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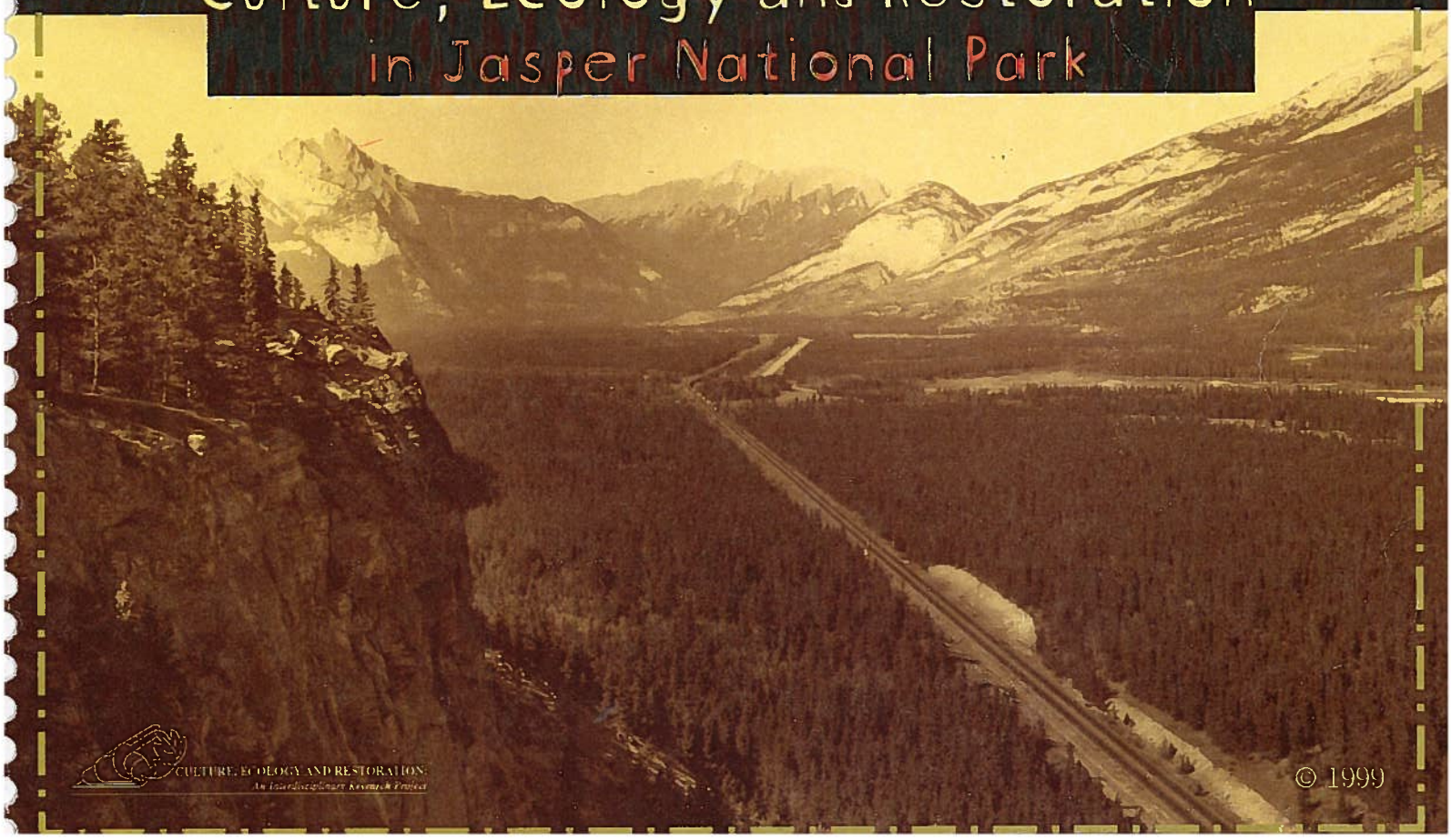
Culture, Ecology and Restoration in Jasper National Park



CULTURE, ECOLOGY AND RESTORATION:
An Interdisciplinary Research Project

Culture, Ecology and Restoration in Jasper National Park

Eric Higgs, Sandy Campbell, Ian MacLaren, Julian Martin, Tim Martin, Carol Murray, Andie Palmer, and Jeanine Rhemtulla.

