblong stone slab of biotite schist. Although rare, the use of local biotite schist for grinding stones, as opposed to the use of imported sandstone metates, is documented both in the park and its region. The only other artifact found on the low subalpine knoll was a single tertiary, tan Kremmling chert flake.

5LR12141

Site Description: 5LR12140 is a small hunting camp located in alpine-subalpine ecotone krummholz on a low north-south trending ridgeline in the northeast corner of an eroded drainage basin north of Forest Canyon Pass. Based on the presence of so few artifacts, the site is believed to be highly ephemeral in nature, possibly only used once for a brief interval, ranging from a few hours to a day. However, the survey which documented the site was brief and more extensive investigations could well uncover more evidence of its occupation. Surface artifacts include three formal tools: a stem base from a Late Paleoindian projectile point, a bifacially flaked knife-graver fragment, and a lunate knife/scrapper. Three secondary stage tool production (or re-tooling) flakes were also recorded. The projectile point's stem base, its lenticular cross-section, and parallel-oblique flaking traits are consistent with the Paleoindian Cody Complex, e.g. Scottsbluff/Cody/Kersey/Firstview point type. The projectile point fragment was made of a reddish brown Hartville chert from south central Wyoming. Its reddened condition is believed attributable to deliberate heat treatment for facilitating flaking. The knife-graver is made of a dark brown chert believed to originate from North Park Valley, Colorado. The knife/scrapper is made from yellow-brown to reddish brown Hartville chert originating from south central Wyoming. The site's final artifact, a secondary thinning flake, is made of a brownish gray Dakota orthoquartzite (Windy Ridge) from either Middle Park or North Park. The site's artifact assemblage is believed to reflect a small, very limited occupation hunting camp dating, based on the projectile point type, between 9,400 and 8,300 rcyrbp.

Appendix B

Forest Canyon Pass Pilot Project Site Artifact Catalogues

5LR2

Artifacts Recovered from University of Northern Colorado Survey Along Ute Trail in 2000 are listed in the section below:

- 001 Brown Table Mountain jasper formal tool (biface scraper).
- 002 Light gray rhyolite informal tool (flake knife) fragment.
- 003 Reddish-brown chert formal tool (flake knife).

Debitage (n=5)

- 1 Light brown chert primary flake.
- 1 Dark brown chert shatter flake.
- 2 Dark brown welded tuff secondary flakes.
- 1 Light gray rhyolite secondary shatter flake.

Note: Artifacts from Husted's 1960 survey were recovered from the University of Colorado Museum in 2003. Those artifacts were subsequently inventoried and studied by this report's lead investigator (Brunswick) and curated in the RMNP Museum. The following section of the catalogue list those artifacts, assigning catalogue numbers which continue the above UNC 2000 survey artifact numbering sequence. These and all 5LR2 artifacts were also assigned RMNP Museum accession (ROMO) numbers.

Artifacts from the 1960 Husted Survey

004 Brown to black with extremely abundant mica, Apachean Ocate Micaceous pottery rim sherd.

005a-f Six brown to black with extremely abundant mica, Apachean Ocate Micaceous upper to lower body sherds. The sherds are almost certainly from the same vessel as does the 004 rim sherd.

006a-b Black to brown thin walled Pueblo IV/V corrugated body sherds (from same original sherd).

007 Red to dark red Table Mountain jasper formal tool (knife/scraper).

008 Brown to light brown sandstone, bifacially ground metate fragment. Note: not Lyons sandstone - Morrison or Dakota formations are the most likely sources.

009 Brown to light brown sandstone, bifacially ground, metate fragment Note: not Lyons sandstone - Morrison or Dakota formations are the most likely source.

010 Gray to gray-brown partial quartzite cobble mano.

Note: the following projectile points were recovered from 5LR2 during the CAS 1987 survey of the site and from prior discoveries turned over to RMNP staff since the 1930's. All the points are curated in the RMNP Museum under their given RMNP Museum accession number (below) and were further documented and photographed by this report's lead investigator (Brunswig) as part of the 1998-2002 UNC/RMNP Systemwide Archeological Inventory Program (SAIP).

5LR2 Projectile Points Listed or Known as coming from the site prior to the UNC SAIP Project Survey (1998-2002)

ROMO 2 Striped brownish-tan agatized chert Late Paleoindian projectile point with stem, base, and part of upper portion intact. Tip area broken off and later reworked. Stem and base grinding. Reworked Cody Complex projectile point. See Mayer 1989: 367.

ROMO 3 White Kremmling chert Early/Late Archaic corner/side notch projectile point base. See Mayer 1989: 368.

ROMO 8 Light red Table Mountain jasper Early Ceramic corner-notched projectile point, base and midsection. See Mayer 1989: 369.

ROMO 9 Brown Table Mountain jasper Late Archaic corner-notched projectile point. See Mayer 1989: 370.

ROMO 50 Gray chert Early/Late Archaic side-notched projectile point. See Mayer 1989: 371.

ROMO 60 Tan Kremmling Chert Late Archaic or Early Ceramic projectile point tip.

ROMO 70 Early Archaic (Mount Albion) corner-notched projectile point base and midsection, of unknown material.

ROMO 147 Dark yellowish-brown with fine black inclusions chert Early Paleoindian (Folsom) projectile point. Its base has been re-worked and the artifact is hypothesized to have been brought to the site at a later time than its direct cultural affiliation time.

ROMO 165 White Kremmling chert Early Archaic corner-notched projectile point base. See Mayer 1989: 373.

ROMO 204 White Kremmling chert Late Archaic corner-notched projectile point. See Mayer 1989: 374.

ROMO 206 Gray, possibly reworked, chert Late/Mountain Paleoindian (Great Basin stemmed) projectile point. See Mayer 1989: 375.

ROMO 235 Brown rhyolite (Specimen Mountain) Early/Late Archaic corner-notched projectile point. See Mayer 1989: 376.

ROMO 1510 Dusky red Dakota orthoquartzite Late Paleoindian projectile point. Parallel-oblique flaking pattern. Upper blade edges reworked resulting in narrowing of that blade portion. Prior to reworking of main body section, the point most likely represented a Cody Complex point type, either Scottsbluff or Firstview. See Mayer 1989: 377.

ROMO 1511 Reddish-brown Table Mountain jasper Late Archaic/Early Ceramic corner-notched projectile point (tip missing). See Mayer 1989: 378.

ROMO 1512 White Kremmling chert Late Archaic side-notched projectile point. See Mayer 1989: 382.

ROMO 1513 Brownish-gray chert Late Archaic corner-notched projectile point. See Mayer 1989: 380.

ROMO 1517 Light brownish-gray Dakota orthoquartzite Late Paleoindian (James Allen/Frederick) projectile point. See Mayer 1989: 381.

ROMO 1519 White chalcedony Late Archaic/Early Ceramic projectile point with one tang missing. See Mayer 1989: 382.

ROMO 1520 Dark brown agatized chert Early/Late Archaic corner-notched projectile point (tip missing). See Mayer 1989: 383.

ROMO 1522 Gray Dakota orthoquartzite Early Archaic corner-notched projectile point. See Mayer 1989: 384.

ROMO 1523 Dusky red Table Mountain jasper Late Archaic corner-notched projectile point. See Mayer 1989: 385.

ROMO 1524 Red Table Mountain jasper Early Archaic (Mt. Albion complex) side/corner-notched projectile point. See Mayer 1989: 386.

ROMO 1526 Black obsidian, Middle Archaic (McKean complex, Hanna type) corner-notched projectile point. See Mayer 1989: 387.

ROMO 1527 White Kremmling chert Early Archaic (Mount Albion complex) corner-notched projectile point. See Mayer 1989: 388.

ROMO 1530 Dark yellowish-brown Hartville chert Late Paleoindian (Lovell Constructed) projectile point. See Mayer 1989: 389.

ROMO 1531 Late Archaic/Early Ceramic corner-notched projectile point (color and material not reported). See Mayer 1989: 390.

ROMO 1544 Middle to Late Ceramic side-notched projectile point (color and material not reported). See Mayer 1989: 391.

ROMO 1545 Middle to Late Ceramic side-notched projectile point (color and material not reported). See Mayer 1989: 392.

ROMO 1549 Late Archaic/Early Ceramic corner-notched projectile point (tip missing), (color and material not reported). See Mayer 1989: 393.

ROMO 1550 Early Archaic (Mt. Albion complex) side/corner-notched projectile point, (color and material not reported). See Mayer 1989: 394.

ROMO 2070 Middle Archaic projectile point base (notches missing) (color and material not reported). See Mayer 1989: 395.

ROMO 4500 Dark grayish-brown unknown material Paleoindian (Great Basin stemmed) projectile point. See Mayer 1989: 376.

ROMO 4512 Light gray Dakota orthoquartzite Middle Archaic (McKean Hanna) projectile point. Tip missing. See Mayer 1989: 397.

ROMO 4513 Tan to light brown Kremmling chert Late/Mountain Paleoindian (Cody Complex, Kersey/Firstview) projectile point.

ROMO 4515 Dark reddish-brown chert with pinkish inclusions Late Paleoindian (Cody Complex, Kersey/Firstview type) projectile point. See Mayer 1989: 398.

ROMO 4559 Gray Kremmling chert Late Archaic projectile point. 1987 Survey: Area A. 2008 UNC Survey: Concentration 1.

