IDENTIFYING HUMAN IGNITED FIRES IN THE CENTRAL CANADIAN ROCKIES OVER THE LAST MILLENNIUM

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Abstract

Identification of human ignited fires in the Central Canadian Rockies has become central to the debate about ecosystem diversity maintenance in the Rocky Mountain National Parks. A review of ethnographic data identifies several key indicators of human ignited fires. Examination of environmental data from the Canadian Rockies including pollen cores, vegetation distribution, fire histories, dedrochronological studies, glacier studies and plant succession suggests that human ignition of fires likely occurred frequently in an attempt to enhance certain Montane habitats for preferred species of plants and animals. The current evidence suggests human ignited fires diminished after the 1780s in the Canadian Rockies probably as a result of disease caused human population reductions.

Résumé

On ne saurait désormais plus aborder la question du maintien de l'intégrité des écosystèmes dans les parcs des Rocheuses sans déterminer les feux d'origine anthropique. Il est possible de dégager des données ethnographiques plusieurs indicateurs clés de ces feux. En examinant les données écologiques sur les Rocheuses canadiennes, y compris les carottes contenant du pollen, la répartition de la végétation, l'historique des feux, les études dendrochronologiques, les études des glaciers et la succession végétale, on peut supposer que souvent, l'homme a allumé des incendies dans l'espoir d'améliorer certains habitats subalpins à l'intention des espèces végétales et animales qu'il préférait. D'après les indications dont nous disposons actuellement, le nombre d'incendies d'origine humaine a diminué dans les Rocheuses canadiennes après les années 1780, sans doute en raison de la réduction des populations humaines par suite de maladies.

Fire has long been recognized as an important process in ecosystems, yet for nearly 100 years National Parks have prevented and controlled any fires regardless of their origin. The net effect of fire suppression has been the apparent disruption of ecological processes. Today, there is an on-going debate in Parks Canada as to the degree of human intervention required to recreate or re-establish certain ecological processes. Whether native people had a significant role in igniting fires is a critical issue for mountain national parks because evidence of when, where and how native peoples conducted burning could become a model for intervention in ecosystems today.

Background

For the last five years Kootenay National Park has been conducting studies to define the historic and current processes within the park's ecosystems. One of the components of this Eco-History project is an archaeological study of the impact and significance of past human activities in the Central Rockies. One key question identified was "Is there evidence that native peoples were active agents of ecosystem alteration through the burning of selected areas?". This issue has been raised by Charles Kay, Brian Patton and Cliff White (1994) in a study conducted for Banff National Park. They state "We believe that human activity, past and present, is the dominant factor controlling Rocky Mountain fire regimes...We contend that Native

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Americans were a significant source of ignition, particularly on the eastslopes and in valleys where lightning is less common."(page 5-37).

In this paper, I examine additional lines of evidence and attempt to identify criteria for identification of human ignited fires in the Central Canadian Rockies.

Identification Criteria of Human Ignited Fires

Ethnographic studies conducted by Lewis (1977), and Lewis and Ferguson (1988) record that Cree, Beaver, Slavey, Chipewyan, and Metis people in northern Alberta regularly and systematically fired selected habitats to influence distribution and relative abundance of plant and animal resources until shortly after World War II. Lewis and Ferguson use the terms fire yards and fire corridors to describe these areas. Fire yards are openings or clearings such as meadows, swales and lakeshores within forest areas. Fire corridors are similar areas maintained to facilitate movement and include grass fringes of streams, sloughs, ridges and trails. Characteristically the places burned were selected to enhance grazing for horses, and to create green shoots for muskrats and moose. Burning such areas occurred in the springtime when grasses were sufficiently dry but the surrounding forests still too wet to burn. Firing occurred before bird nesting began and was done repeatedly, spring after spring, at the same location whenever conditions required it. The overall effect of Indian fires would have had relatively little direct effect on most forested areas other than "to limit the encroachment of trees into grasslands". The effects on the meadows themselves were significant. Burning these areas ensured the continued presence of grasses, and the burning off of shrubs and accumulated forest debris along the meadow margins acted to enlarge the meadows in places. Burning also fostered humus accumulation and reduced soil acid levels beneficial to grassland maintenance. Fire corridors had the added benefit of creating strips of low fuels that functioned as fire breaks.

