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Archaeology and Rocky Mountain Ecosystem Management: Theory and Practice

The benefits that could be obtained by a collaborative relationship between archaeological sciences and ecosystem management principles are only just beginning to be realized. Examination of current applied and theoretical directions reveals common concepts that need to be developed more firmly, at the same time that archaeology needs to express more confidence in its potential contributions as well as be more explicit about its limitations. Examples of archaeological knowledge applied to ecosystem issues in the Canadian Rocky Mountain National Parks are discussed here, indicating where substantial research is yet required.

Issues

Having legislated in 1988 the priority of ecological integrity in all management decisions, Parks Canada is now engaged with creating fundamental principles and standards regarding management of national parks ecosystems. I discuss here four topics central to the ongoing debates, focusing on the role that archaeological research can play. The principal topics are:

- Natural regulation versus adaptive management of the environment;
- Factoring past human interactions with the environment into contemporary management practices;
- Understanding historical variability in ecosystems; and
- Employing historical and archaeological research in a multidisciplinary context to contribute to ecological integrity.

Background

Ecological management of national parks can take two extremes: allowing "nature to take its course" with no active human management, or intervening constantly and deliberately to maintain a "slice in time." Within our national parks system, we have examples approaching each of these extremes. In between them is a tremendous range of practices and philosophies. There are, for example, many instances of various practices aimed at restoring communities, structures, or processes. The variety of management options we apply derive from real management needs as

well as political realities.

There is in our day no escaping the need to employ all our resources to understand ecosystems. A recent article in *Science* (Vitousek et al. 1997) reports that humans have modified one-third to one-half of the Earth's surface, carbon dioxide is up 300% since the Industrial Revolution, and humans use one-half of all fresh water. The paper concludes by stating that "there is no clearer illustration of the extent of human dominance of Earth than the fact that maintaining the diversity of 'wild' species and the functioning of 'wild' ecosystems will require increasing human involvement" (Vitousek et al. 1997, 499). This applies to our Rocky Mountains—without specific active interventions, they will suffer considerably; and this we know since previous interventions such as fire suppression have greatly contributed to the ecological problems the parks now face.

DeLeo and Levin (1997) state that, "in managing ecosystems, the goal should not be to eliminate all forms of disturbance, but rather to maintain processes within limits or ranges of variation that may be considered natural, historic, or acceptable." This appears to be the goal of Parks Canada's "ecological integrity" policy, a key component of which is to manage contemporary human disturbances. In Parks Canada's *State of the Parks Report* (1998), "ecological integrity" is defined as "the condition of an ecosystem where the structure and function of the ecosystem are unimpaired by stresses induced by human activity, and the ecosystem's biological diversity and supporting processes are likely to persist" (Parks Canada 1998, 23).

Yet we really do not know how resilient the mountain ecosystems are to human disturbance. There must have been some variation in the past—climatic, human, catastrophic, or all of those. Can we tell? The potential of archaeology and the paleosciences to contribute meaningfully to ecosystem management, I believe, lies in part in their ability to describe "baselines" at different points in time, points in time for which humans are a significant component. From these baselines the effects of human influence, and of natural occurrences, can be charted against particular locations, species, or systems, using more precisely documented data available for more recent times.

Mountain parks ecosystem managers have proposed significant interventions to manage wildlife and vegetation. Employing background literature studies and computer generated models, key actions are being advanced as the most feasible, and representing the least public risk, for elk population reduction, carnivore enhancement, and vegetation renewal. Archaeological information has been used in studies undertaken

by biologists and figure prominently in their conclusions, but the cultural information employed in these studies and models requires proper consideration of the roles of aboriginal peoples in past landscapes, of the limitations of the archaeological record, and an awareness of the nature of paleoenvironmental knowledge.