ROMO 4560 Light gray Dakota orthoquartzite quartzite with fine black specks Late Paleoindian (Cody Complex-Scottsbluff-Kersey-Firstview type (s)) projectile point base.

ROMO 4562 Reddish brown to brown Hartville chert (central Wyoming) Late Paleoindian (Angostura type) projectile point. Tip and base missing. Parallel-oblique flaking across both blade faces.

ROMO 4648 Complete reddish brown Table Mountain jasper triangular, corner-notched Early Ceramic projectile point. Serrated blades. Flat to slightly convex base. See Mayer 1989: 399.

ROMO 4649 Dusky red Dakota orthoquartzite Late Paleoindian (James Allen/Frederick type) projectile point base. See Mayer 1989: 400.

ROMO 4988 Light gray Dakota orthoquartzite Late Paleoindian (Angostura type) projectile point. See Mayer 1989: 401.

ROMO 5034 Yellowish-brown, dusky red in stem area Table Mountain jasper Late Paleoindian (Concave Base Stemmed point type) projectile point base. See Mayer 1989: 402.

ROMO 6639 Light red Table Mountain jasper Early Ceramic corner-notched projectile point with tip missing. 1987 Survey: Area B. 2008 UNC Survey: Concentration 3.

Pottery listed as coming from 5LR2 in RMNP Museum

ROMO 182 Fifty-nine dark brown to black Ute Uncomphagre Brownware fingernail-impressed potsherds.

ROMO 246a Multiple dark brown to black Ute Uncomphagre Brownware fingernail-impressed potsherds.

ROMO246b and Fire-blackened, brown, micaceous Dismal River Lovitt Stamped potsherds.

ROMO 389 Twelve dark brown to black Ute Uncomphagre Brownware fingernail-impressed body sherds.

ROMO 1516 Six dark brown to black Ute Uncomphagre Brownware fingernail-impressed potsherds.

ROMO 2096 Seventeen Ute Uncomphagre Brownware fingernail-impressed potsherds.

Groundstone listed as coming from 5LR2 in RMNP Museum

ROMO 152 Sandstone grinding slab.

ROMO 1503 Sandstone grinding slab.

ROMO 1504 Sandstone grinding slab.

ROMO 1505 Sandstone grinding slab.

ROMO 1506 Sandstone grinding slab.

ROMO 1507 Sandstone grinding slab.

ROMO 1508 Sandstone grinding slab.

ROMO 1552 Sandstone grinding slab.

ROMO 1553 Sandstone ground stone.

ROMO 1554 Sandstone ground stone.

ROMO 18407 Sandstone grinding slab.

ROMO 18408 Sandstone grinding slab.

1987 Survey Projectile Points Described in Mayer 1989 Report, but not located in RMNP Museum Catalogue as part of the 1998-2002 SAIP investigations. Catalogue numbers are those given for the 1987 survey and recorded in its 1989 research report:

#5 Red Table Mountain jasper, Early Archaic (Mount Albion) corner-notched, convex base, projectile point base. Mayer 1989: 58, 404. From Area B, equivalent to UNC 2008 Concentration 3.

#10 Pink welded tuff Early Archaic (Northern Plains/Central Rockies) corner-notched projectile point with tip missing. Slightly concave base. Mayer 1989: 77-78, 404). From Area E.

#14 Red Table Mountain jasper, projectile point upper mid-section, tip missing. Type indeterminate. Mayer 1989: 77, 80, 404. From Area E.

#16 White Kremmling chert, Early Ceramic, corner-notched, projectile point with concave base. Mayer 1989: 77, 80, 405. From Area E.

#17 White Kremmling chert Early Ceramic corner-notched projectile point base. Mayer 1989: 104, 106, 405. From Area H.

#22 Brown jasper projectile point. No further description given nor illustration published. Mayer 1989: 163, 405. From Area Q.

#48 Tan to white Kremmling chert Early Ceramic corner-notched projectile point. Mayer 1989: 110-111, 113, 408. From Area M.

#64 White to tan Kremmling chert Late Prehistoric (Mid-Late Ceramic), side-notched projectile point. Mayer 1989: 128, 130-131, 408. From Area M.

2008 UNC Forest Canyon Pass Survey Artifacts:

All 2008 survey artifacts are listed below with information on their respective concentrations and equivalents of artifact areas noted in the 1987 survey report. Tools have been provided with a UNC project artifact catalogue number following the earlier numbering sequence established during the 2000 UNC survey and including the above

Husted Survey artifacts recovered from the University of Colorado Museum in 2001 and studied as part of the UNC SAIP project. It should be noted that, while all formal or more unusual tools were recovered during the site's 2008 survey, some informal tools, e.g. utilized flakes, were recorded in the field and left in place.

011 Yellow-brown chert, hafted scraper (base and lower portion), Edge retouch around blade margins. Formal tool. Material Source: North Park. Concentration 1.

012 Dark brown chert, triangular corner-notched projectile point. Flat base. Complete except for one missing tang. Early Ceramic Period, ca. 1850-900 rcyrbp (Brunswig 2005b: 84-85). Formal tool. Material Source: Unknown, consistent with brown cherts observed at Northeastern Colorado Plains sites and quarries. Concentration 6.

013 Pink to tan chert (with dark brown inclusions) knife-scraper. Its intact edges are bifacially retouched. Formal tool. Material Source: Unknown, consistent with cherts observed at Northeastern Colorado Plains sites and quarries. Concentration 1.

014 White to tan Kremmling chert flake knife. Edge retouch along one complete blade side. Formal tool. Material Source: Middle Park or North Park. Concentration 1.

015 Yellow-brown to medium brown, opaque, petrified wood, triangular, corner notched, stemmed projectile point. Early Ceramic Period, ca. 1850-900 rcyrbp (Brunswig 2005b: 84-85). Formal tool. Material Source: Eastern Colorado Plains. Concentration 1.

016 Tan, translucent Kremmling chert, utilized flake knife. Edge wear and light retouch noted. Informal tool. Material Source: Middle Park or North Park. Concentration 2.

017 Tan to gray tool fragment (edge retouch thinning flake) made of fine Dakota orthoquartzite (Windy Ridge). From possible formal tool. Material Source: Middle Park or North Park. Concentration 2.

018 Dark green to brown chert utilized flake knife (not collected). Informal tool. Material Source: Unknown. Concentration 2.

019 Dark green to brown chert utilized flake scraper. (not collected). Informal tool. Material Source: Unknown. Concentration 2.

020 Yellow-brown Table Mountain jasper projectile point mid-section. Late Paleoindian Period, type indeterminable due to fragmented condition, ca. 9,000-7,500 rcyrbp. Period affiliation based on its lenticular cross-section and a surviving section of parallel-oblique flaking pattern on one blade edge. Formal tool. Material Source: North Park or Middle Park. Concentration 4.

021 Dark red Table Mountain Jasper core with cortex over 50% of its surface.

Material Source: Specimen Mountain, RMNP. Note: the core size and appearance are closely comparable to similar small cores and locally occurring nodules found eroding or on the surface of 5LR90, an alpine tundra site west of 5LR2 and across Milner Pass. No evidence of having been used as a tool. Concentration 4.

022 Specimen Mountain rhyolite utilized flake scraper-knife. Evidence of burning or intentional firing for increased flakability. Edge retouch evident. Informal tool. Material Source: Specimen Mountain or Trail Ridge, RMNP. Concentration 7.

023 Yellow-brown chert flake scraper with retouch flaking around 80% of tool perimeter. Formal tool. Material Source: Unknown. Consistent with some Eastern Colorado Plains cherts. Concentration 5.

024 Mottled tan and brown chert, hafted flake knife. Edge retouch is evident on remaining, intact, blade margins. Formal tool. Material Source: Unknown. Concentration 5.

025 Tan, brown and gray rhyolite flake knife with obsidian and basalt inclusions. Edge retouch. Material Source: Specimen Mountain or Trail Ridge, RMNP. Concentration 6.

026 Tan chert flake knife. Informal, utilized flake tool. Edge use “nibbling” evident. Material Source: Eastern Colorado Plains. Concentration 6.

027 Translucent, tan to light brown Kremmling chert biface knife fragment. Formal tool. Material Source: Middle Park or North Park. Concentration 7.

028 Light gray Dakota orthoquartzite (Windy Ridge) corner-notched projectile point base. Convex base. Formal tool. Early Ceramic Period, ca. 1850-900 rcyrbp (Brunswick 2005b: 84-85). Material Source: Middle Park or North Park. Concentration 7.

029 Ovate, brown to tan chert (with black inclusions) knife-graver. Well-made formal tool. Material Source: Unknown. Concentration 7.

030 Reddish brown to reddish tan chert blade knife-scraper. Minimal edge retouch. Informal tool. Material Source: Unknown, possibly South Central Wyoming. Concentration 7.

031 Dark gray rhyolite scraper-knife. Informal tool. Material Source: Specimen Mountain-Trail Ridge, RMNP. Concentration 9.

032 Light tan Kremmling chert flake knife. Well-defined edge retouch. Informal tool. Material Source: Middle Park or North Park. Concentration 9.

033 Dark brown chert hafted knife or projectile point base. Incurvate base. Formal tool. Material Source: Middle Park or North Park. Concentration 4.

034 Yellow brown petrified wood flake knife. Utilized flake, informal, tool. Material Source: Colorado Piedmont, aka Parker Petrified Wood. Concentration 4.

