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Long-Term Ecosystem States and Processes
in
Banff National Park
and
the Central Canadian Rockies



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TABLE OF CONTENTS

| | Page |
|--|------------|
| ACKNOWLEDGEMENTS | iii |
| TABLE OF CONTENTS | v |
| LIST OF TABLES | vii |
| LIST OF FIGURES | ix |
| ABSTRACT | xiii |
| CHAPTER | |
| I. INTRODUCTION | 1-1 |
| LEGISLATIVE MANDATE | 1-1 |
| BANFF MONTANE ECOSYSTEM MODEL | 1-1 |
| THE PROBLEM | 1-9 |
| METHODS | 1-10 |
| II. HISTORICAL OBSERVATIONS | 2-1 |
| INTRODUCTION | 2-1 |
| RESULTS AND DISCUSSION | 2-3 |
| Foothills | 2-3 |
| Rocky Mountains | 2-5 |
| Columbia Valley | 2-19 |
| TABULAR SUMMARIES | 2-20 |
| JUDGING THE VALIDITY OF EARLY REPORTS | 2-31 |
| WHY DID EARLY EXPLORERS SEE SO LITTLE GAME? | 2-33 |
| SUMMARY AND CONCLUSIONS | 2-36 |
| III. ARCHAEOLOGICAL EVIDENCE | 3-1 |
| INTRODUCTION | 3-1 |
| BANFF NATIONAL PARK | 3-2 |
| JASPER NATIONAL PARK | 3-8 |
| KOOTENAY NATIONAL PARK | 3-11 |
| YOHO NATIONAL PARK | 3-11 |
| ALBERTA'S EASTERN SLOPES | 3-11 |
| BRITISH COLUMBIA | 3-14 |
| SUMMARY | 3-18 |
| WHY ARE ELK SO RARE IN ARCHAEOLOGICAL SITES? | 3-19 |
| BONE GREASE PROCESSING | 3-25 |
| IV. REPEAT PHOTOGRAPHS | 4-1 |

| | | |
|--------------|--|------------|
| | INTRODUCTION | 4-1 |
| | PAIRED PHOTOS | 4-2 |
| | SUMMARY AND CONCLUSIONS | 4-26 |
| | COMPARISON WITH OTHER AREAS | 4-26 |
| V. | FIRE HISTORY AND ECOLOGY | 5-1 |
| | INTRODUCTION | 5-1 |
| | FIRE IGNITION | 5-1 |
| | FIRE BEHAVIOR | 5-8 |
| | LANDSCAPE LEVEL BURNING PATTERNS | 5-12 |
| | AREA FIRE REGIMES | 5-12 |
| | HUMAN INFLUENCES | 5-19 |
| | BANFF'S ECOSYSTEM MODEL | 5-27 |
| VI. | ASPEN ECOLOGY..... | 6-1 |
| | INTRODUCTION | 6-1 |
| | BANFF NATIONAL PARK | 6-2 |
| | Inside-Outside Park Comparisons | 6-2 |
| | Aspen Exclosures | 6-8 |
| | Aspen Burns | 6-18 |
| | KOOTENAY NATIONAL PARK..... | 6-23 |
| | YOHO NATIONAL PARK | 6-26 |
| | SUMMARY AND CONCLUSIONS | 6-28 |
| VII. | SUMMARY AND DISCUSSION..... | 7-1 |
| | ASPEN | 7-1 |
| | FIRE | 7-1 |
| | ELK..... | 7-2 |
| | WOLVES..... | 7-3 |
| | HUMANS..... | 7-7 |
| | MOUNTAIN BISON..... | 7-11 |
| | MANAGEMENT CONSIDERATIONS..... | 7-12 |
| VIII. | FURTHER RESEARCH NEEDS..... | 8-1 |
| | LITERATURE CITED..... | 9-1 |