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So many people and organizations made the CER project possible that I have no doubt neglected appropriate mention of a few of them. Please accept my apologies. And to be clear, the report's views are not necessarily shared by all whose help was much appreciated.

ESH
November 18, 1999

Acronyms Used in This Report

ARV .....Athabasca River Valley

BNP .....Banff National Park

CER.....Culture, Ecology, and Restoration

GIS .....Geographic Information Systems

HAD .....Human Activity Database

HBC .....Hudson's Bay Company

JNP .....Jasper National Park

J-YM&A .....Jasper-Yellowhead Museum and Archives, Jasper, AB

NWC .....North West Company

1 Executive Summary

1.1 Overview

The Culture, Ecology and Restoration (CER) Project in Jasper National Park (JNP) ran for three years from 1996 to 1999. The aim of the Project was to advance a restorative model of park management; it was cast as a pilot project, one in which new ideas and approaches could be tested.

JNP is experiencing development at a rapid pace; many say too rapid. The quiet town of Jasper, long appreciated by locals for its unassuming charms, is filling with destination retail outlets and franchise eateries. Traffic is increasing on the Yellowhead Highway, as are the number of visitors who engage in an increasingly wide array of pursuits. Development proposals abound. The town of Hinton, fewer than twenty km distant from the East Gate of JNP, is boosting tourism as an adjunct to resource extraction. Further coal-mining operations are planned for the eastern boundary. Local JNP activists commonly cry that JNP cannot be allowed to become another Banff, a Park in crisis because of too much development and visitation.

What made JNP so attractive a site for study, apart from the growing fiduciary responsibility felt by university researchers who live nearby, was the symbolic place it occupies in the minds of so many Canadians and visitors from other countries. As an icon of Canadian wilderness, it offered a pre-eminent challenge for ecological restoration. Why restore wilderness? What is wilderness? One of our earliest and central contentions in the CER Project was that perhaps we needed to re-conceive the way we look at wilderness in JNP.

In 1991, several University of Alberta researchers, David Schindler, Suzanne Bayley, and Eric Higgs, predicted that JNP managers would arrive at a fork in the road. They began building a co-operative research program with JNP. Park managers, these researchers believed, were faced with two main options. More likely was the business-as-usual approach: respond to development applications in a moderately conservative way, fight defensive battles against deleterious and avoid conflict whenever possible.

The alternative tine in the fork is a restorative one. It compels managers and the public to be clear first about what values are important for appreciating JNP, and then about how these match up against ecological values and realities. After almost a century of management, ecosystems in the Athabasca River Valley (ARV) have been transformed by virtue of Park management practices. In other words, our choices in the past have shaped JNP, and one of the challenges is to wrestle with how our choices, based on shifting cultural values, will affect the future. There is an opportunity to restore JNP, which means not so much returning to the exact conditions that flourished before the creation of the Park (please see Chapter 3.0 of the report, "A Restorative Model for JNP" for an extended discussion of ecological restoration), as balancing the long-term ecological and cultural history of the place with present circumstances.

Two insights guided the project. The first involved binding together ecological and cultural knowledge, usually regarded as two separate spheres. Presently ecological data are the core around which management programs are based. Cultural resources are important in so far as they honour particular past events and contribute to a broader appreciation of the park, but they are seldom brought into correspondence with ecological data; thereby, opportunities are lost for a richer understanding of landscape change.

The second insight guiding the work of the CER Project was that history, in all its myriad forms and topics, is vital to successful Park management. History is more than a curiosity; it becomes a set of guideposts to the future. Once we begin using those guideposts, the machinations of present circumstances fail to provide a satisfactorily broad context for the setting of goals.

These insights were made possible by adapting wisdom from the ecological restoration movement. What ecological restoration thinking counsels is the combination of historical knowledge—cultural and ecological—with goal setting. This produces long range, conscious choices that simultaneously respect ecological integrity and acknowledge the role of people in caring for, and sometimes living with, landscapes.