035 Yellow brown petrified wood flake knife. Utilized flake, informal tool. Material Source: Colorado Piedmont, aka Parker Petrified Wood. Concentration 4.

Lithic Debitage Summary (n=643):

Concentration 1-45 secondary (82.22%) and tertiary flakes (17.78%) made of chert, quartzite, jasper, and quartz. 73.33% of all flake materials are regionally local (Kremmling chert, Table Mountain jasper, Windy Ridge Dakota Orthoquartzite, Middle Park/North Park Brown chert, RMNP Quartz). 26.67% of all flake materials are non-local or from unknown sources.

Concentration 2-267 primary (1.12%), secondary (43.45%), tertiary (48.69%), and shatter (6.74%) flakes made of chert, quartzite, jasper, petrified wood, and andesite. 53.93% of all flake materials are regionally local (Kremmling chert, Table Mountain jasper, Windy Ridge Dakota Orthoquartzite, North Park Green chert, RMNP Andesite). 46.07% of all flake materials are non-local or of unknown sources.

Concentration 3-243 primary (2.06%), secondary (44.86%), tertiary (50.62%), and shatter (2.47%) flakes made of chert, quartzite, and jasper. 86.83% of all flake materials are regionally local (Kremmling chert, Table Mountain jasper, Windy Ridge and Colorado Front Range Dakota Orthoquartzite, North Park Brown chert). 13.17% of all flake materials are non-local or of unknown sources.

Concentration 4-55 primary (3.64%), secondary (74.55%), tertiary (14.55%), and shatter (7.27%) flakes made of chert, quartzite, jasper, petrified wood, and andesite. 52.73% of all flake materials are regionally local (Kremmling chert, Table Mountain jasper, Windy Ridge Dakota Orthoquartzite, RMNP Andesite). 47.27% of all flake materials are non-local or of unknown sources.

Concentration 5-8 primary (12.5%), secondary (62.5%), tertiary (12.5%), and shatter (12.5%) flakes made of chert, quartzite, jasper, petrified wood, and andesite. 53.93% of all flake materials are regionally local (Kremmling chert, Table Mountain jasper, Windy Ridge Dakota Orthoquartzite). 46.07% of all flake materials are non-local or of unknown sources.

Concentration 6-15 primary (0.00%), secondary (93.33%), tertiary (6.67%), and shatter (0.00%) flakes made of chert and rhyolite. 93.33% of all flake materials are regionally local (RMNP Rhyolite). 6.67% of all flake materials are non-local or of unknown sources.

Concentration 8-2 primary (100.00%), secondary (00.00%), tertiary (00.00%), and shatter (00.00%) flakes made of chert and rhyolite. 100.00% of all flake materials are regionally

local (Kremmling chert and RMNP Rhyolite).

Concentration 9-8 primary (00.00%), secondary (75.00%), tertiary (00.00%), and shatter (25.00%) flakes made of chert, jasper, and rhyolite. 100.00% of all flake materials are regionally local (Kremmling chert, Table Mountain jasper, and RMNP Rhyolite).

5LR12138

001 Translucent, opaque black, red, and tan chert graver. Formal tool. Material Source: Unknown. Concentration 1 (south).

002 Dark red Table Mountain jasper flake knife. Minimal edge retouch and edge wear. Informal tool. Material Source: Middle Park or North Park. Concentration 1.

003 Reddish gray, with black flecks, chert biface knife. Formal tool. Flattop chert. Material Source: Northeastern Colorado Plains. Concentration 1.

004 Brown, with black inclusions, Hartville chert end scraper. Formal tool. Full retouch. Material Source: South Central Wyoming. Concentration 1.

005 Brown chert core, with light brown inclusions. No evidence of use as a tool. Material Source: Unknown. Concentration 1.

006 Yellow-brown, brown and reddish-brown coarse-grained quartzite flake chopper-scraper. Informal tool. Material Source: Unknown. Concentration 1.

007 Yellow-brown to red quartzite, down-tapered, flat to convex-based projectile point base. Base has impact fracture scars on both blade faces. Evidence of parallel-oblique flaking. Formal tool. Late Paleoindian, Angostura type (cf. Brunswig 2005b: 74-77; 2007: 278-283, Table 9.3; Pitblado 2007: 315-318), ca. 9,700-7,550 rcyrbp. Material Source: Unknown. Concentration 1.

008 Tan chert (with black speck inclusions and a grainy crystal quartz mass on one surface) flake knife. Informal tool. Material Source: Unknown. Concentration 1.

009 Dark brown chert blade knife. Informal tool. Material Source: Unknown. Concentration 1.

010 White (with black flecks) Kremmling chert blade tool edge fragment. Possibly from a knife. Formal tool. Material Source: Middle Park or North Park. Concentration 1.

011 Gray Dakota orthoquartzite (Windy Ridge) biface knife tip. Formal tool. Material Source: Middle Park or North Park. Concentration 1.

012 Yellow brown quartzite flake knife. Retouched cutting edge. Formal tool. Material Source Area: North Park. Concentration 1.

- 013 Dark to reddish brown quartzite, bifacially worked, flake knife. Found in two pieces. Possibly once hafted. Formal tool. Material Source: Possible North Park provenance. Concentration 1.
- 014 Ovate, gray Dakota orthoquartzite (Windy Ridge) scraper-graver-spokeshave. Very well-made formal tool. Material Source: Middle Park or North Park. Concentration 1.
- 015 Red to yellow brown Table Mountain jasper flake knife. Informal tool. Material Source: Middle Park or North Park. Concentration 1.
- 016 Yellow-brown quartzite biface knife tip. Tip is rounded. Formal tool. Material Source: North Park. Concentration 2.
- 017 Small, mottled, light to dark brown chert blade knife with edge retouch on both blade edges. Formal tool. Material Source: Unknown. Concentration 2.
- 018 White Kremmling chert blade knife. Informal tool. Edge use wear and retouch “nibbling” on one blade side. Material Source: Middle Park or North Park. Concentration 2 (north).

Lithic Debitage Summary (n=79):

Concentrations 1 and 2-79 primary (1.27%), secondary (54.43%), tertiary (36.71%), and shatter (7.5%) flakes made of chert, quartzite, jasper, and petrified wood. 50.63% of all flake materials are regionally local (Kremmling chert, Table Mountain jasper, Windy Ridge and Colorado Front Range Dakota Orthoquartzite, Middle Park/North Park Brown chert, Middle Park/North Park Petrified Wood). 49.377% of all flake materials are non-local or of unknown sources.

5LR12139

- 001 Light tan Kremmling chert ovate scraper. Very well-made formal tool. Material Source: Middle Park or North Park.
- 002 White to light tan Kremmling chert, wedge-shaped chopper. Formal tool. Material Source: Middle Park or North Park.
- 003 Round, tan to white Kremmling chert flake knife. Informal tool. Edge wear and fine retouch around its perimeter. One side is fully covered with heavy lichen growth. Material Source: Middle Park or North Park.
- 004 Round, tan to white Kremmling chert flake knife. Informal tool. Edge wear and “feathering” noted on tool working margins. Material Source: Middle Park or North Park.
- 005 Tan, yellow-brown to white Kremmling chert flake knife. Informal tool. Material

Source: Middle Park or North Park.

006 Tan to white Kremmling chert graver-awl. Informal tool. Material Source: Middle Park or North Park.

007 Tan to reddish yellow Kremmling chert flake knife. Informal tool. Material Source: Middle Park or North Park.

5LR12140

001 Gray to dark gray biotite-schist, unifacial slab metate. Smoothing from grinding on exposed surface. Eleven distinct lichen colonies on exposed surface, ranging from 4-12 cm in diameter. Dimensions: 53 cm (L) x 33 cm (W) x 2.7 cm (Th). Material Source: Local, Rocky Mountain National Park.

Lithic Debitage Summary (n=1):

1 secondary Dakota orthoquartzite flake.

5LR12141

001 Reddish brown, with reddish tan inclusions, Hartville chert, flat projectile point base. The base is thinned at its bottom, has parallel-oblique flaking, and blade edge (stem) edge grinding. It represents a Late Paleoindian Cody (Scottsbluff/Kersey/Firstview) projectile point type, ca. 9,400-8,300 rcyrbp (cf. Brunswig 2005b: 74-77; 2007: 278-283, Table 9.3). Material Source: Hartville chert, South Central Wyoming, with its reddening believed attributable to deliberate heat treatment for facilitating its flaking.

002 Dark brown chert, bifacially worked, knife-graver. If it is in original condition, then is an informal tool. If it is a tool fragment, which it appears to be, then it represents a formal tool. Material Source: North Park.

003 Yellow-brown to reddish brown Hartville chert (with dark brown inclusions) knife. It is a formal tool which has been shaped from a flake and having extensive edge retouch. Material Source: South Central Wyoming.

Lithic Debitage Summary (n=1)

One secondary thinning flake made of brownish gray Dakota orthoquartzite (Windy Ridge).

Appendix C

Upper Forest Canyon Wildlife Survey, Rocky Mountain National Park July 15, 2008

Jeff Connor, Natural Resources Specialist, Continental Divide Research Learning Center,
Rocky Mountain National Park, September 12, 2008

Introduction

Doerner and Brunswig, this volume, conducted paleoenvironmental baseline research and modeling long-term climate change in Forest Canyon Pass during July, 2008. As a part of this study, I was asked to conduct a wildlife survey in Upper Forest Canyon in July 2008 to determine presence or absence of wildlife. This report includes the results of a one day survey, and provides some insight based on my years of work in the park. I also attempted at the end of this report to reflect on differences between 2008 and a defined period of time before the effects of European man.

