Repeat Photography in Southeastern British Columbia:

100 Years of Landscape Change

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December 22, 1995

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ABSTRACT

Located in Southeastern British Columbia, Kootenay National Park was established in 1920, and is part of the Four Mountain Parks System (Yoho, Kootenay, Jasper and Banff). Since the time of Kootenay Park's establishment, landscapes both in and around the park have undergone significant changes. This preliminary report discusses the results of an historical photo search, one portion of a larger project "Ecological History of the Central Rockies, Eastern Columbia Mountains, and Rocky Mountain Trench" presently underway in Kootenay National Park. This report identifies historical photos which would could be used to determine changes in local ecosystems through the process of repeat photography, and discusses findings that might be anticipated once the photo repeat work is completed.

TABLE OF CONTENTS

Abstract..... i

Table Of Contents..... ii

List of Figures..... iii

Acknowlegements..... iv

1.0 Introduction..... 1

2.0 Study Area..... 2

3.0 Methods..... 5

3.1 Photo Selection Criteria..... 5

4.0 Results..... 5

5.0 Discussion..... 8

5.1 Rocky Mountain Trench-IDF Biogeoclimatic Zone..... 8

5.2 Montane-Spruce/ESSF Biogeoclimatic Zone..... 10

5.3 Alpine Zone..... 11

6.0 Conclusion..... 12

7.0 Literature Cited..... 14

LIST OF FIGURES

Figure	Page No.
Figure 1. Map and Physiographic subdivisions of Kootenay National Park (from Achuff et. al. 1984)	3
Figure 2. Distribution of Ecoregions in KNP (from Achuff et. al. 1984)	4
Figures 3a and 3b. The Columbia Valley (near Invermere) in (a) 1906 and (b) 1990.	7
Figure 4. "Parklands at Windermere". Photo (ca. 1911) depicting typical Douglas Fir forest in the Lake Windermere area	9

ACKNOWLEDGMENTS

There are almost too many people to thank for their assistance, ideas and guidance for this project. But I will start by thanking my supervisors, Danny Catt and Alan Dibb. Firstly, I would like to thank Danny for opening the doors for my involvement in this project; his knowledge, experience and guidance was always appreciated and willing given. Alan was subjected to constant questions and requests for materials from me, and he always took the time to provide needed information or answers - in spite of a very full plate. Thank you both for your encouragement and support.

Graham MacDonald from Parks Canada Western Regional Office in Calgary proved to be ever helpful: providing names of contacts, useful suggestions, and a showing a willingness to discuss and take an interest in every aspect of the project. Darryl White's (Fort Steele Historical Park) assistance was invaluable: helpful and more than accommodating in spite of his enormous workload, Darryl always went the extra mile. The Windermere District Historical Society (Ann Newhouse, Jarryl MacIssac and Arnor Larson) were able to provide many excellent photos and reproductions and resources. As well, The Glenbow Museum, The Whyte Museum of the Rockies, and the Provincial Archives provided research materials and facilities and helpful staff.

Larry Halverson, Brian Sheehan, Byron Irons, Gloria Hendry and rest of the Kootenay Parks staff, as well as Cliff White from Banff National Park: thank you all for being willing to help whenever it was asked of you. I also would like to thank Shelagh W. for her support and enthusiasm during my final days on the project. Good Luck and have fun, Shelagh!

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1.0 Introduction

Landscapes, or ecosystems, are dynamic and ever-changing. Prior to European settlement, changes to North American landscapes have occurred via natural processes such as climate, gravity, and chance occurrences; as well as by deliberate manipulations by natives (e.g. seasonal fires). In more recent times (i.e. the last 70-100 years) the influence of humans and human development within their environment has become more profound and pronounced through agricultural and resource extraction and management. Coupling human-induced changes within landscapes to changes in natural cycles of climate and fire, some environments presently exhibit significant departures from their ecological characteristics in the not so distant past.

The National Parks Act requires that ecological integrity be the first priority for park management plans (Woodley 1993 in Kay et. al. 1994). Recognizing that our national parks' lands and wildlife are intimately connected to the the larger landscapes around them, the challenge has become how to best manage the long-term health of protected areas that are: experiencing increased development demands within boundary areas; isolated or islandized from other wilderness areas; affected by global environmental changes; and shoulder-to-shoulder with adjacent lands undergoing changes in use and increased development.