There is, for example, excellent anthropological evidence for Aboriginal burning in mountain environments of Alberta and British Columbia. This evidence is not voluminous but it is fairly extensive, ranging from the southern east and west slopes of the Rockies to the northern east slopes. The literature points to aboriginal burning of many different kinds: fires to encourage certain fruiting bushes, to encourage ungulate forage, to drive animals for hunts, or accidental fire from camps. Any or all of these would account for the "mosaic" observed in times past, but direct evidence of Aboriginal fires is, in fact, slim. Vegetation managers are making great use of proxy data: changes in fire regimes as indicated by tree ring studies, macrocharcoal in pollen cores, and so forth. There are three main problems here. First, attributing agency to the fire patterns is extremely difficult. Biologists and archaeologists are limited to inference, no matter how strong—we are lacking the smoking torch. Second, to date very little direct consultation with local aboriginal people has taken place about past burning practices. Third, interpretations of the 13,000-year-old pollen record are remarkably coarse and finer resolution is required to illuminate patterns or events at the 10- to 100-year level. The dendrochronological record that forest managers of the mountain parks use to infer aboriginal burning patterns is only 600 years old at the most.

Kay's Theory of Aboriginal Overkill

As a prime example, I will focus on the faunal management hypothesis held by Charles Kay (Kay 1994; Kay, Patton, and White 1994; Kay and White 1995), that aboriginal people "overkilled" elk in the mountains and were responsible for the apparent low ungulate population levels witnessed by early explorers of the West. This is highly debatable. It may on the surface appear that elk population levels were low, but there are several difficult problems in need of further investigation before this "overkill hypothesis" can be taken seriously:

1. Why did the elk populations not recover following the drastic decline of aboriginal populations in the early historic period?
2. Why does the archaeological record not show an "overkill horizon"? If native people were killing elk in this manner, where are the bones?
3. Did early European hunting, or the introduction of horses, sig-

nificantly modify the environments employed by elk?

4. How can taphonomic effects be accounted for in the archaeological record that Kay cites? The different ways that people processed bones, in different places, for different reasons, in different times of the year, and the different depositional regimes in which they have lain, all have considerable effect on what we see today.

Now, I do not have the degree of faunal expertise that Lyman does—expertise that he used in his remarkable study of mountain goats and national parks policies in the Olympic Mountains of Washington state (Lyman 1995)—but, taphonomic effects aside, let us examine the Rocky Mountain faunal data from an archaeological perspective.

I had two graduate students with faunal analysis expertise re-examine the archaeological literature from the eastern slopes of Alberta and the mountain national parks and tabulate the evidence available. We derived conclusions at odds with Kay and his co-workers. From 49 sites in western Alberta and eastern British Columbia, some with multiple components, a total of 401 bison MNI (minimum number of individuals) are apparent and 54 elk. If we look at the three mountain parks and one national historic site in Canada with preserved faunal remains, including some sites that Kay et al. (1994) did not examine, the pattern is quite different from what one would expect from their findings: 125 bison MNI compared with 74 elk MNI (Table 1).

Given that we know bison were extremely populous and were the ungulate mainstay of this part of the world, and also given the robusticity of bison bone, the pattern shown above in fact indicates substantial elk populations as well. Kay (1994) may

Table 1. Comparison of bison and elk MNI in the Canadian Rockies

Location	Bison MNI	Elk MNI	Ratio
49 sites in Western Alberta and BC	401	54	7:1
Waterton Lakes NP	54	9	6:1
Banff NP	34	16	2:1
Jasper NP	2	13	1:7
Rocky Mountain House NHS	35	36	1:1
TOTAL	**526**	**128**	**4:1**

believe that the evidence points to Aboriginal overkill of elk (and moose), but the archaeological record is not at all clear on this point. It may simply be evidence of bison outcompeting elk in certain environments, of differential bone preservation, or of other causes.

Kay (1994) cites some 1,600 archaeological reports from the mountains and eastern slopes as evidence of his overkill hypothesis, yet beyond the questions posed above, there are other problems with taking archaeology at face value as a source of ecosystem knowledge. These are problems that can be overcome in some instances, but one needs the awareness that they exist, not some naïve gathering of data that appears to support one's theories.

Archaeological sites are far from perfect records. If we look at what is desirable in archaeological sites for ecosystem reconstruction purposes and compare it with what is normally found, we have something like the discrepancies outlined in Table 2. Kay's studies and our own show that by far most of the bone to be found in the sites he examined is fragmentary and unidentified. Maybe it is elk? We have started work on DNA to see if we can tell. When my students looked at the Parks Canada data, we found that most faunal remains had never even been analyzed and that some had been misidentified.