I completed a general wildlife survey in Upper Forest Canyon on all sides from the 3,414 m (11,200 ft) contour up to Forest Canyon Pass 3,658 m (12,000 ft) and also surveyed the East facing slope of Specimen Mountain from Forest Canyon Pass with binoculars on July 15, 2008. I did not document any insects due to my lack of knowledge, though many insects were observed. Reptiles and amphibians are not known to exist in the area and no effort was made to look for them. Following is a discussion on birds, mammals, and fish.

Birds

I completed one bird transect on July 15, 2008 (table 1). The bird transect was 15 point count stations each 250 meters apart, starting time at 0600 and ending at 0850. The transect started on the Forest Canyon Pass to Milner Pass hiking trail and ended on the south side of upper Forest Canyon. The first station started at the old Gore Range Trail junction and proceeded south/southeast for 3.75 km. I left the hiking trail at point count station 8 and proceeded off trail for the remaining stations. I documented all birds seen and heard at each station for 7.5 minutes.

This point count transect (transect number 1500) was started in 1994 by the Rocky Mountain National Park bird monitoring program. The surveys used point count transects that were established in every major habitat type within the park and surveyed yearly from 1994 to 2005, excluding 2004 (table 2). Surveys were completed by park staff, volunteers, and the Rocky Mountain Bird Observatory. The program was discontinued in 2005 due to budget constraints. Rocky Mountain National Park bird monitoring data is located in a database in park files

N:/resources/working/songbird_2000 and includes UTM coordinates for each station. The protocol for surveying point count transects is described in park files at

N:/resources/working/highly sensitive/bird monitoring end of season report 2005.

Table 1. Bird species observed or heard July 15, 2008 at transect 1500.

Species	Total Number for 15 Stations	% Of Stations	Habitat Type Birds were Observed Occupying
White-crowned sparrow (<i>Zonotrichia leucophrys</i>)	34	87	Willow and Krumholtz
American pipit (<i>Anthus rubescens</i>)	16	47	Alpine Tundra
Lincoln sparrow (<i>Melospiza lincolnii</i>)	11	47	Willow
American robin (<i>Turdus migratorius</i>)	4	27	Spruce/Fir, Krumholtz, Willow, Alpine Tundra
Pine siskin (<i>Carduelis pinus</i>)	4	27	Flying overhead, but Associated with Spruce/Fir
Hermit thrush (<i>Catharus guttatus</i>)	2	13	Spruce/Fir
Broad-tailed hummingbird (<i>Selasphorus platycercus</i>)	2	13	Alpine Tundra
Yellow-rumped warbler Audubon's type (<i>Dendroica coronata</i>)	2	13	Spruce/Fir, Krumholtz
Hairy woodpecker (<i>Picoides villosus</i>)	1	07	Spruce/Fir/Lodgepole Pine
Ruby-crowned kinglet (<i>Regulus calendula</i>)	1	07	Spruce/Fir
Red-cross bill (<i>Loxia curvirostra</i>)	1	07	Spruce/Fir, Krumholtz
Gray Jay (<i>Perisoreus canadensis</i>)	1	07	Spruce/Fir, Krumholtz
Northern flicker (<i>Colaptes auratus</i>)	1	07	Spruce/Fir, Krumholtz
White-tailed ptarmigan (<i>Lagopus leucurus</i>)	1	07	Alpine Tundra

The following is a discussion of key species:

The American robin is a generalist found nesting and foraging in all major habitat types within the park. Broad-tailed hummingbirds are also found in all habitats, but tend to nest in lower elevation willow and aspen and forage elsewhere. They are observed in the alpine tundra later in the season when wildflowers began to flower and their breeding season is over. The Lincoln sparrow is a Partners-in-Flight Species of Continental Importance because most of its breeding range is located in a single biome making the

species more sensitive to climatic changes (Rich et al. 2004). The Intermountain West contains the largest percentage of the species breeding range.

The Wilson's warbler, was observed previously, but not in this survey (table 2). It is interesting that the total number of this species observed has fluctuated throughout the years. They nest in willow and upper Forest Canyon has healthy willow, but the willow is located in the species upper elevational range. Birds such as the Wilson's warbler tend to respond to climatic conditions on a year to year basis and are opportunistic enough to move into more favorable habitat such as higher elevation willow if conditions are not favorable in lower elevations, or avoid higher elevation habitat if conditions are unfavorable (J. Connor pers. obs.). This spring was cold and wet keeping many species of birds in lower elevation areas longer than normal. American pipits were observed in montane meadows into early June a couple weeks longer than usual before they moved into their breeding range in the alpine tundra (J. Connor pers. obs.).

An example of a species adjusting to climatic conditions is the lark bunting (*Calamospiza melanocorys*) that is occasionally observed migrating through RMNP. During the severe drought of 2002 in Colorado, lark buntings, which are normally common on the plains of Eastern Colorado, were nearly absent, whereas in Montana, this species normally uncommon, was numerous (North American Breeding Bird Survey 2002). The species had shifted north due to the severe drought. The species was common again in Colorado the next year, when conditions were move favorable.

Table 2. List of species observed or heard in transect 1500 by year, 1994-2008.

Species	1994	1995	1996	1997	1999	2000	2001	2002	2003	2005	2008
WCSP	59	42	39	31	20	18	12	30	26	78	34
HOLA	1	-	-	2	-	2	-	1	-	1	-
AMPI	6	6	10	10	13	13	18	21	22	14	16
WTPT	1	-	-	-	-	1	-	2	-	-	1
AMRO	10	4	11	7	12	4	12	7	4	22	4
HETH	6	-	-	-	-	3	2	4	7	8	2
WIWA	11	-	-	1	-	1	1	2	6	4	-
BCRF	2	-	-	-	-	-	-	-	-	-	-
RCKI	2	-	6	1	5	7	7	15	9	8	1
RUHU	1	-	-	-	-	-	-	-	-	-	-
LISP	13	1	3	6	4	8	8	5	14	37	-
COSN	1	-	-	-	-	4	3	2	1	-	-
CLNU	1	1	1	-	2	1	3	1	-	-	-
TOSO	4	-	-	-	-	-	-	2	1	-	-
MOBL	2	-	-	-	-	2	1	1	1	-	-
NOFL	-	-	-	-	-	-	-	-	-	-	1
HAWO	-	-	-	-	-	-	-	-	-	-	1
GRJA	-	-	-	-	-	-	-	-	-	-	1
YRWA	-	-	-	1	-	-	1	-	3	2	2
BTLH	-	1	-	-	1	-	-	2	-	3	2

Species	1994	1995	1996	1997	1999	2000	2001	2002	2003	2005	2008
RECR	-	12	-	-	-	-	-	-	-	1	2
PISI	-	1	-	-	1	-	-	1	1	-	4
TRES	-	1	-	-	-	-	-	-	-	-	-
PIGR	-	1	-	-	1	-	-	1	-	-	-
LASP	-	-	1	-	-	-	-	-	-	-	-
AMCR	-	-	-	2	-	-	-	-	-	-	-
DEJU	-	-	-	-	-	1	-	2	-	6	-
CORA	-	-	-	-	-	1	2	-	-	2	-

Common names for the codes

WCSP = White-crowned sparrow

(*Zonotrichia leucophrys*)

HOLA = Horned lark (*Eremophila alpestris*)

AMPI = American pipit (*Anthus rubescens*)

WTPT = White-tailed ptarmigan (*Lagopus leucurus*)

AMRO = American robin (*Turdus migratorius*)

HETH = Hermit thrush (*Catharus guttatus*)

WIWA = Wilson's warbler (*Wilsonia pusilla*)

BCRF = Brown-capped rosy finch (*Leucosticte australis*)

RUKI = Ruby-crowned kinglet (*Regulus calendula*)

RUHU = Rufous-tailed hummingbird (*Selasphorus rufus*)

LISP = Lincoln sparrow (*Melospiza lincolnii*)

COSN = Common snipe (*Gallinago gallinago*)

CLNU = Clark's nutcracker (*Nucifraga columbiana*)

TOSO = Townsend's solitaire (*Myadestes townsendi*)

MOBL = Mountain bluebird (*Sialia currucoides*)

NOFL = Northern flicker (*Colaptes auratus*)

HAWO = Hairy woodpecker (*Picoides villosus*)

GRJA = Gray jay (*Perisoreus*

canadensis)

YRWA = Yellow-rumped warbler

(*Dendroica coronata*)

BTAH = Broad-tailed hummingbird (*Selasphorus platycercus*)

RECR = Red-crossbill (*Loxia curvirostra*)

PISI = Pine siskin (*Carduelis pinus*)

TRES = Tree swallow (*Tachycineta thalassina*)

PIGR = Pine grosbeak (*Pinicola enucleator*)

LASP = Lark sparrow (*Chondestes grammacus*)

AMCR = American crow (*Corvus brachyrhynchos*)

DEJU = Dark-eyed junco (*Junco hyemalis*)

CORA = Common raven (*Corvus corax*)

Discussion of Species and Habitat

The white-crowned sparrow was consistently the most common bird observed along with the American pipit and American robin. The white-crowned sparrow and American pipit are specialists nesting in specific habitat types; the white-crowned in willow and krumholtz, and the pipit in grasses within alpine tundra. Both species could be sensitive to climate change if there is a significant shift in habitats. If willow and krumholtz habitat are reduced by encroaching spruce/fir, the white-crowned sparrow would no longer be the most numerous species observed. The same would apply to the pipit if tundra is replaced with more krumholtz and spruce/fir. Only a handful of avian species manage to breed in the alpine tundra and the American pipit is the most common species, followed by the horned lark.