Two questions have guided the research of the CER Project during the past three years:

1. What are the extent, character and ecological influence of past human activity in the montane valleys of JNP?
2. How can such historical knowledge of landscape change influence ecological restoration and management?

These two initial questions have been answered in various ways and are addressed in the main report. The CER Project proved to mark the incipience of a new era in research about JNP, an era that has entailed:

- the establishment of cohesive research facilities at the Palisades Centre,
- the crossing (at first, the trespassing) of borders among disciplines,
- the spawning of a number of new research projects,
- the placing of emphasis on cultural and historical data,
- the striking of a delicate balance between basic and applied research, and
- the delineation of a new approach to long-term management through ecological restoration.

But it is just a beginning. There is much work to be done, whether in mapping the cultural history of the entire montane ecoregion and the rest of JNP, in developing new spatial models that integrate cultural and ecological data, in establishing ecological restoration as a paradigm for management of the montane ecoregion, in extrapolating the results to the working landscapes surrounding JNP, or in conveying the results of the CER Project to a wider audience.

1.2 CER Project Study Area

Jasper National Park (52°N, 118°W) is 10,800 km^2 in extent, and located 350 kms west of the City of Edmonton in the Rocky Mountains of Alberta (see Figure 4-1). We chose to focus on the montane ecoregion (these ecologically rich valleylands along the Athabasca River Valley comprise roughly 8.5% of the total JNP area) because it is the most imperiled by human activity. JNP is located in the Rocky Mountains of Alberta, about 400 km west of the city of Edmonton. We chose a subset of the montane ecoregion in order to make our job of mapping and understanding historical change managable. The study site, 64 km^2 in extent or less than one per cent of the total Park area, is located in the central region of the park, northeast of and downstream from the Town of Jasper.

This particular study area was chosen as the study site for a number of reasons. First, it was small enough to permit detailed mapping of historical cultural activities and ecological patterns, but large enough to permit analysis of underlying processes. Second, it contained a good sampling of the types of human activity which have been recorded in the montane ecoregion. The Three-Valley Confluence (centred on Jasper townsite) was deliberately avoided because JNP managers have concentrated their planning activities in this area since 1997. Third, it was important that the Palisades Centre be included in the study area as its served as the focus of a pilot study in 1995 that

led to the CER project. Fourth, the study area also lies within the bounds of the most intensive fire-history investigation yet conducted in the park. Finally, good coverage by aerial photographs was available for the entire study area.

1.3 Project Components

The CER project comprises nine research components, some of which rose to become major initiatives and have evolved into continuing research programs, and others which were test projects with a shorter life-span.

1.3.1 Vegetation Change

We have an unprecedented account of vegetation history. This is due chiefly to the unexpected recovery of a remarkable collection of survey photographs from 1915 taken by M.P. Bridgland. Jeanine Rhemtulla compared and analyzed the changes in vegetation between aerial photographs from 1949 and 1991, and between the 1915 Bridgland and repeat survey photographs taken by her in 1997. Rhemtulla's techniques allowed us to push quantitative analysis of oblique photographs further than other repeat photographic projects have achieved.

1.3.2 The Human Activity Mapping Project

Developed and led by Tim Martin, the Human Activity Mapping project comprises an innovative database of historical information about human activity in the CER Project's study area. Human activity information can be selected according to any combination of characteristics—activity type, time period, intensity of activity, uncertainty, and so forth—and laid over biophysical information. Thus, a map, or maps, of human activity can be interpreted with direct reference to vegetation, animal movements, landforms, and so on. The cultural and the ecological realms are thus brought into direct contact.

1.3.3 Oral History

Led by researchers Andie Palmer and Cindy Dunnigan, group and individual interviews were conducted; pre-existing oral history taped records were incorporated to some extent, as well. The CER Project had a pragmatic goal: to enrich our knowledge of particular sites and of the human activities at those sites. This goal is reflected in the way in which our oral history record is organized and deposited—not by interviewee but by site within the study area. Such organization and deposition lend themselves to tagging records so that they can accord with the GIS mapping database.

1.3.4 The ARV During the Fur Trade Era

Ian MacLaren led an allied project to assemble and more fully document and interpret key texts, journals and maps of the fur trade era. During this crucial period in the latter part of the nineteenth century, the ARV experienced intensive use, especially as a transportation corridor. The activities of the fur trade created an ecological signature on the landscape that is only now being deciphered through painstaking historical research.