It is important to understand what the "naturalness" of an ecosystem is if it is to be effectively managed. In order to establish a benchmark for measuring ecological integrity and health, or naturalness, work is currently underway in Kootenay National Park (KNP) that will measure past ecological conditions. KNP's Ecohistory Project is a multi-discipline study involving archaeology, aspen ecology, palynology, fire history, oral history, and the topic of this report, repeat photography work. It is hoped that the individual pieces of the project will provide an accurate picture of the whole, establishing in some quantifiable way the present state of Kootenay Park's ecosystem as compared to past conditions.

The saying "a picture is worth a thousand words" stands true in the context of examining localized landscape changes over the relative short term. Several researchers (Kay et. al. 1994, Gruell 1983, Chadde and Kay 1991) have used repeat photography to successfully illustrate short-term changes within a landscape. This process is currently underway in KNP. Once completed, the original photos and their repeats will provide, in pictorial terms, an examination of recent landscape changes and results of human influences in and around KNP and the Southern Rocky Mountains and Trench. These changes will be considered within the context of longer-term conditions found within the park and area (through the other project components), and the findings applied to Park Management decisions and policies. The findings would also provide valuable information for other resource management agencies currently operating in the area.

In the Kootenay National Park area, approximately 300 photos have been obtained that are potentially suitable for repeat photography. These photos will be examined in terms of potential wildlife habitat, and clues to past fire history and human influences within the environment in order to establish what landscape changes have occurred in the short-term.

2.0 Study Area

Kootenay National Park is relatively long and narrow, encompassing 1406 km^2. It outlines portions of two strongly linear river valleys (Kootenay and Vermilion Rivers), forming the shape of a dog-leg (see Figure 1). Roughly 85 km in length and 15 km wide, the park is located between 50" 34' and 51" 19' N, and 115" 48' and 116" 22' W. Centrally bisecting the park is the Banff-Windermere Highway. This two-lane highway was the key element behind the establishment of the park in 1920, and the park's boundaries reflect the scenic corridor of the highway rather than ecological zones or boundaries.

Most of the park is situated in the Eastern and Western Main Ranges, and the Western Ranges of the Rocky Mountains (Figure 1). A narrow ribbon of land falls within the Southern Rocky Mountain Trench at the park's southwestern edge (Achuff et.al. 1984). Achuff describes three main ecoregions in Kootenay Park - Montane, Subalpine (Upper and Lower), and Alpine

