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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.