1.3.5 The Restoration Pilot Project

Ann Ronald performed a detailed review of the literature on public participation in ecological restoration, identified prospective field sites requiring restoration and brought together a group to investigate the feasibility of a comprehensive restoration planning project.

1.3.6 The Multimedia Project

Fusing historical research and a desire to communicate effectively to a wider audience, collaborator Sandy Campbell led the development of a separately-funded multimedia project. This project presents specifically the history of the Métis peoples who lived in the ARV in the first decade of the twentieth century. A main intention was to provide a document, in this case an electronic one in CD-ROM format, that used the scholarly base of the CER Project's research to present the material in an innovative manner accessible to a broader public.

1.3.7 Natural Disturbance Mapping

In 1997, the CER Project entered into a co-operative project with Foothills Model Forest in order to map the history of forest disturbance in the half of the CER Project's study area lying in the ARV north of (downstream from) the Snaring River. The objectives of the project were to gather dendrochronological (tree history) data in order to learn more about the montane ecoregion's history of ecological disturbances, such as fire, wind, and insects. Sampling took place in 1997 and 1998, and the data are still being analyzed.

1.3.8 Archaeology

During its first field season (1996), members of the CER Project gathered all known information about archaeological information and placed these materials in a strictly confidential database for subsequent spatial and historical analysis. JNP is rich with archaeological sites, and investigations are just beginning to provide a composite view of human prehistory.

1.3.9 Palaeoecological Research

Cynthia Zutter undertook sampling of several small wetlands in the CER Project's study area with the aim of learning more about changing ecological conditions. These data are still being analyzed. The aim of this work is to integrate palaeoecological data with dendrochronological data and the vegetation change information to construct a detailed composite view of ecological change in the montane ecoregion.

1.3.10 Data Management

Considerable investment was made in organizing data, including the construction of a professional (compatible with local library systems) database of reference materials about the montane ecoregion, the building of closer links between JNP and the University of Alberta Library, the construction of a library finder about Jasper, and the creation of a core collection of historical reference materials (mostly copies).

1.4 Summary of Findings & Implications

How has the CER Project as a research program served to apply new approaches and concepts to the understanding of human influence on the montane ecoregion, and how might the insights gained from this research be applied to the ecological restoration of JNP? The research has developed potential applications:

- by showing how ecological and cultural history can be intertwined,
- by creating a common language for mapping human activities,
- by using historical materials in innovative ways,

- by stretching the CER Project's initiatives from conceptual research all the way to applications, and
- by promoting interdisciplinary and intersectoral research.

These achievements have occurred during a decade when the challenges confronting research in JNP, as in other parks and protected areas, have been mind-boggling; JNP is caught in a web of institutional mandates, cultural values, a poverty of well-researched knowledge, and relentless development pressure.

We provide here, in summary form, our implications in five categories. These are followed by recommendations (on the next page) that highlight the need for more research that focuses on the integration of cultural and ecological aspects of parks management. For a fuller account of each section, in particular an overview of issues and list of contributions of the CER project, please consult Chapter 6.0 of this Report.

1.4.1 Challenging the Idea of Wilderness

Common Eurocanadian cultural values emphasize the forbidding and extreme wilderness image of JNP. The problem with this view is that it contradicts the reality of the presence of a sizable, permanent community, all modern amenities, a major cross-continental highway and railway and a burgeoning tourism industry that includes large-scale developments (a golf course, downhill skiing, a tramway, hot springs and so forth). More than this it belies a history of land use by First Nations peoples that stretches back for millenia. Wilderness has different meanings depending on the era and cultural perspective, which leads us to conclude that this apparently core idea needs to be questioned and reconfigured as appropriate. Ironically the idea of wilderness may be doing damage what is now JNP by directing our attention away from the real character and history of the landscape.