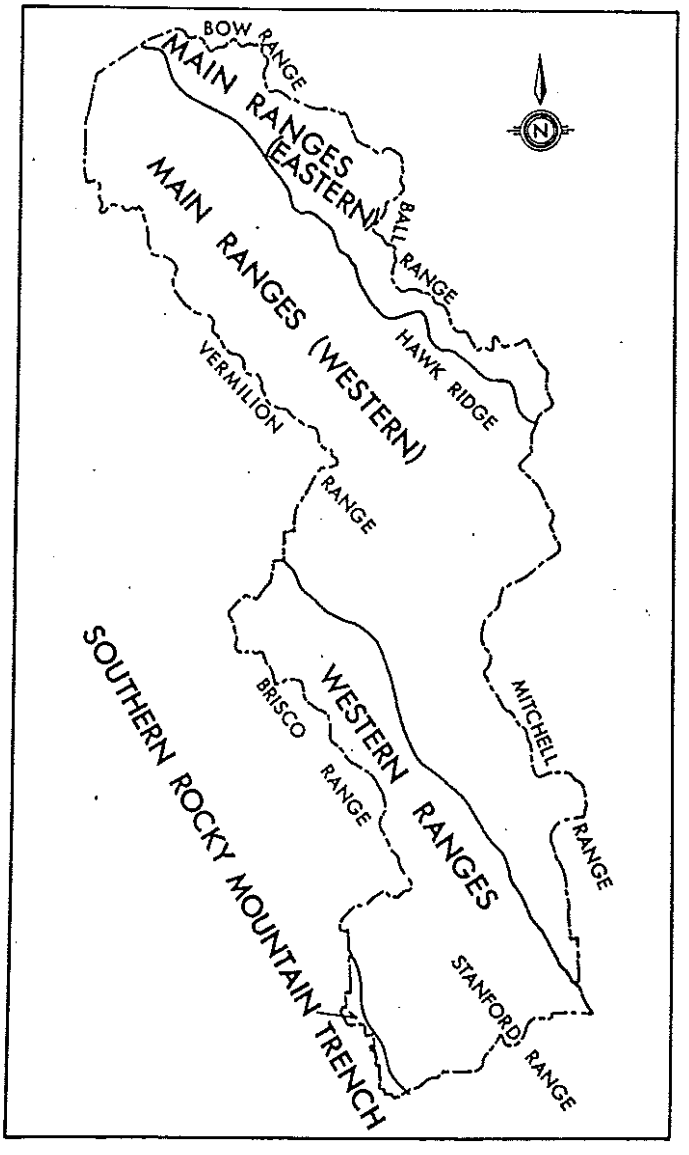

Figure 1. Map and Physiographic subdivisions of Kootenay National Park (from Achuff et. al. 1984).

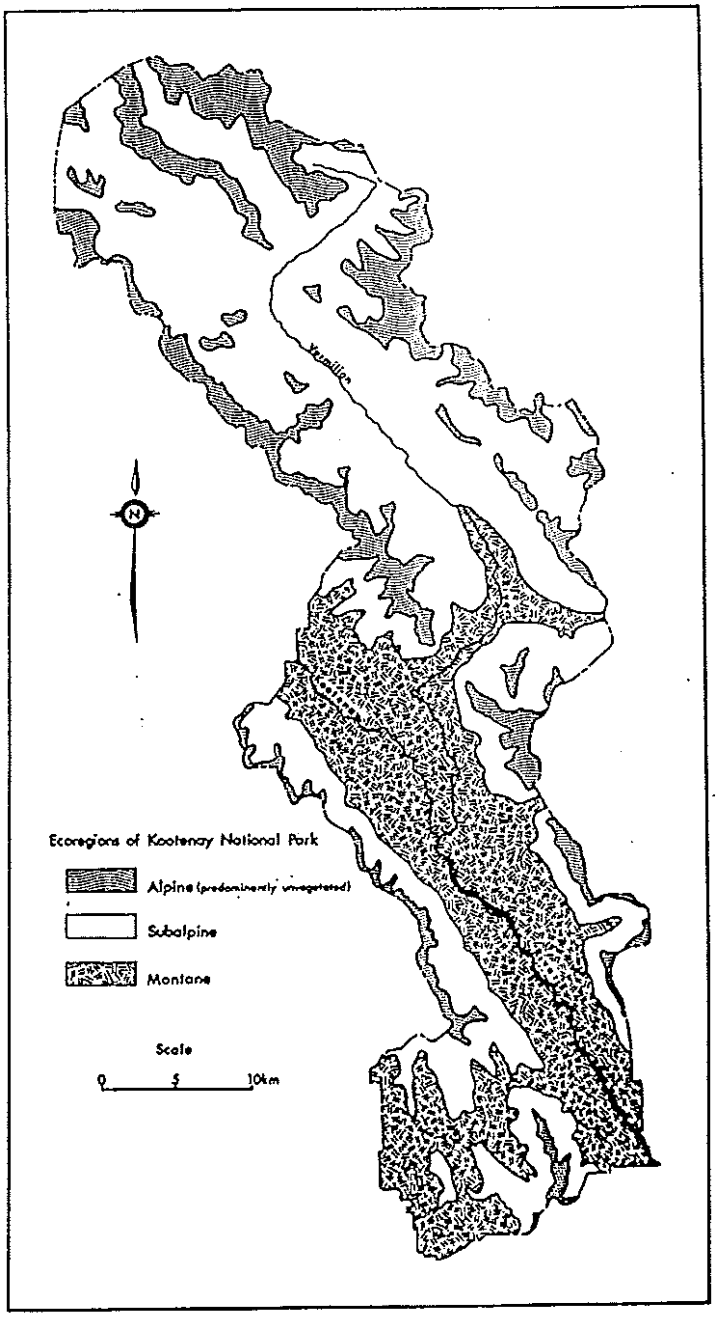

Figure 2. Distribution of Ecoregions in KNP (from Achuff et. al. 1984).

(Figure 2). Following Meidinger and Pojar (1991), the park's vegetation can also be classified as Alpine Tundra, Englemann Spruce-Subalpine Fir (ESSF), Montane-Spruce (MS), and a small area of Interior Douglas Fir (IDF) in the south Rocky Mountain Trench region of the park.