Air quality is an issue of concern that may have an impact on alpine tundra. Rocky Mountain National Park has experienced high levels of nitrogen deposition for decades (Baron et al. 1994) and recent research indicates that changes to the composition of alpine tundra plants could occur (Bowman et al. 2006, Suding et al. 2006). High levels of nitrogen could shift the herbaceous plant composition from grasses, sedges and wildflowers to more grass and sedge. The pipit and horned lark feed their young a diet composed entirely of insects (Kingery 1998). A loss of wildflowers would probably mean a lower abundance of insects. Adult horned larks do eat some plant material, but pipits often do not. If alpine tundra is changed to more grasses and sedges, populations of the pipit and horned lark could change. Horned larks also have a wide elevational range breeding from short grass prairie in Eastern Colorado up into tundra, but the pipit only breed in the alpine tundra. The pipit would be threatened more than the horned lark if tundra shifts into less favorable habitat. Both species generally migrate after the breeding season, the pipit to the southern United States and Mexico and the horned lark into lower elevations. However, some birds can remain in Colorado through the winter.

The white-tailed ptarmigan is probably the most sensitive avian species to climatic change. It is considered fairly common in the tundra, but the species was rarely observed along transect 1500, 1994 – 2005 (table 2). Their nests are usually located in rock fields or tundra grasses adjacent to sheltering rocks. A small percentage builds their nests among willow or krumholtz. Transect 1500 is located more in krumholtz and willow than alpine grasses and rock, and is probably why less ptarmigan were observed. The dominant habitat of willow and krumholtz could also be a reason why horned lark are not often observed. On July 15, I observed one female ptarmigan among rock and tundra grasses. The female was emitting alarm calls, an indication that she may have had chicks; however, I did not observe any.

The ptarmigan relies heavily at certain times of the year on willow and willow buds for food (Braun et al. 1993, Gisen et al. 1980). Both the female and male spend the winter feeding on the tips and buds of willow and the female needs willow buds in early spring to develop healthy eggs. A loss of willow would be detrimental to its survival and research indicates the species is sensitive to high numbers of elk browsing on willow (Melcher 1992). The ptarmigan is restricted to alpine tundra during the breeding season and does not usually shift much in elevation throughout the year (Kingery 1998).

It was interesting to observe a hairy woodpecker and northern flicker for the first time. Due to

the current ongoing bark beetle outbreak, which could be a climate change response, woodpeckers are responding favorably. I noted a lot of conifers in Forest Canyon that were recently attacked by bark beetles and these birds are known to feed them.

Several species observed throughout the years are listed as Species of Continental Importance in the Intermountain West (Rich et al. 2004). Brown-capped rosy finch, Clark's nutcracker, and mountain bluebird, are of concern because the majority of their breeding habitat, and for the finch and nutcracker winter habitat, occur in the intermountain west. The brown-capped rosy finch is also a watch list species due to restricted distribution and low population size. The rosy finch could also be sensitive to climate change and respond negatively if habitat shifts to less favorable conditions.

The Clark's nutcracker, common to Rocky Mountain National Park, relies on seeds from limber pine (*Pinus flexilis*) and ponderosa pine (*Pinus ponderosa*), and is another species that may respond negatively to climate change. It is listed as a Species of Continental Importance due to its breeding range being in a single biome (Rich et al. 2004). Limber pine relies on the nutcracker to distribute its seed. Bark beetles are currently killing large numbers of limber pine in the park. Blister rust (*Cronartium ribicola*) an exotic to North America, is known to occur just outside the park and is expected to negatively impact regeneration of limber pine. If there is a significant loss of limber pine, in the long-term, it could negatively affect the nutcracker.

Mammals

While conducting the bird transect and afterwards, I counted all mammals or noted their scat, tracks, or other sign. The survey area included the upper end of Forest Canyon from the 3,414 m (11,200 ft) contour up to Forest Canyon Pass on all sides and I scanned the east facing slope of Specimen Mountain with binoculars from Forest Canyon Pass. Mammals noted were as follows:

Elk (*Cervus canadensis*) – Observed 39 cows, 14 calves, and 8 bulls, all in upper Forest Canyon. Cow/calf ratio was 2.78. I noted two collared elk, one cow with a yellow tag marked T6 and another cow with a blue tag, but too far away to note the identification number. The collared elk are part of fertility and chronic wasting disease (CWD) studies (Hoover 2007, Baker et al. 2002).

Mule Deer (*Odocoileus hemionus*) – I observed one buck and three does in Upper Forest Canyon. I did not observe any fawns.

Bighorn Sheep (*Ovis canadensis*) – 78 animals were counted on the east facing side of Specimen Mountain. This appears to be a higher number than usual (Therese Johnson, pers. obs.). The sheep were too far away to sex or age with a pair of binoculars. I did not have a spotting scope.

Moose (*Alces alces*) – I did not observe moose, but I noted several pellet piles in Upper Forest Canyon indicating that moose occasionally use the area.

Snowshoe Hare (*Lepus americanus*) – I observed only one hare, but noted pellets in a number of locations indicating the species is probably more common than observed on July 15.

Vole (*Microtus* spp.) – I observed one fairly large vole, but was not able to identify it to species. The length of the tail and its location in a krumholtz, indicates it was likely a long-tailed vole (*Microtus longicaudus*). It is doubtful it was a montane vole (*Microtus montanus*), which is about the same in size. The montane vole is a lower elevation species. I did not note any runway building which is less prevalent with the long-tailed vole than the montane vole (Armstrong 2008). It was not a southern red backed vole (*Myodes gapperi*), since I did not observe any reddish color on its back.

Chipmunk (*Neotamias* spp.) “I observed one animal along the trail foraging among krumholtz and willow and showing an interest towards me, indicating it may have taken handouts from park visitors. Of the three species of chipmunks known to occur in the park it was probably the Least chipmunk (*Neotamias minimus*) which tends to be more common than the Unita chipmunk (*Neotamias umbrinus*). It was most likely not the Colorado chipmunk (*Neotamias quadrivittatus*), which is usually not found above 2,440m (8,000 ft). However, one issue related to climate change is the movement of lower elevation species to higher elevations, so it is not outside the realm of possibilities that the Colorado chipmunk may be found in tundra environments.

Yellow-bellied marmot (*Marmota flaviventris*) – “I observed one animal on a boulder on the south side of Forest Canyon pass. I noted scat from the animal in a couple other areas.

Pika (*Ochotona princeps*) – I observed one pika in a rocky scree slope on the south side of Forest Canyon pass located partway down an unnamed knoll. I noted two haypiles under a couple overhanging rocks near where I observed the animal.

Mountain lion (*Puma concolor*) – I observed one paw print in a muddy area within willow on the south side of Forest Canyon pass. The print indicated the animal was moving down into the canyon from the alpine tundra. The print appeared relatively fresh leading me to believe the animal may have moved through the area within the previous 24 hours. The size of the track was about 3 ½ ” wide by 3 ½ ” long. I did not observe any killed prey in the area.

There is a slight chance the track could have been made by the Canada lynx (*Lynx canadensis*) the track of a lynx is about the same size as a lion 3 ¾” by 3 ¾” (Halfpenny 1986). Lynx within the park are considered rare to occasional. There have been observations of the lynx within the park in recent years (NPS 2008) and any observations are related to the reintroduction program started by the Colorado Division of Wildlife in the late 1990s. I observed one lynx with a radio collar along the Grand Ditch in 2006 approximately five miles west from Forest Canyon and it has been observed in other areas to the south, southwest and east of Forest Canyon.

Coyote (*Canis latrans*) – I noted scat and tracks of coyote in the area. The coyote has a wide diet feeding on many species including elk, deer and bighorn sheep and carrion.

Porcupine (*Erethizon dorsatum*) – I did not see a porcupine, but I did note bark from one lodgepole pine and one Subalpine fir chewed by porcupine. It is probably more prevalent in lower elevation conifers, but has been observed in the Upper Forest Canyon area (NPS 2008). During the summer months it feeds primarily on herbaceous vegetation and woody vegetation

during the winter (Armstrong 2008). One porcupine in 2006 was a nuisance at the nearby Alpine Visitor Center and store, chewing on the wood siding of the buildings.

Black bear (*Ursus americanus*)– I did not see a bear or note bear tracks or scat on July 15. They are known to den on steep slopes on the north facing side of Forest Canyon. I hiked to one den in the spring of 1989 located about mid way down the canyon and half way up from the bottom on the north facing slope of Stones Peak.

Other carnivores not observed on July 15, but I have observed previously in upper Forest Canyon, include American marten (*Martes americana*), ermine (short-tailed weasel) (*Mustela erminea*), and the long-tailed weasel (*Mustela frenata*).