At the regional level, most of the archaeological reports that Kay examined were consulting reports describing small-scale, linear projects. Very few regional studies have been undertaken in Alberta's mountains or Eastern slopes. In addition, many sites outside the national parks also have faunal remains that have never been examined. When fairly large projects have been undertaken, the questions asked of the faunal data are those of interest to archaeologists, not to ecosystem managers, and that influences how the data are gathered in the first place. All of these constraints impose serious bias not

Table 2. Characteristics of archaeological sites

Desirable	Normal
Stratified	Single Component or Mixed
Bone samples	Stone only
Identifiable bone	Fragmentary bone
Pollen	No preservation
Dendrochronological wood	No preserved wood
C14 Dates	No dates or artifact types, estimates only

only on interpretations, but also on how anyone else can use those results. Table 3 outlines what we would like to have available for regional archaeological evidence and what is the norm.

One of the constraints with the regional archaeological evidence is in the kinds of sites archaeologists choose to investigate. These are biased, in the case of the mountain parks, toward relatively large, valley-bottom campsites that probably represent late-summer-to-fall occupations. We do not have representative assemblages for other seasons.

Traditional Knowledge in National Parks

A key component of ecosystem archaeology should be traditional environmental knowledge held by aboriginal peoples. To include such knowledge is, however, quite rarely done in Canada's Rocky Mountains. Although there is increasing collaboration by government, academic, and private archaeologists, the state of information concerning aboriginal knowledge of mountain ecosystems is rather poor.

Traditional environmental knowledge of aboriginal peoples with respect to the Canadian Rocky Mountains has not been systematically attempted. Traditional environmental knowledge is only occasionally regarded as a potential management tool in the mountain parks, but is an accepted and useful component of land management in the Northwest Territories and Yukon, and, increasingly, in British Columbia. A study being completed at Waterton Lakes is the only comprehensive one ever undertaken in the Canadian mountain parks. The Waterton-Glacier Ethnoarchaeological Project by B.O.K. Reeves has resulted in a much-improved picture of Blackfoot land uses and interests there, with a focus on plants and ethnogeography. Kootenay National Park's current environmental history study includes consultations with Ktunaxa Elders concerning ungulate history and plants, and has grown to include Ktunaxa involvement in prescribed

Table 3. Characteristics of regional archaeological evidence

Desirable	Normal
Well-described settlement and seasonality patterns	Biased settlement pattern representation
Representative universe sampling	Linear projects
Judgmental sampling	Biased sampling
Good knowledge of human population interactions and regional environmental effects on humans	Sketchy culture histories, ambiguous reconstructions of environmental effects

forest burning. The Stoney, Sarsi, Metis, Beaver, Slave, and Cree people of western and northern Alberta should also have significant contributions to make to our knowledge of ecosystem processes in the mountain parks.

Table 4 points out that we have a ways to go in integrating traditional environmental knowledge with park management. The ethnographic record is useful, but in some cases very limited to what the particular observer was interested in recording. I think it is also worth mentioning that progress with traditional environmental knowledge would have benefits beyond ecosystem management. Working together would enhance mutual relationships and serve to help preserve knowledge that is in danger of permanent loss. Dedicated research into traditional environmental knowledge may also show us where it has its limits, which is worth keeping in mind since we need to realize that a traditional way of doing something may not in fact be the best way of managing today. As Hunter (1996) has expressed it, how to apply knowledge of aboriginal management methods depends on what our objectives are: lighting fires to drive game is not the same objective as lighting fires to encourage aspen growth.

The question indeed largely remains: What roles did aboriginal peoples and early Europeans play in shaping the mountain ecosystem? Certainly, both groups were an integral part of it. But whether they had long-lasting but small-scale effects, large-scale and long-term effects, or temporary local effects are all questions we can only have opinions on at the present time.

There are positive aspects to cultural systems as environmental proxies, though, that we should learn to make the most of. Gunn (1994) points out that cultural systems can respond more quickly to climatic change than can some biological systems such as forests—there is no time lag. Cultural responses may

Table 4. Characteristics of aboriginal relations and traditional environmental knowledge in Rocky Mountain national parks

Desirable	Normal
Traditional environmental knowledge well studied	Poor or no traditional environmental knowledge
Traditional environmental knowledge has direct links to archaeology and ecosystem research	Late-19th-century ethnographic data only
Close relationships with First Nations	Fair relations

be better indicators of change than pollen diagrams. Some of these responses may be captured in prehistoric patterns we see but don't recognize as such. Other patterns may be captured in knowledge retention, particularly in societies that have been in place for a long time. Examples here are Haida stories about moving across grassy areas, walking between villages that are only accessible by water now, or of moving villages when waters were rising—situations occurring 12,000 to 6,000 years ago.