Turner (1991) reviewed and recorded occurrences for aboriginal landscape burning in British Columbia. Specific records exist for at least 15 aboriginal traditional territories across the southern half of British Columbia from the Pacific Coast to the Rocky Mountains. In the past, Native peoples of British Columbia frequently burned areas to enhance habitats for selected plant species and to enhance abundance. In particular, burning enhanced growth of seventeen documented plant species, especially berries and edible roots. Areas burned, and the time of burning, varied with local conditions and the type of plant production being enhanced. One Lillooet elder noted that areas for berries were burned over every four to five years. Another elder remembered they burned in the fall just before a rain so the fires were not spread too much.

Barrett (1981) examined the evidence for aboriginal burning in northwestern Montana. He used historic journals plus interviews with Native people to identify areas of significant use by native peoples, reasons for burning and areas burned. Many of the Kootenai and Salish people interviewed were familiar with purposeful fires. These were set to "burn out the old, dense underbrush" and stimulate new growth of big game browse. They also enhanced berry production, aided food gathering, improved forage for horses and facilitated ease of travel. In the winter of 1858 Father Pierre DeSmet recorded use of fires to drive deer into a lake in northern Idaho where they "...could be killed easily from light bark canoes " (Chittendon and Richardson 1969:1021-22).

For the Northern Great Plains, Arthur (1975) and Nelson and England (1971) document several occurrences of intentionally ignited fires but the pattern was somewhat different than in forested areas.

In general then, in forested areas, the characteristics of aboriginal ignited fires are high frequency, low intensity, usually of small area, and most commonly located in areas of meadows and prairies. They had the overall effect of enlarging grasslands, clearing underbrush and preventing encroachment of trees and forest.

Lewis and Ferguson (1988) record that the dangers of large area high intensity fires was recognized and these were never started intentionally. They also identify that natural fires are characterized by being primarily ignited during summer, when fuel supplies are abundant. Usually started by lightning, natural fires are high intensity, and result in large to very large "patches" of varying aged forests.

Fire Frequencies in the Central Rockies

Masters (1990) determined fire frequencies for Kootenay National Park. Three periods of fire frequencies were identified. From 1508 to 1788 fires occurred at a 60 year cycle. Between 1788 and 1928 this frequency more than doubled to a 130 year cycle, while in the most recent period 1928 to 1988 very little of the area burned giving a fire cycle >2700 years. Masters concluded "The differences in fire cycles are attributed to "changes in climate rather than the influence of European man" (Masters 1990:1765). He attributes the change from a 60 to 130 year fire cycle about 1780 "to change in climate associated with the cooler, wetter weather during the Little Ice Age."

Johnson *et al*. (1990) studied fire frequencies in Glacier National Park, B.C. He found a bimodal distribution of fire cycles. From 1520-1760 fires occurred at a 80 year fire cycle while from 1760-1988 the fire cycle extended to 110 years. This change was also attributed to changes in climate in the mid-1700s from a warm, dry interval to the start of the Little Ice Age.

Johnson and Larsen (1991) in their study of fire frequencies in the Kananaskis Valley also found a bimodal distribution of fire cycles. From 1600 to 1730 the fire cycle was 50 years, from 1730 through 1980 the fire cycle occurred on a 90 year cycle. This change is attributed to a climatic shift towards a cooler and wetter interval.

Fire Histories and Climate Change

Is there a correlation between fire frequencies and climate change over the last 500 years, especially with the Little Ice Age?

Case and MacDonald (1995) conducted dendrochronological research along the east slopes of the Rocky Mountains. They document that annual precipitation decreased just before 1800 and then maintained higher levels through the 19th century. In addition, they demonstrate that significant warmer periods occurred both before and after this time. Luckman (1986, 1990, 1993) recorded tree rings near mountain glaciers. These show no significant reduction in tree ring widths between 1760 and 1800 which might be correlated with reduced fire rates documented in the fire histories, although tree ring widths do reduce in size after 1800 when reduced fire frequencies had already occurred. In addition the cooling after 1800 did not further lengthen the rate of fire frequency returns. There appears to be little or no correlation of fire frequencies with climate change.