LIST OF TABLES

| Table | Page |
|---|------|
| 2.1 Foothills: Part I – Animals observed | 2-21 |
| 2.2 Foothills: Part II – Animal sign..... | 2-22 |
| 2.3 Foothills: Part III – Animals killed | 2-23 |
| 2.4 Rocky Mountains: Part I – Animals observed..... | 2-24 |
| 2.5 Rocky Mountains: Part II – Animal sign | 2-25 |
| 2.6 Rocky Mountains: Part III – Animals killed..... | 2-26 |
| 2.7 Columbia Valley: Part I – Animals observed..... | 2-28 |
| 2.8 Columbia Valley: Part II – Animal sign..... | 2-29 |
| 2.9 Columbia Valley: Part III – Animals killed | 2-30 |
| 3.1 Ungulate remains recovered from the Vermilion Lake sites (153R, 502R; EhPv-8) in Banff National Park | 3-3 |
| 3.2 Ungulate remains recovered from archaeological sites in Banff National Park. Part 1: Number of identified specimens | 3-4 |
| 3.3 Ungulate remains recovered from archaeological sites in Banff National Park. Part 2: Minimum number of individuals..... | 3-5 |
| 3.4 Comparison of the relative abundance of ungulates wintering in the Bow Valley portion of Banff National Park during the 1980s with the relative abundance of ungulate remains recovered from archaeological sites in the same area..... | 3-7 |
| 3.5 Ungulate remains recovered from Jasper House (230R) in Jasper National Park | 3-10 |

| Table | Page |
|--|------|
| 3.6 Ungulate remains recovered from Alberta eastslope archaeological sites | 3-12 |
| 3.7 Ungulate remains recovered from archaeological sites in British Columbia. Part 1: Number of identified specimens | 3-16 |
| 3.8 Ungulate remains recovered from archaeological sites in British Columbia. Part 2: Minimum number of individuals | 3-17 |
| 5.1 Ignition source, location, and timing of fires in the northern Rocky Mountains..... | 5-3 |
| 5.2 Recent burn area statistics and current fire cycles for the Canadian Rockies | 5-14 |
| 5.3 Mean historical fire intervals for forests in the northern Rocky Mountains..... | 5-15 |
| 5.4 Area burned and number of fires greater than 40 ha during natural and historic periods in Banff National Park | 5-20 |
| 6.1 Summary of elk use and aspen regeneration on burns in Banff National Park..... | 6-22 |
| 7.1 The impact of carnivore predation on caribou populations in Canada and Alaska..... | 7-5 |

LIST OF FIGURES

| Figure | Page |
|--|------|
| 1.1 Map of the Southern Canadian Rockies and the Central Canadian Rockies Ecosystem..... | 1-2 |
| 1.2 A simple model for Banff's lower Bow Valley and the Central Canadian Rockies that incorporates elk, aspen, wolves, fire, and humans as key ecosystem components..... | 1-4 |
| 2.1 The combined routes of early explorers in the Canadian Rockies..... | 2-2 |
| 3.1 An example of ungulate bones typically unearthed at archaeological sites in the Canadian Rockies | 3-26 |
| 4.1 Mount Norquay and Banff townsite viewed northwest from Tunnel Mountain in 1902 and 1984 | 4-2 |
| 4.2 Banff townsite and the Bow Valley viewed northeast from Sulphur Mountain in 1898 and 1981 | 4-4 |
| 4.3 Cascade Mountain viewed north from the Bow Valley in 1886 and 1981 | 4-6 |
| 4.4 Hoodoos near Banff townsite viewed southeast in 1890 and 1981 | 4-8 |
| 4.5 Banff's Hoodoos viewed northwest in 1894 and 1985 | 4-10 |
| 4.6 Banff's Bow Valley viewed north above the Hoodoos in 1889 and 1985 | 4-12 |
| 4.7 View west up the Bow Valley in 1914 and 1983..... | 4-14 |
| 4.8 Hillsdale Meadows west of Banff townsite in ca. 1907 and 1986 | 4-16 |
| 4.9 The Ya Ha Tinda viewed north in 1937 and 1986..... | 4-18 |
| 4.10 Viewed south over Kootenay Plains in 1907 and 1993 | 4-20 |