3.0 Methods

Although Kootenay National Park was the main area of study, the photo archive search was conducted with the understanding that the park lies within a larger landscape, and park boundaries do not reflect ecological boundaries. Searches for pre-1930 photos depicting local landscapes were conducted in provincial and local museums, including B.C. Provincial Archives, The Glenbow Museum, The Whyte Museum of the Rockies, Windermere District Historical Society archives, Golden and District Museum, Fort Steele Historical Park archives; preliminary work has been conducted off-site with the National Archives and the National Air Photo Library.

3.1 Photo Selection Criteria

Criteria used to evaluate the suitability of a photo as a repeat candidate were as follows (based on Gruell 1983):

1. Photos depicting landscapes in the Upper Columbia and Kootenay River regions of the East Kootenays were highest priority, as well as any pictures taken within Kootenay National Park and the area directly surrounding it. Other regions were considered if the photos were of excellent quality or depicted similar vegetation.
2. Pre-1930 photos were preferred. More recent photos were considered if the quality was exceptional or the subject matter was unique.
3. Good quality photos only were considered. If photo quality was marginal, but the photo subject matter was unique or exceptional, then the photo was considered as a repeat candidate.
4. Photos had to portray a distinguishable landmark or recognizable feature that would facilitate relocation and repeat work.

4.0 Results

Approximately 300 photos for all ecoregions of Kootenay National Park and the Columbia

Valley were located, as well as photos taken in the Ponderosa Pine/Douglas Fir zone transition areas south of the park in the Rocky Mountain Trench (Fort Steele/Cranbrook), and the southernmost Rocky Mountain region of B.C. in the Fernie/Bull River area.

The earliest repeatable photos of the Columbia Valley region are from ca. 1906-14, by H.W. Gleason, a resident of the Valley and professional photographer. His landscape photos depict the Upper Columbia region prior to significant European influences, although agricultural practices and homesteading was on the increase at the time. His work has resulted in many high quality pictures of the study area from Canal Flats to just south of Radium Hot Springs, one of which has already been repeated in Kay et. al. 1994 (see Figures 3a and 3b). There are also several photos from his collection taken in the Toby Creek Valley and Earl Grey Pass areas of the Purcell Mountains.

The earliest photos available for land within the park boundaries are late 1890's photos of the hot springs themselves, as well as one photo of Sinclair Canyon prior to any road development. Various landscape photos of Kootenay and Vermilion River valleys are available from the early 1920's to mid-30's, just after the park was established. These constitute the bulk of pictures available for Kootenay Park, and are excellent quality photos presumably intended for publicity shots and tourist brochures.

A series of photos were taken in the late 1800's by the Dominion Government for the production of topographical maps of the area now known as Kootenay National Park. National Archives staff members are currently searching archive files, and these photos (if they still exist) will be valuable additions to the photographic collection. There is also a collection of airphotos taken in the mid to late 1940's covering the Rocky Mountain Trench from Golden to Cranbrook, and the Kootenay/Vermilion Rivers, available at the National Air Photo Library in Ottawa. The air photos may be useful for examining patterns of development and agricultural influences in the Rocky Mountain Trench and the Columbia River Wetlands.

Figure 3a. This 1906 photo was taken approximately 20 years after the first European permanently settled in the valley. The valley bottom and south facing slopes are predominantly open, grassy forests, described by early settlers and travelers in the area as parkland (Parker 1911); David Thompson reveals in his journals that timber is only found in the gullies and ravines (Belyea 1994) when he arrived in the Lake Windermere region in about 1808.

Figure 3b. This photo, taken in the same location by Cliff Whyte of Banff National Park 84 years later (1990), demonstrates the amount of forest ingrowth that has occurred in this area. Grassy, open forests have been replaced by dense closed-canopy forests of Douglas Fir, reducing the value of this habitat for animal species that rely on open grass-forb forest types.

5.0 Discussion

From initial observations and without the benefit of repeat photography being completed, it is apparent that landscapes in all regions of the study area have changed to varying degrees. The most significant changes appear to be in the lower elevations of the Rocky Mountain Trench in the Columbia Lake and Lake Windermere area, as well as the Fort Steele/Kootenay River region. These areas are representative of IDF and Ponderosa Pine ecological zones, as well as transitional zones between the two. (At the time of writing, many photos were not available for reproduction in this report. Any relevant available photos have been included.)