Forest Fires, Plant Succession and Ungulate Populations

Van Egmond (1990) recorded changes in vegetation in Montane areas of Kootenay National Park utilizing air photo coverages from 1945 and 1978. In 1945, 44.6% of the study area was considered open or meadows. By 1978, 95% of the Montane ecoregion of the park was classed as closed forest and meadow areas made up less than one and one half percent of the total montane ecosystem (Van Egmond 1990:102). This change in Montane areas of Kootenay National Park is indicative of advanced successional forests reaching climax vegetation stage. This indicates that major fires in the Montane zone have not occurred in the range of 100 to 300 years. One of the effects of the reduction of open areas is that browse standing stock for elk in 1978 was approximately 20% of that available in 1945. Not surprisingly, elk populations in Kootenay National Park have declined from approximately 1000 animals in the 1920s to less than 200 today (A. Dibb, personal communication 1995). By ensuring open forest or meadows in the Park area, Native peoples could have increased ungulate populations by at least a factor of 5 times, a strong incentive to burn less productive forests.

Locations of Aboriginally Ignited Fires

In addition to the fire yards and fire corridors identified above, are there other characteristic locations burned? Barrett (1981) examined the pattern of Indian fires in western Montana's lower elevation forests. He compared fire histories in 10 pairs of old-growth stands in areas of Ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) forests. One of each pair was located in an area of past Salish or Kootenai habitation termed "heavy-use" stands. These typically bordered large intermountain valleys. These were compared to areas with similar vegetation potential, elevation and aspect usually in adjacent secondary canyons.

Barrett found that prior to 1860 there was a significant difference in fires between "heavy use" and "remote" stands. The mean fire return interval for heavy use areas was more than double that of remote stands. Following the introduction of widespread fire suppression the fire free intervals increased substantially in both areas but the mean intervals became almost identical for the two categories. Barrett (1981:40) concluded "The data suggest that the Salish and Kootenai Indians were largely responsible for causing the high frequencies characteristic of stands in habitation zones". Barrett's data correlates major intermountain valleys with preferred locations to burn.

Fires in the Athabasca Valley around Jasper were studied by Tande (1979). Between 1669 and 1913 fires created a mosaic of age classes in the lodgepole pine dominated forests. These fires were a combination of frequently recurring, low-intensity fires and less common medium to high intensity ones. At higher elevations even-aged stands were created by high intensity fires. At lower elevations, more frequent, low intensity fires created patchworks of several age-classes over short distances. Because of fire control, no significant new-age classes have been established since 1913. Major fires covering more that 50% of the valleys had a Mean Fire Return Interval (MFRI) of 65.5 years. However, the MFRI for certain vegetation communities occurred at higher frequencies: Douglas fir forest 17.6 years, Grassland-savanna 20.6 years, and lodgepole pine forest 26.8 years. This contrasts with low return frequencies for Subalpine forests at 74.0 years. This pattern of fires for the Athabasca Valley corresponds to the characteristics expected of aboriginal peoples manipulating the environment utilizing burning. Fires occurred at high frequencies in Douglas fir, grassland-savanna and lodgepole pine forest and were typically of small area and low intensity. Fires at higher elevation occurred at much greater intervals and greater intensity, which is more characteristic of a natural ignition cycle.