| Figure | Page |
|---|------|
| 4.11 Viewed southeast over Kootenay Plains in 1907 and 1993 | 4-22 |
| 4.12 The Columbia River Valley viewed north from Swansed Peak in 1906 and 1990..... | 4-24 |
| 5.1 Factors influencing Rocky Mountain fire regimes | 5-2 |
| 5.2 Spatial pattern of lightning-caused fires in the Canadian Rockies from 1961 to 1994..... | 5-5 |
| 5.3 Known burn periods for fires greater than 40 ha in Banff National Park from 1888 to 1980 | 5-11 |
| 5.4 Cumulative stand-age distributions for Rocky Mountain forests | 5-17 |
| 5.5 The distribution of lightning-caused fires in Banff, Kootenay, and Yoho National Parks..... | 5-28 |
| 5.6 The area burned by lightning fires in Banff, Kootenay, and Yoho National Parks..... | 5-29 |
| 6.1 A typical aspen stand in Banff National Park's Bow Valley | 6-3 |
| 6.2 Typical aspen stands along the North Saskatchewan and on Kootenay Plains | 6-4 |
| 6.3 Typical aspen stands on the Ya Ha Tinda east of Banff National Park..... | 6-6 |
| 6.4 Aspen communities inside and outside Banff's 10.5 mile aspen exclosure..... | 6-9 |
| 6.5 Repeat photoset of Banff's 10.5 mile aspen exclosure's outside plot..... | 6-12 |
| 6.6 Repeat photoset of Banff's 10.5 mile aspen exclosure's inside plot..... | 6-14 |
| 6.7 Aspen inside and outside the fenced Trans- Canada right-of-way in Banff's Bow Valley..... | 6-16 |
| 6.8 Aspen protected from elk at the Two Jack burn in Banff's Bow Valley | 6-20 |

| Figure | Page |
|--|------|
| 6.9 The relationship between ungulate use and aspen regeneration in Kootenay National Park | 6-25 |
| 6.10 The impact of cutting and ungulate browsing on aspen regeneration west of Yoho National Park | 6-27 |
| 6.11 Fire initiated age classes of aspen stands in Kootenay and Yoho National Parks | 6-29 |
| 7.1 Model of Alaska wolf-ungulate interactions simulated under circumstances in which human harvest triggered a decline in both predator and prey..... | 7-6 |

ABSTRACT

Aspen, elk, wolves, fire, and humans were used to assess the long-term ecosystem states and processes in Banff National Park and the Central Canadian Rockies. These components were selected because they effect both community structure and function, and because they can be used to judge ecosystem integrity. In addition, these species and processes have been susceptible to change during the period of European influence, and they are understood, at least to some degree, from previous research and monitoring. We used archaeological evidence, observations recorded by early explorers, aspen ecology measurements, historical and repeat photographs, and fire-history data to describe the ecosystem in pre-Columbian times and during the late 1800s when Banff was established as Canada's first national park. For as Aldo Leopold noted over 40 years ago, "if we are serious about restoring ecosystem health and ecological integrity, then we must know what the land was like to begin with." We then compared the state of aspen, elk, wolves, fire, and human influences in pre-Columbian times and ca. 1885, with conditions today, not only to understand what has changed and why, but also to measure the ecological integrity of the present system.

Aspen in Banff's Bow Valley has been in decline since the early 1900s due, primarily, to repeated browsing by large numbers of elk, not other factors such as climatic change or fire suppression. Under present conditions, burned aspen stands have failed to successfully regenerate due to intense ungulate browsing. Aspen, unlike most plants, seldom grows from seed, and during the period of recorded history, no aspen clones are known to have established from seed in the Canadian Rockies or anywhere in the Intermountain West. It is thought that environmental conditions have not been favorable for clonal establishment since shortly after the glaciers retreated 10,000 or more years ago. During the intervening millennia, Banff's aspen survived climatic change and other factors, yet under park management, aspen is approaching ecological extinction. Aspen in Kootenay and Yoho are declining for similar reasons. This suggests that conditions in Banff's Bow Valley are different today than at any time in the past.