5.1 Rocky Mountain Trench - IDF Biogeoclimatic Zone

Photos from the turn of the century taken in this area show open, grassy forests where trees are generally larger, widely spaced, and have few lower branches (Figure 4) than present day forests. Early pictures suggest that frequent low-intensity ground fires occurred regularly in the Rocky Mountain Trench and western slopes of the Rockies, and the forests reflect this fire history in the archival photos..

There is insufficient data available regarding the fire history of the forests in the Upper Columbia region, but it is likely that native burning was practiced in this part of the province. Turner (1991) indicates that Kootenay Indians to the south and west of the study area knew of the practice of seasonal burning, and David Thompson mentions winter and summer fires set by the Kootenays in the Columbia Valley (Belyea 1994). With the arrival of European settlers in the late 1800's and early 1900's, there is little evidence that this practice continued.

The elimination of native seasonal burning combined with active fire suppression have altered the forest structure from that seen in early photos. Without frequent fires, conifer seedlings are not thinned and the forest reverts from an open, park-like state to a dense forest with increased canopy cover. This trend was demonstrated by Ohanjanian (1993) when she examined grasslands in the Columbia Valley by comparing 1946-47 air photos to ones taken in 1988. Although changes were not quantified, she found a general decline in the overall area and condition of grassy IDF

Figure 4. "Parklands at Windermere". Photo (ca. 1911) depicting typical Douglas Fir forest in the Lake Windermere area. This photo shows what is presumed to be a typical forest in the Lake Windermere area of the Rocky Mountain Trench: large, widely-space Douglas Fir trees with a grass/forb community understory. Note that there appears to be few (none) regenerating seedlings or saplings in this photo, and that there are few or no live branches on the lower portion of the trees. This pruning could be due to a) cattle grazing, or b) frequent low-intensity fires. Photo courtesy B.C. Provincial Archives and Records Service - ref. #ZZ-95121.

communities in the past 50 years due to ingrowth and grazing pressure, but also suggests that the photos may not accurately reflect changing conditions because of the short time frame (<50yrs). Numerous sites in her study area included old Douglas Fir stumps that were large (> 60 cm dbh) and widely spaced (6 to 10 m), indicating that the forest conditions prior to logging activity was more open and park-like.

Reduced fire-frequency also results in the build up of fuels on the forest floor, increasing the chances of intense, stand-replacing crown fires (Mutch 1994). In the 1930's, prior to effective large-scale fire fighting techniques, much of the Rocky Mtn. Trench region was burned in large, intense stand-replacing fires (I. Jack; J. Conroy; pers. comm.). As a result, the forest cover in these areas today is predominated by Douglas Fir (*Pseudotsuga menziesii*) and Western Larch (*Larix occidentalis*), two species that benefit from the presence of fire and have now formed relatively dense, closed canopy stands throughout most of this region.

Barrett and Arno (1982) examine the importance of native burning prior to European settlement in the Northern U.S. Rockies, and suggest that the elimination of native burning has significantly altered portions of the landscape in the study area (south of this study area). The influence of European settlement on Ponderosa Pine forest structure has also been the subject of numerous studies (Covington and Moore 1994; Cooper 1969). It would be reasonable to expect that similar studies in the East Kootenays would produce similar results: a shift from a grass-forb open timber forest structure to old-growth forest over dense, young trees with a closed canopy and minimal forb, as the archival photos taken in the Rocky Mountain Trench suggest.

5.2 Montane-Spruce/ESSF Biogeoclimatic Zone

Pictures taken from the Sinclair Summit Viewpoint in KNP in the late 1920's show the effects of a large burn, which occurred after a prolonged hot and dry weather pattern in 1926. This fire, similar to fires in the Kananaskis Valley (Johnston and Larson 1991), burned several miles of the Kootenay River valley and resulted in an extensive even-aged lodgepole pine forest. Forests depicted in photos taken in the same area of the park during road construction prior to the

burn (ca.1912-25) show that similar fire activity had occurred there, probably within the last 60 years. Several other photos also suggest that large, stand-replacing fires were not uncommon, having occurred in the Sinclair watershed in 1886 and the Storm Mountain area around the turn of the century.