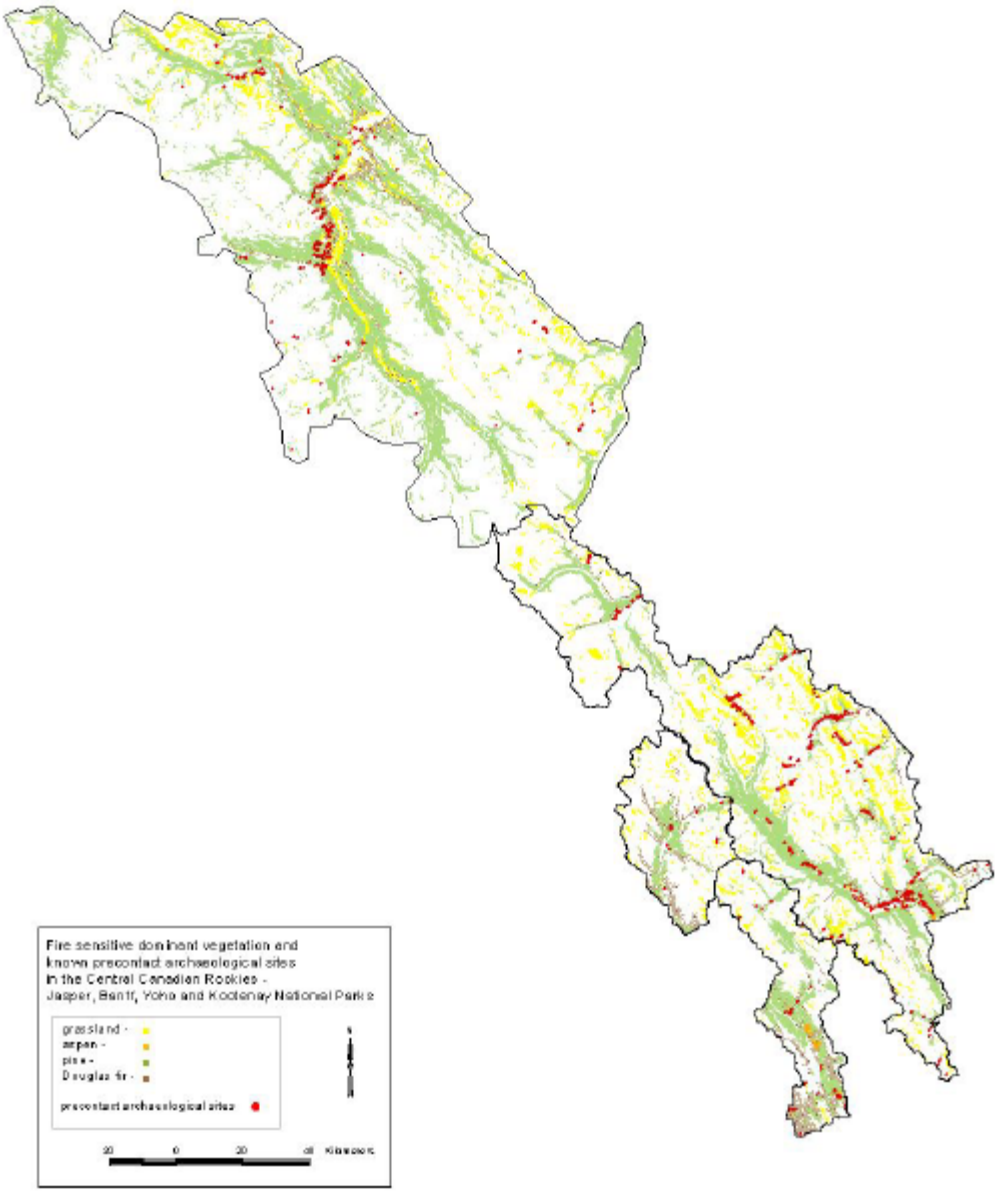

Figure 1. Distribution of archaeological sites by ecological zones in Rocky Mountain National Parks.

Grasslands and open Montane forests are concentrated in valley bottoms in Rocky Mountain National Parks. These have the greatest significance for ungulate populations and in turn, were of greatest importance for Native peoples in the past. The distribution of prehistoric sites of all types are closely correlated to Montane valley bottoms. The distribution of grasslands and montane forests corresponds to the location of archaeological sites in Banff and Jasper (Figure 1). This is not merely a reflection of where archaeologists have looked for sites because, although archaeologists have concentrated their search for sites in valley bottoms, they have also examined many other areas as well.

Figure 2. Shrub invasion into a meadow along Rock Creek, Jasper National Park, Alberta.

Fires and Grassland Maintenance

The interrelationship between fire, grasslands and ungulates has not been thoroughly studied for Rocky Mountain regions. However, some studies of burning effects exist for grassland areas. In Kansas, studies by Gibson and Hulbert (1987) demonstrate that burning affects plant species composition favouring grasses over forbes, and released nutrients favorable for grasses.

In chalk grasslands in Europe, Grubb (1986) notes the importance of human maintenance. For many European grasslands, grazing, cutting or burning are essential. Grubb (1986:209) notes "If management ceases, it quickly develops into a tussocky sward some 30 to 50 cm high, in which fewer species survive and which shrubs and trees invade". As shrubs invade, available direct light decreases, which in turn favours increasing shrubs and trees. This also increases water retention which further reduces suitability for grasses. This description is equally appropriate to many Rocky Mountain grasslands such as along Rock Creek in Jasper N.P.(Figure 2).

Reducing grasses in turn reduces suitability for ungulates. In Kansas, Vinton et al.(1993) conducted studies on the interactive effects of fire, bison grazing and plant community composition in grasslands. In areas subject to prescribed spring burns, bison were observed up to three times more frequently than expected. In spring, bison preferentially grazed recently burned watersheds, whereas in the autumn and winter their grazing was more evenly distributed.