Fish

No ponds or stream in the survey area above the 3,414 m (11,200 ft.) contour contain fish, but fish in lower Forest Canyon are important in the ecosystem. Forest Canyon has native Greenback Cutthroat Trout (*Oncorhynchus clarki stomias*). Arrowhead Lake within Forest Canyon was originally fishless due to steep waterfalls that prevented fish from moving upstream, cold conditions and limited spawning habitat. Attempts to stock the lake were made in 1913, 1930s and 1940s with apparently native greenback cutthroat trout and 1936, 1937 and 1940's with rainbow trout (*Salmo gairdneri* Richardson) and Yellowstone cutthroat (*Oncorhynchus clarki bouveri*), which are exotic species to the park (Rosenlund et al. 2001). Fish from the lake were sampled in 1998 and determined to be strain A- greenback cutthroat with a slight Yellowstone cutthroat influence. Rosenlund, Kennedy and park staff have been releasing strain A greenback cutthroat to reduce the Yellowstone cutthroat influence. Arrowhead Lake does not support a high number of fish due to the extreme conditions, high elevation, and limited spawning habitat and could revert back to fishless status if no further stocking occurs.

Greenback cutthroat in the Big Thompson River within Forest Canyon exist from a barrier above Spruce Creek 2,574 m (8,445 ft.) and extends 12.5 km (7.8 mi) to another barrier within a meadow at 3,242m (10,636 ft.) (Rosenlund and Kennedy 2001). Surveys in 1957 determined that this population at that time was pure greenback cutthroat and considered a relic population. However, in 1962 stocking records were found showing that Forest Canyon was stocked with a total of 140,000 Yellowstone cutthroat trout in 1922 and 1923 (Behnke 1976). Genetic techniques to identify strains of fish in 1998-1999 determined the fish to be strain A- greenback cutthroat with no Yellowstone cutthroat or rainbow trout influences. New genetic tests in recent years are showing that many areas of the park where greenback cutthroat were thought to have been restored may actually be Colorado River cutthroat. A fish management plan for the park will eventually be completed that will determine what areas of the park have pure A strain fish and which areas need to be restored.

Discussion on Wildlife Observed on July 15, 2008 A Comparison with the Past

The National Park System is comprised of more than 390 individual units administered by the National Park Service (NPS) for their natural, cultural, and recreational values. There are three

laws that constitute the primary authorities for the administration of the National Park System. The 1916 NPS Organic Act charges the NPS to conserve the scenery and the natural and historic objects and wildlife therein and to provide for the enjoyment by means that will leave them unimpaired for the enjoyment of future generations. The General Authorities Act of 1970 defines the National Park System. The 1978 Redwood Act expanding Redwood National Park further amended the NPS Organic Act that all park units are to be managed and protected “in light of the high public value and integrity of the National Park System” and that no activities should be undertaken “in derogation of the values and purposes for which these various areas have been established.”

The purpose of Rocky Mountain National Park (RMNP) is, in part, to preserve the natural conditions and scenic beauties and conserve its natural and historic objects and wildlife (RMNP 1915 & RMNP Master Plan 1976) with about 95% of the park identified as wilderness, either designated or recommended. The Master Plan states, “park visitor experience, now and in the future, should be a dynamic interaction of human values based on the perpetuation of natural features in as near to pristine conditions as possible.” The current management of the park recognizes humans, where present, as part of the park’s ecosystem, but the major emphasis is on the perpetuation of natural processes. Therefore the primary objective of the management of the park is to protect the natural resources and values in as natural condition as possible, while allowing for their enjoyment for present and future generations of park visitors — but what does “natural condition” mean? The National Park Service Management Policies of 2006 describe “natural condition” as “the condition of resources that would occur in the *absence of human dominance over the landscape*.”

NPS-77 (1991) defines “natural conditions” as those that would have existed today in the absence of the effects of European man. The settlement of Estes Valley, beginning about 1860, is the point in time when European immigration and the settlement of Colorado started influencing wildlife within the area that would become RMNP in 1915 (NPS 2007).

The question I will try to answer: Is there an *absence of human dominance* over wildlife in Upper Forest Canyon and are the wildlife present in 2008 the same that existed previous to 1860?

Doerner and Brunswig (2008), as previously mentioned, are conducting paleoenvironmental baseline research and modeling long-term climate change. Their research will help answer the question what the past was like versus present and possibly expected future conditions that may better define wildlife differences past, present and future.

Native Americans have been using Upper Forest Canyon for thousands of years (Brunswig 2005), European immigrants for only about 148 years. If I had been standing at Forest Canyon Pass before 1860, the natural landscape would not have looked much different than it did on July 15, 2008. The geology of the surrounding mountains and Forest Canyon would be undistinguishable from past and present. Spruce/fir, krumholtz, willow and alpine tundra would have been present, but could have been slightly spatially different.

Fire was primarily the natural disturbance agent in the forest of Upper Forest Canyon for

thousands of years. The fire regime within Rocky Mountain National Park for spruce/fir was characterized by large scale (>500 ha), but infrequent high-severity fires that were typically stand-replacing (Veblen et al. 2004, Baker and Eshel 2002). Fire history research in Rocky Mountain National Park indicates that spruce/fir, which is the dominate forest in upper Forest Canyon is still within its natural range of variability. The large stand replacing fires that occurred in Forest Canyon in the past had a fire frequency of 300-500 years, or longer. Spruce/fir trees in Forest Canyon are as old as 300+ years.

Elk, bighorn sheep and mule deer the principal wildlife hunted by Native Americans in what is now Rocky Mountain National Park, were considered abundant before 1860 (Smith 1935, Yeager 1932). However, distribution and abundance of wildlife were different than they are today. For example, more bighorn sheep back then as today, elk perhaps more widely dispersed due to hunting from Native Americans and the presence of predators such as the gray wolf and grizzly bear that are no longer present. Other mammals and birds noted on July 15, 2008 were probably in upper Forest Canyon, as well as, greenback cutthroat trout in lower Forest Canyon. All wildlife noted on July 15, 2008 are considered native to Rocky Mountain National Park. Native species as defined by National Park Service Natural Resources Management Guidelines (Department of Interior National Park Service 1994) as those species that occur, have occurred, or may occur in a park as a result of natural processes. Species that have moved into park environments directly or indirectly as a result of human activities are not considered native except in cases where human activities accelerated native animal movements that would have occurred without human influence. Native American influences probably had no affect on accelerating mammal's that previously did not occur in the park and it is doubtful they redistributed fish in upper Forest Canyon due to existing fish barriers and previously discussed park records (Rosenlund et al. 2001).

Comparing native versus exotic vascular plant species, the habitat in Upper Forest Canyon is largely intact today as it was before 1860. I observed no exotic plants in the area on July 15, 2008 with the possible exception of the common dandelion (*Taraxacum officinale*), which is native to Europe. The spatial distribution, density and cover of plants may be different today than in the past, but probably all the species of plants, with the exception of the common dandelion, present on July 15, 2008, were present before 1860.

However, even though there are many similarities between 2008 and pre 1860, and upper Forest Canyon appears relatively pristine, there are significant differences due to human (*Homo sapiens*) influences.

While conducting the bird survey, I counted ten commercial aircraft flying overhead heading eastbound into Denver International Airport and one helicopter flying low heading west. Noise from the aircraft was very noticeable and impacting the natural quiet that would have been present pre 1860. Due to the aircraft, I did not have what I would have called a "true wilderness experience," however even though a disturbance to me, the aircraft noise had no impact on wildlife that I observed. Wildlife behaved "naturally" when an aircraft flew overhead, since the aircraft were thousands of feet above the ground. The helicopter flying about 1,000 feet above the ground could have displaced large ungulates such as elk, deer and bighorn sheep if it had passed nearby, but it passed to the north of upper Forest Canyon and was far enough away to not

affect wildlife in the area.

On July 15, 2008 Trail Ridge Road that did not exist pre 1860 was quite noticeable from upper Forest Canyon (< 1.6 km, 1mi away) and even though the sound from automobiles was not heard, the sound from motorcycles was. I could also see park visitors, automobiles, trash cans and a wayside exhibit at the Gore Range Overlook and automobiles driving along Trail Ridge Road. The road, automobiles and visitors have a negative impact on wildlife that live near the road or cross it. Vehicles do kill wildlife at times and small mammals such as chipmunks, golden mantled ground squirrels, marmots and also birds such as Clark nutcrackers and common ravens are influenced at pullouts by visitors feeding them. Bighorn sheep occasionally lick antifreeze found on pavement at parking areas from overheated vehicles and coyotes sometimes become habituated taking handouts, and then becoming dangerous to humans. They sometimes have to be removed by park staff. Black bears often forage for human food at backcountry campsites in Forest Canyon or try to get to trash from trash cans. At times they have to be relocated or removed. The road, park visitors and vehicles, have minor to moderate impacts on wildlife in Upper Forest Canyon.

In the early morning there were no park visitors in the Forest Canyon Pass area, but as I was walking back to the Alpine Visitor Center along the trail in the afternoon, I passed 27 other people. These humans that visit Upper Forest Canyon are considered day use seasonal visitors to the park not living in upper Forest Canyon. Trail Ridge Road is closed to vehicles during the winter from about mid to late October to April, and Upper Forest Canyon is rarely visited by humans due to the harsh winter conditions. Camping is limited in Upper Forest Canyon today with no camping allowed in the krumholtz or alpine tundra at Forest Canyon Pass, unlike Native Americans that seasonally camped in the area. Visitors today do have an impact on wildlife they encounter, mostly due to temporally displacing animals or influencing them by feeding and habituation. Humans were present in Upper Forest Canyon pre 1860, but obviously looked much different, behaved differently and were doing different things back then, such as hunting. Their impacts on wildlife were significantly different. Hunting is not allowed in the park today, as it was a normal human activity before the establishment of the park. Elk, deer and bighorn sheep within Rocky Mountain National Park are habituated to humans in present time often showing little fear, but would probably have behaved differently when encountering humans 148 years ago.