What to Do?

To identify alternative models of human–environment dynamics within the larger Rocky Mountain ecosystem requires a thorough multidisciplinary programme involving the body of scientific and historical disciplines that relate to population and community dynamics—biology, ecology, anthropology, history, and archaeology. A professional workshop has been held recently to frame the key management issues within an understandable perspective and to begin testing models with regards to a longer-term perspective. Forty people came together in Jasper National Park to offer 29 discussions over three days, covering topics ranging from bison fat to marsh sampling to highway impacts. This workshop sought to reach agreement on what is "natural variation" and how this was represented in the past. It helped to delineate the bounds of our knowledge to provide focus for work in areas where information is lacking. The workshop concluded with three main recommendations:

1. **Policy.** There is a recognized need for development of policy in the area of recognizing human influences on ecosystems through time.
2. **Aboriginal peoples.** Mountain parks should make greater efforts to work with aboriginal groups towards ecosystem management goals.
3. **Communications.** At all levels, from senior management to the general public, more communication is required regarding what research is taking place, and why.

The mountain parks need to develop a long-term multidisciplinary research strategy to address the role of humans in the mountain ecosystem over time. This would involve:

- Working with other ecosystem researchers, historians, and park managers to identify the research questions of most pressing common interest, and to identify our knowledge gaps;
- Reviewing known archaeological site information to identify key sites with the potential to address such questions;
- Carrying out archaeological site surveys to identify new sites for time periods or environments of

interest where there are no known sites,
- Carrying out multidisciplinary excavations at selected sites;
- Analyzing results focusing on changes or lack thereof in human–ecosystem interactions through time; and
- Integrating results with other ecosystem specialist studies, and integrating results into natural and cultural resource management practices.

In several cases we are doing exactly some of those things. Archaeologists in Banff National Park have searched for and found sites with clear strata and identifiable ungulate bones; near Kootenay National Park waterlogged deposits have been found that contain an unusually rich assemblage of carnivores, ungulates, and fish remains. What we are lacking is an explicit strategy to integrate the entire suite of interests with the overriding objective of ecological integrity.

Conclusions

A key issue in parks management is the mediation of human recreational use and impact with biodiversity and ecological integrity. With the growth of public utilization of park resources, the importance of addressing the interrelationships of cultural and ecological systems will only increase. Archaeology and history are in a good position to situate human cultural systems within a more expansive environmental and ecological understanding. With such an understanding, it is possible to make more informed management decisions with regard to public impacts within a national park environment. Current trends in both ecosystem sciences and archaeology have made the time ripe to allow meaningful collaboration. Just as ecologists have tended to view humans as "stressors" on ecosystems, archaeologists have been guilty of viewing ecosystems as "conditioners" of human adaptation. We need to step outside of our disciplinary straitjackets to find solutions, and we need to teach developing professionals how to do so as well.

What should not be ignored in our efforts is what I consider to be highly misinformed criticism of aboriginal peoples' relationships with the environment. A recent Toronto *Globe and Mail* article (Widdowson and Howard 1998) entitled "Natural stewards or profit-makers?" is subtitled "Aboriginal peoples haven't lost their spiritual bond with the land: they never had one." The principal argument is that aboriginal people have knowingly made poor decisions or profit-oriented ones in certain instances where they have asserted their prerogatives. It is true that aboriginal people are people and that mistakes will be made, but that is not the issue with respect to their culture's long-term connection to the land. It is also true that aboriginal

people no longer live by "stone axes and snowshoes" and that contemporary resource extraction and management require contemporary solutions. But by using the alarmist method of generalizing a few cases to the entire situation, this kind of critical approach ignores the bulk of traditional knowledge, the widespread respect that aboriginal people do show for the land, and the many instances where they have opposed damaging resource management practices.

The establishment of baseline criteria for ecological integrity purposes requires very firm and defensible information on the relative stability, agents of change, and natural variability in the mountain ecosystem. Proper evaluation and application of the evidence require team approaches with full awareness of inherent scientific and cultural biases.

Acknowledgments

I would like to thank Sherri Lensen and Mark Diab for their help with compiling faunal data.

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