This conclusion is supported by archaeological evidence and historical observations recorded by the first explorers who visited the Canadian Rockies. Although elk are exceedingly common today and dominate Banff's ungulate community, this was not the case in the past. Between 1792 and 1872, 26 different expeditions spent 369 days traveling through the Canadian Rockies on foot or horseback but reported seeing elk on only 12 occasions or once every 31 party-days. Similarly, elk are one of the least frequent ungulates whose bones are unearthed from archaeological sites in the Canadian Rockies, Alberta Foothills, and Columbian Trench. Archaeological data also suggest that all ungulate species were relatively rare in pre-Columbian times. The unbrowsed condition of woody vegetation, like aspen, depicted in historical photographs also suggests that ungulate populations, and especially elk, were much lower ca. 1885 than they are today.

Repeat photographs also show that Banff's Bow Valley, and other montane valleys in the Central Canadian Rockies, were much more open in the past than is the case at present. Under park management, grasslands, open-timber types, shrublands, and regenerating aspen communities have all declined markedly reducing available ungulate winter range by approximately 90%. Conversely, since Banff National Park was established, forests have both grown-up and thickened-up due to fire exclusion and fire suppression policies.

Repeat photographs indicate that frequent low-intensity fires were the norm prior to park establishment, and that historically, large-scale high-intensity crown fires were rare, especially in lower-elevation montane forests. These photographs also suggest that frequent low-intensity fires created and maintained the open-vegetation mosaic seen at park establishment.

Fire-history studies support the same conclusion. Historically, and probably in pre-Columbian times as well, Banff's montane fire regime was dominated by frequent but low intensity burns. One hundred years of fire exclusion and suppression, however, have not only altered the park's original vegetation communities,

but they have also changed the area's fire regime. In the absence of fire, forest fuels have accumulated setting the stage for high-intensity crown fires, especially under extreme burning condition. If those fires occur, they will create a vegetation mosaic that has never before been seen in the park.

Fire-history data, aspen ecology, and ethnographic accounts all indicate, however, that Banff's original low-intensity, high-frequency fire regime was caused, primarily, by native burning, not lightning fires. Fires set by hunter-gatherers differ from lightning fires in terms of seasonality, frequency, intensity, and ignition pattern. Most aboriginal fires were set in spring, between snowmelt and vegetation green-up, or late in the fall when burning was not severe. Unlike lightning fires, which tend to be infrequent high-intensity conflagrations, native burning produced a higher frequency of lower-intensity fires. So, aboriginal burning and lightning fires create different vegetation mosaics, and in many instances, entirely different plant communities. Aboriginal peoples burned to modify their lands to meet human needs, such as the production of plants used for food or to create grazing areas favored by game.

Moreover, native hunting acted in concert with wolf and other carnivore predation to keep ungulate populations low historically and in pre-Columbian times – this explains why Banff's Bow Valley was not heavily used by ungulates in the past and how aspen prospered in the park until recent times. Aboriginal activities, though, promoted biodiversity and created the plant and animal communities found when Europeans first entered the Canadian Rockies. Contrary to prevailing beliefs, North America was not a "wilderness" waiting to be discovered. Instead, it was home to as many as 100 million native people before European-introduced disease decimated their numbers. The modern concept of wilderness as areas without human influence did not apply to the Americas in pre-Columbian times. Any wilderness that existed did so only in the minds of Europeans. In short, Native Americans were the ultimate keystone species that structured entire ecosystems prior to European arrival in the New World.

This has important implications for park management. A hands-off, let-nature-take-its-course approach, also called "natural regulation," will not, for instance, recreate the conditions that existed in the past. If the goal is to maintain the biological diversity and ecosystem integrity of pre-Columbian times, as some have suggested, then the system must be actively managed to duplicate the aboriginal practices that once structured those communities. Instead of being a window on the past or an environmental benchmark, conditions in Banff National Park today have not existed at any other time in the last 10,000 years.