Upper Forest Canyon had an abundance of game animals on July 15, 2008. These ungulates were considered abundant pre 1860, but by 1880 due to market hunting and development in their winter range, elk had been extirpated (NPS 2007). Elk were reintroduced into the area in 1913/1914. All the elk present in the park today are descendants from elk trapped from the Grand Teton/Yellowstone National Parks area and are not considered relic. The bighorn sheep noted on Specimen Mountain on July 15, 2008, are considered part of a relic herd that always existed in the area now known as Rocky Mountain National Park. Mule deer are also considered relic. Both bighorn sheep and deer were far more numerous in the park pre 1860 than they are in 2008 (Smith 1935, Yeager 1932). Settlement in the west introduced livestock along with their diseases, and development increased stress that lead to catastrophic die-offs of bighorn sheep in the Rocky Mountains (Wisehart 1978). Bighorn sheep in the park have suffered from bottlenecks and disease die-offs (Luikart et al. 2007). The total park population dropped from

thousands to ~ 200 in 1970. The population was back up to ~700 by 1989, but a pneumonia outbreak reduced the population size and lamb recruitment for years in the mid 1990s and the sheep in the park have not yet recovered to the 1989 level. A mark-resight study in 2003-2004 estimated the park population to be ~300 sheep.

The largest difference in wildlife in 2008 in Upper Forest Canyon verses pre 1860 is the absence of the gray wolf (*Canis lupus*) and the grizzly bear (*Ursus arctos*), which were extirpated by 1900. Both species had an influence on large ungulates, the wolf more than the grizzly bear, but both had an influence on humans. One other species that was probably present but now gone was the bison (*Bos bison*). Even though poorly known, remains were found in a number of areas within the park (Armstrong 2008). The animal was probably never abundant. This bison described as a mountain bison was often mentioned in historical accounts of the Rocky Mountains (Meagher 1978), but Skinner and Daisen (1947) classified the mountain bison with the subspecies wood bison (*Bison bison athabasca*). The last native bison killed in Colorado was in 1897. Buffalo found in Colorado in 2008 are classified as livestock and not considered free ranging.

Other carnivores most likely more common in the past was the Canada lynx (*Lynx canadensis*) and the wolverine (*Gulo gulo*). The lynx was at one time extirpated from Colorado, but has been reintroduced by the Colorado Division of Wildlife. Several animals have been observed in the park in recent years, not far from Upper Forest Canyon. The amount of snowshoe hare sign I observed on July 15 makes Upper Forest Canyon excellent lynx habitat.

The wolverine may be extirpated (Andrews 1991). There have been observations of what observers called wolverine in Upper Forest Canyon in the past 50 years, but not confirmed by photographs, scat, tracks or hair (Armstrong 2008, National Park Service 2008). Over 80 observations of wolverine exist in park files. Almost yearly, observations of the wolverine are documented. Based on the number of observations, there is a slight possibility a very small relic population in the North Central Mountains of Colorado that include Rocky Mountain National Park could still exist. Upper Forest Canyon is excellent wolverine habitat and credible observations in the area warrant further research. Agueri (2008) is currently conducting a carnivore survey that includes upper Forest Canyon. The wolverine has a very large home range so Forest Canyon would most likely be just a small part of an animal's territory.

Another species that was probably common pre 1860 and now considered rare to uncommon, but known to occasionally utilize Forest Canyon is the Northern river otter (*Lontra canadensis*). It is a species that was also extirpated from the park, but reintroduced in 1978 along the Colorado River. Its primary habitat within the park is the Colorado River within Kawuneeche Valley, but observations of probably one otter were noted in 1994 in Upper Forest Canyon, Sprague Lake and Estes Park (NPS 2008). The otter could have come up either Timber Creek or Beaver Creek from the Colorado River and crossed over the Continental Divide on Mount Ida Ridge into Forest Canyon and down the Big Thompson River into Estes Park.

The beaver (*Castor canadensis*) was not noted in Forest Canyon on July 15, 2008, but would probably have been in the canyon pre 1860. The beaver played a major role in the expansion and exploration of European immigrants due to the fur trade. The population in wetlands that are

now the park was unknown from 1860 to 1947 when Packard (1947) conducted the park's first beaver survey. The National Park Service trapped beaver between 1940 and 1960 (NPS 2007), significantly reducing the population of beaver in some areas of the park. When regular monitoring began in the 1970's biologists recorded a decline and the population has remained low since 1980 due to development, an over abundance of elk and the elk's impact on willow. Native Americans probably hunted beaver for food and its fur within Rocky Mountain National Park, but did not have as big an influence as European immigrants. The beaver's dams play a significant role in wetlands, creating ponds and slowing the movement of sediment, and its presence in the park is presently below natural levels. However, its habitat, beneficial to many animals, may not have included the high elevation willow at Forest Canyon pass. It may have included the Big Thompson River and Forest Canyon Lake below about 3,414m (11,200 ft).

There is one species of mammal that is hunted today near Rocky Mountain National Park that did not exist pre 1860. It is the mountain goat (*Oreamnos americanus*) that was introduced into Colorado in 1949 (Armstrong 2008). There is evidence from 650,000 to 800,000 years ago of an extinct species of mountain goat (*Oreamnos harringtoni*) that have been excavated from a site in South Park, but no evidence of the present day mountain goat existed until it was introduced. The introduced species of mountain goat did not enter Rocky Mountain National Park until 1994 when two were observed in Forest Canyon. The mountain goat's natural habitat begins about 500 miles north of Rocky Mountain National Park. Rocky Mountain National Park is managed for natural conditions and park staff does not believe the mountain goat would ever had naturally immigrated south into Colorado. Therefore, the park considers the present day mountain goat as an exotic species and any that enter the park are removed as humanely as possible. The two mountain goats observed in 1994 were trapped and relocated to Mount Evans south of the park. On August 13, 2008, I observed two possible mountain goats from the Forest Canyon Overlook. The animals were on the south side of Forest Canyon on steep rocky scree on the north side of Terra Tomah Mountain. Due to the distance, even with binoculars I could not confirm they were goats or bighorn sheep. Further observations with spotting scopes have not confirmed either goats or sheep in that area, but a park employee climbed Terra Toma Mountain in August and noted a lot of bighorn sheep scat (Paul McLaughlin, pers. obs.).

Another species of interest is the moose. In the early 1860's Milton Estes shot a moose from a band of elk within what is now Rocky Mountain National Park. Other Colorado records exist from the vicinity of Steamboat Springs and from southwest of Meeker Park (Armstrong 2008). The animal most likely existed in the park pre 1860, but probably only on an occasional basis. Armstrong (2008) does not consider the animal to have been a native resident of Colorado, but only occasional animals wandered down into Colorado from Wyoming. It was introduced into North Park, 55 miles from Rocky Mountain National Park in 1978 to help control willow encroachment in irrigated hayfields. It was documented in the park on a regular basis starting in 1985. It is a common species in the park today usually observed in lower elevation riparian wetlands, but occasionally observed in the alpine tundra and feeding on high elevation willow in areas such as upper Forest Canyon. It is speculative that the animal may have become a resident to the park naturally if they had not been introduced into North Park. In the park, it is now a year round reproducing resident.

Native Americans might have eaten greenback cutthroat trout, since it existed in the park pre

1860. Of interest is a fish barrier above Spruce Creek that keeps exotic rainbow or brook trout from the upper reaches of Forest Canyon and probably kept native trout pre 1860 from moving upstream. Park records indicate fish were stocked in Forest Canyon in the 1920's and in Arrowhead Lake in 1913, but no information exists if the trout existed naturally above the tributary of Spruce Creek. If they existed in the canyon before 1860 it may have been because of Native Americans trapping and moving trout, but this is doubtful since trout today in Forest Canyon are relatively small in size due to cold water and not optimal habitat. A question I have is would it have been worth the effort for Native Americans to introduce trout into Forest Canyon? Native American use of the park was seasonal and based on the number of game drives; it appears to me the emphasis was on hunting big game. Greenback cutthroat on the eastside of the Continental Divide have been displaced by exotic trout in most other areas of the park. Some high elevation lakes and streams that did not have any fish pre 1860 such as Arrowhead Lake have fish today because of introductions that include both exotic and native trout (Rosenlund and Kennedy 2001).

Upper Forest Canyon pre 1860 did not have air quality issues of concern that could impact wildlife, other than possible smoke from a wildland fire or from Native American ignited fires. On July 15, 2008, even though it was a beautifully clear day, air quality is a significant issue of concern to park managers and may have long-term impacts on wildlife. Research has been ongoing for over two decades that indicate nitrogen deposition is much higher today than it was pre 1860 (Baron 1991-2007, Baron et al. 2004). Studies in alpine tundra show that the trend in nitrogen deposition could change the plant distribution, density and cover of herbaceous plants (Baron et al. 1994, Bowman et al. 2006, Suding et. al. 2006). Impacts to diatoms have been noted in high elevation lakes based on sediment samples taken from lake bottoms (Wolfe 1999).