Although I could find no studies on the effects of burned pasture on the growth rates of wild ungulates, studies of cattle growth performance have been conducted. Like bison, cattle prefer pasture that has been burned. Studies in Kansas show that late spring burning resulted in significant increased weight gains in cattle

in 12 of 16 summer seasons (Smith and Owensby 1972). It is likely that similar growth performance would occur for wild ungulates. Access to burned grasslands in mountain areas would likely enhance the health, reproductivity and overwintering ability of ungulates, all additional incentives for Native people to ignite spring fires.

That grasslands require maintenance is not well understood for the Rocky Mountains. In Rocky Mountain National Parks virtually no grassland maintenance has occurred for over 50 years, other that grazing by ungulates and horses. The effect of this lack of maintenance can be viewed in virtually every meadow or former meadow in these parks. Lack of grassland maintenance has allowed these areas to become overgrown with forbes and shrubs with invasion of forest species along its margins. Typical are meadows near Scotch Camp on the upper Red Deer River in Banff National Park and in Jasper National Park near Southesk Lake, Willow Creek Warden Station, and Rock Creek Valley.

Changing Human Populations Through the Last Thousand Years

Aboriginal Populations prior to 1800

Most of the Rocky Mountains area was not seen first hand by Europeans until after 1800. By that time, Native populations reductions due to epidemic diseases were widespread. Studies of the drastic reductions in native populations from 1530 onwards have been conducted by Dobyns (1983), Ramenovsky (1987) and Campbell (1990).

A typical account is provided by John Work in 1829 who reported from the Hudson's Bay Company's Fort Colvile:

> Immense numbers of them were swept off by a dreadful visitation of the smallpox, that..., may have happened fifty or sixty years ago [1769-1779]. The same disease committed a second ravage, but less destruction than the first about ten years afterwards. (Work cited in Chance 1973).

Among others, significant epidemics occurred throughout the Plains and Mountain regions in 1730 and 1780.

Native Populations after 1800

The effects of Native populations reductions over much of the Central Rockies Regions were that remnant populations combined into bands in key strategic environmental areas. The Upper Kutenai, for example, combined into the bands at Tobacco Plains and near Cranbrook. A cultural vacuum on the west side of the mountains in the northern Rocky Mountain Trench was filled by a small group of Shuswap Indians under Chief Kenpesket who settled there about 1840 (Teit 1909). The cultural vacuum on the east slopes was filled by the Blackfoot, Stoney and Sarcee whose settlement of the eastern slopes in the nineteenth century is well documented. These people utilized the Rocky Mountains area periodically but not intensely in the nineteenth century.

However, in the Athabasca Valley there was extensive ongoing traditional use. The Athabasca Valley was of strategic significance because of the important Yellowhead and Athabasca Pass fur trade routes and continued to be occupied by Metis and Aboriginal peoples. There, continued maintenance of grasslands

was important because horses were essential to crossing the Rocky Mountain passes. The pattern of Montane traditional burning continued through the nineteenth century as recorded by Tande (1979). Other areas of the Central Rockies do not provide evidence of intensive traditional burning in the nineteenth century because of lack of intensive human occupation.

Conclusions

Traditional burning of selected areas by Native peoples typically occurred in the early spring, was of low intensity, and targeted grassland, savannas and open forests as is documented in the ethnographic and historic literature. Fires were set by native peoples to enhance these areas to encourage ungulate productivity and certain plant species. That aboriginal people burned, in the past, in areas of Rocky Mountain National Parks is indicated by changes in fire histories, fire frequency rates, vegetation succession, lack of grassland maintenance, incongruity with climate change record and distribution of archaeological sites. Changes in fire frequency rates correlate strongly with population reductions caused by smallpox epidemics especial those of the 1730s and 1780s.

The current vegetation conditions observable in portions of Rocky Mountain parks are clearly related to the lack of burning. Consequences reverberate throughout the food chain causing reduction of aspen cover and affecting ungulate populations, which in turn reduces carnivore populations. Lack of corridors for elk, may prevent them travelling to higher altitude summer ranges thereby concentrating populations in the Montane forcing overbrowsing of young aspen and preventing regeneration. The apparently high elk populations have lead to elk herd culling in some areas.

Regardless of the origin of fires in the past, Parks Canada has begun a program of prescribed burns and the effects of these will carefully monitored and studied.

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