Masters (1989, 1990) indicates that fire frequency in KNP has changed since the 1780's and now follows a much longer cycle, but he maintains that fire has been an important force shaping the montane forests of the park. Similar changes in forest fire frequency have been found in the Kananaskis Valley (Eastern Range of Rockies) and in Glacier National Park by Johnson (1991 and 1990), although it is unclear whether this change is due to natural climatic shifts as the researchers argue, or some other cause. One suggestion put forth by David White, archaeologist with the U.S. Forest Service in Libby Montana, is that the change in fire frequency coincides with the reduction of aboriginal populations due to a serious smallpox epidemic in Western Canada and U.S. (D. White, pers. comm.) at around 1760-80. This epidemic reduced the numbers of many native communities east and west of the Rockies by half or more. Because of the losses of life and the associated impacts on the surviving peoples, it is possible that traditional practices such as seasonal burning may have been altered, this in turn having an effect on fire cycles.

5.3 Alpine Zone

Few pictures were found in the photo search which were taken in the alpine ecoregion, although several photos of mountain ranges include the alpine areas, but these photos are taken from a distance. It is likely that this ecoregion will have changed the least, except perhaps in areas of high use (i.e. Floe Lake area, Magog Lake in Assiniboine) where changes due to human influences and development will be obvious. Even though lightning strikes are common in the alpine region, fire frequency is relatively low, regardless of fire suppression (Rogeau 1994). This is thought to be because plant growth and fuel build-up is very slow, and available fuels tend to be moister. Generally, it is anticipated that few noticeable changes in vegetation have occurred in the alpine, with the exception of the high-use areas noted above.

6.0 Conclusion

In order to maintain "healthy" ecosystems today and in the future, it is essential that past ecological processes and conditions are known. Repeat photography work can provide many clues about the most recent changes in landscapes or vegetation. Without the benefit of the repeat photography, only very general conclusions can be drawn regarding the most obvious changes in landscapes and vegetation from what is seen in the original photographs. With the completion of the repeat photography, actual changes in the landscapes will be more readily identifiable. The completed repeat photo sets will contribute significantly to the knowledge of past and present ecological processes operating in the Central Rockies and Rocky Mountain Trench region.

Even without the repeat photography completed, the historical photos obtained suggest that the most dramatic and obvious changes in the last 100 years have occurred in the Rocky Mtn. Trench and the Western Rockies. In order to understand the scope of these changes, there needs to be further research regarding the climate and fire history of the area prior to European influences, agriculture, and fire-suppression. Research examining present-day forest characteristics and structure, and how this forest structure compares to past conditions would be useful. Quantitative research measuring the amount and rate of decline in grasslands through ingrowth and advancing forest succession in the Rocky Mountain Trench is also needed. How these changes in vegetation structure affect wildlife species dependent upon the open, grassy, forested habitat that existed in the recent past are also needed in order to properly manage for the maintenance of ecosystems in this region.

Within the boundaries of Kootenay National Park, advancing forest succession threatens aspen stands and their dependent wildlife species (Kay 1995). The extent of this problem needs to be examined in greater detail, and management alternatives need to be agreed upon which would maintain or enhance the health of existing aspen stands within the park and surrounding area, thereby ensuring adequate habitat for aspen-dependent species. Work is currently planned for the 1996 season that will add to previous research by Kay in 1995 regarding aspen stands in KNP.

One major gap in the understanding of the role that fire has had in shaping the landscape of Kootenay Park and the Central Rockies concerns the observed change in the forest fire cycle in recent years; the fire cycle has decreased significantly since the mid-1700's, and again in the early 1900's (Johnson et. al. 1990; Masters 1989, 1990; Johnson and Larsen 1991). Researchers have argued that climate is the primary factor influencing this change in the fire cycle, but this argument is not supported by everyone (Kay et. al. 1994; Kay and White 1994). It could be that changes in the fire cycle are due to altered patterns of native burning, or some other reason not yet considered. More research on the effects of climate and the extent and nature of native burning is needed.

As part of the Ecological History of the Central Rockies project, research is currently being conducted in several disciplines in KNP and the region. Completed work will include paleoecology, archaeology, fire history in the Central Rockies, as well as other areas of study. This research will provide answers to many questions concerning the ecological history of this part of the Kootenays. With a cooperative interagency effort, the geographic scope of the repeat photography work could be expanded to include major portions of ecoregions of the Central Rockies, Rocky Mountain Trench and Columbia Mountains. The information gained from this type of research would greatly add to our understanding of recent changes in landscapes and ecological processes. This added knowledge would enable land, wildlife, and resource managers to make more informed decisions about management issues affecting East Kootenay ecosystems today, and in the future.

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