Perhaps another noticeable difference is the influence on park forests due to bark beetles. Rocky Mountain National Park is roughly 2/3 forested and one third tundra, and is presently experiencing the largest outbreak of bark beetles killing pines, spruce and firs since the park was established in 1915. In August 2007, an aerial survey documented about 56,000 acres (35%) of the park's forest had been impacted by bark beetles. It is expected that acres of impacted forest will increase significantly in 2008. It is also expected that most of the large diameter lodgepole pine and limber pine will succumb to the bark beetle in the next three to five years. There is ongoing research in the park predicting the impacts of climate change, insect outbreaks, and fire on Colorado lodgepole pine forests and if the scale of the current bark beetle outbreak ever happened in the past (Rocca 2008). We do know that some limber pines in the park are as old as 1,000 years that are now being killed by bark beetles. I speculate that the scale of the current outbreak did not happen within the past 900 years, since the older limber pine were not killed during this time. There is ongoing debate among forest ecologists if the beetle outbreak is natural or is influenced due to human caused global climate changes and fire suppression. Rocca hopefully will provide some insight on this question. We do know that milder winters, hot and drier conditions during the summer are stressing pine forests, and influencing bark beetles.

Conclusion

Wildlife in Forest Canyon, excluding the loss of the gray wolf and grizzly bear, even though not ecologically the same as pre 1860 are still considered biologically diverse with native species

that have existed for many centuries. The goals and objectives of the park's Master Plan and NPS guidelines for protecting natural resources for future generations is still largely met. From an ecological perspective the lack of two very important predators, and a low beaver population are major issues of concern for the park, but these loss of species have less of an influence in upper Forest Canyon than other areas. Climate change and air quality could have long-term impacts to plants and animals in Upper Forest Canyon.

What will Upper Forest Canyon look in the future? Most likely the geology will still be undistinguishable from 2008, but perhaps plants and animals may be significantly different. It depends on the influence of humans and if the National Park Service can continue to preserve and protect the natural resources of the park for future generations. Research, park management plans and databases have documented that more changes to natural resources and human influences on wildlife in Upper Forest Canyon have occurred since 1860 than before that point in time.

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Appendix D

Upper Forest Canyon Pass Research Project Botanical Inventory of Coring/Botanical Sampling Area on July 13, 2008 Conducted by Leanne Benton, Park Ranger and Karin Edwards, Botanist

The following species were identified within the Sampling Area, either by flowers or leaves. They are arranged alphabetically by family, and then by scientific names. The source used for names is *Plants of Rocky Mountain National Park*, by L.H. Beidleman, R.G. Beidleman, and B.E. Willard, St. Helena, MT, Falcon Publishing, 2000.

Scientific Name	Common Name	Family	Known Edible(E), Medicinal (M), Poisonous(P)	Species or genus Abundant (a), Common (c), Uncommon (u), Rare (r) for site
<i>Lidia obtusiloba</i>	alpine sandwort	Alsinaceae		u
<i>Stellaria longipes</i>	alpine starwort	Alsinaceae	genus E & M	u
<i>Angelica grayi</i>	Gray angelica	Apiaceae	E, genus M	r
<i>Pseudocymopterus montanus</i>	mountain parsley	Apiaceae		r
<i>Achillea lanulosa</i>	yarrow	Asteraceae	E (roots)*, M	c
<i>Antennaria spp</i>	pussytoes	Asteraceae	M	c
<i>Artemisia spp</i>	sagewort	Asteraceae		c
<i>Erigeron peregrinus ssp callianthemus</i>	subalpine daisy	Asteraceae		u
<i>Erigeron simplex</i>	alpine fleabane	Asteraceae		c
<i>Senecio crassulus</i>	thickbract senecio	Asteraceae		u
<i>Senecio triangularis</i>	triangularleaf senecio	Asteraceae		r
<i>Taraxacum officinale</i> (non-native)	common dandelion	Asteraceae	E & M	r
<i>Mertensia ciliata</i>	tall chimingbells	Boraginaceae	E	u
<i>Mertensia lanceolata</i>	lanceleaf chimingbells	Boraginaceae		locally c
<i>Noccaea Montana</i>	mountain candytuft	Brassicaceae		locally c
<i>Clementsia rhodantha</i>	rose crown	Crassulaceae	E	u
<i>Rhodiola integrifolia</i>	kings crown	Crassulaceae	E	u
<i>Carex spp</i>	sedge spp	Cyperaceae		c
<i>Carex aquatilis</i>	water sedge	Cyperaceae		locally a
<i>Kalmia microphylla</i>	swamp laurel	Ericaceae	P	r
<i>Vaccinium cespitosum</i>	subalpine blueberry	Ericaceae	E & M	c
<i>Vaccinium myrtillus ssp oreophilum</i>	myrtleleaf blueberry	Ericaceae	E & M	c
<i>Vaccinium scoparium</i>	broom huckleberry	Ericaceae	E & M	c
<i>Trifolium dasyphyllum</i>	alpine clover	Fabaceae		c
<i>Trifolium parryi</i>	Parry clover	Fabaceae		locally c
<i>Gentianodes algida</i>	arctic gentian	Gentianaceae		u
<i>Pneumonanthe parryi</i>	Parry gentian	Gentianaceae		r
<i>Ribes montigenum</i>	red-fruited gooseberry	Grossulariaceae	E, genus M	locally a
<i>Aconitum columbianum</i>	monkshood	Helleboraceae	P	r
<i>Psychrophila leptosepala</i>	white marsh-marigold	Helleboraceae	E&M;P(in large amts)	locally c
<i>Trollius albiflorus</i>	globeflower	Helleboraceae		u
<i>Luzula spp</i>	woodrush	Juncaceae	E	u
<i>Lloydia serotina</i>	alpine lily	Liliaceae	E&M	locally c
<i>Abies bifolia</i>	subalpine fir	Pinaceae	E & M	a
<i>Picea engelmannii</i>	Engelmann spruce	Pinaceae	E & M	a
<i>Alopecurus alpinus</i>	alpine foxtail	Poaceae		u
<i>Deschampsia cespitosa</i>	tufted hairgrass	Poaceae	E & M	c
<i>Helictotrichon mortonianum</i>	alpine oatgrass	Poaceae		u

<i>Poa spp</i>	grass spp	Poaceae		c
<i>Polemonium pulcherrimum ssp delicatum</i>	subalpine Jacobs-ladder	Polemoniaceae		u
<i>Bistorta bistortoides</i>	American bistort	Polygonaceae	E & M	c
<i>Oreobroma pygmaea</i>	pygmy bitterroot	Portulacaceae	E & M	locally a
<i>Androsace septentrionalis</i>	northern rockjasmine	Primulaceae		u
<i>Pyrola spp (either chlorantha or minor)</i>	pyrola	Pyrolaceae	genus M	u
<i>Anemonastrum narcissiflorum ssp zephyrum</i>	narcissus anemone	Ranunculaceae	P	u
<i>Ranunculus adoneus</i>	snow buttercup	Ranunculaceae	genus P (if eaten raw)	locally c
<i>Ranunculus alismifolius var montanus</i>	caltha-flowered buttercup	Ranunculaceae	genus P (if eaten raw)	u
<i>Ranunculus eschscholtzii</i>	subalpine buttercup	Ranunculaceae	genus P (if eaten raw)	u
<i>Acomastylis rossii ssp turbinata</i>	alpine avens	Rosaceae		c
<i>Potentilla diversifolia</i>	blueleaf cinquefoil	Rosaceae	genus M	c
<i>Sibbaldia procumbens</i>	cloverleaf rose	Rosaceae		locally c
<i>Salix arctica ssp petraea</i>	arctic willow	Salicaceae	genus M	c
<i>Salix brachycarpa</i>	grayleaf willow	Salicaceae	genus M	**
<i>Salix planifolia</i>	Nelson willow	Salicaceae	genus M	**
<i>Micranthes odontoloma</i>	brook saxifrage	Saxifragaceae		u
<i>Micranthes rhomboidea</i>	snowball saxifrage	Saxifragaceae		locally c
<i>Castilleja rhexifolia</i>	rosy paintbrush	Scrophulariaceae	genus P w/selenium	r
<i>Pedicularis bracteosa ssp paysoniana</i>	bracted lousewort	Scrophulariaceae		c
<i>Pedicularis groenlandica</i>	elephantella	Scrophulariaceae	M	locally c
<i>Pedicularis parryi</i>	Parry lousewort	Scrophulariaceae		u
<i>Penstemon whippleanus</i>	Whipple penstemon	Scrophulariaceae	genus M	u
<i>Veronica nutans</i>	alpine speedwell	Scrophulariaceae		u
<i>Viola labradorica</i>	blue violet	Violaceae	genus E	c

Sources for cultural uses of plants:

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A note about commonality of species: These designations are somewhat subjective, assigned three months after the inventory was completed, and from memory. A *rare* designation was given to those species seen only once or twice, *uncommon* given to those seen less than ten times, *common* given to those seen numerous times and generally in several locations, and *abundant* given to those that were dominant and generally in several locations. Because the sampling area consisted of a wetland and some forested slopes no single species were found

throughout the entire sample area. It is interesting to note some of the most common alpine species (typically found in fellfields and dry meadows) are absent from this inventory: moss campion, *silene acaulis ssp subacaulescens*; and dwarf clover, *trifolium nanum*.

*Yarrow roots are used for food by many Native American groups. *Note and designation added by RHB.*

**Note about willow. Either or both of the willow species, *Salix brachycarpa* and *Salix planifolia*, were abundant in the wetland area.