1.4.2 Static vs Dynamic Images of the Future

Surveys of national parks indicate that the public wishes to "keep things as they are." In addition to the practical difficulties entailed by this goal, the assumption is deeply flawed in its implication that the "way things are" is somehow correct and deserving of preservation in perpetuity. Ecological processes and human practices and beliefs ensure continuously dynamic landscapes. It is not either realistic or appropriate to manage for stability, a point that is sometimes difficult to act upon when change pushes away from widely accepted norms (viz., moving away from a publically-favoured, densely-forested landscape to a patchy one that is more faithful to long term historical conditions).

1.4.3 Ecological Integrity and Cultural Considerations

Many challenges confront those attempting to better incorporate the human dimension into research, planning, and management of protected areas such as JNP, but there is one particularly strong barrier to overcome—the perception that the human dimension has no place at all in a national park. The task now is to truly integrate—not simply to manage—ecological and cultural elements. The formidable challenge comes in determining what is acceptable practice: how much activity is too much? This determination must be based on a host of considerations, including ecological goals, visitor experience goals, cultural resource management goals, and economic and fiscal realities.

1.4.4 A Restorative Approach

Internationally, and particularly in North America, ecological restoration has emerged as not only a practice but also an orienting framework for ecosystem management. It has the following chief benefits:

- it extends sensibly the practice and theory of ecosystem management by giving ecological integrity an historical anchor point, thereby allaying anxieties over the idea that maintaining integrity does not necessarily include respect for the continuity of earlier ecosystem functions;
- it depends on clear goal-setting and planning, so that to know what to restore means having a good understanding of historical patterns and processes, and an informed anticipation of appropriate future conditions;
- as distinguished from *restoration ecology*, it implies broader commitments to environmental awareness, community participation, and social responsibility; and
- because it seldom means restoring to a static prior condition, it builds in and on an understanding of ecological change.

1.4.5 The Research Environment

Effective management depends on reliable information. JNP has taken important strides in the last three years with the development of a comprehensive GIS program, the creation of a library/resource centre, and the establishment of the Ecosystem Secretariat. We need vital research programs adding to our knowledge about JNP, but these programs should combine traditional and innovative approaches. In the spirit of integration, research programs must be founded on an interdisciplinary approach similar to that taken by the CER Project. Fortunately current policy is pushing in this direction.

1.5 Recommendations for Further Activity

1.5.1 A new, more realistic portrayal of JNP as a wild place that has attracted people for millennia is required to shift public awareness away from obfuscating or isolated notions of wilderness, such as the one that identifies visitors only as consumers.

1.5.2 Historical and cultural research is vital to understanding the changing character of JNP and better approaches are needed to ensure such research is integrated in decision making.

1.5.3 Raising public awareness of and support for the dynamic nature of cultural and ecological processes is crucial to the successful functioning of parks and protected areas.

1.5.4 Adaptive goal setting for future landscapes is the key in ensuring clear expression of values, integration of the most effective science, broad participation, and reliable implementation and monitoring.

1.5.5 Goals should be clear to all stakeholders and should involve the specification of an appropriate range of variability or the return of certain processes.

1.5.6 The Human Activity Mapping project warrants further research and development. This would involve:

- improving the content of the database for the CER Project's study area,
- conducting extensive analysis in conjunction with ecological datasets,
- determining effective modes of presentation of data and analyses,
- developing a user-friendly front-end means of access to facilitate use by other groups (especially local historians),
- integrating with JNP's GIS system, and
- expanding the database to incorporate the entire montane ecoregion.

1.5.7 CER strongly encourages JNP and Parks Canada to establish a substantial if not ongoing working relationship with historians of the fur trade, with a view to making JNP a locus of fur trade tourism and open-air study, unique in Canada.

1.5.8 Studies should be initiated into public values about JNP, and how they are changing.

1.5.9 Ecological restoration should be incorporated as a new model for ecosystem management in JNP. This would position JNP at the lead of national parks in North America.

1.5.10 An ecological restoration program should be implemented in measured stages. A series of experimental research plots should be developed to test prescribed fire, mechanical removal, and other site treatments on different ecosystems. The goal would be to develop effective and efficient techniques for managing larger areas of the ecoregion.

1.5.11 A site-specific restoration project, such as the one proposed by the Restoration Pilot Project for the Henry House flats, should be undertaken. This project should be larger than a single contiguous site (e.g., a dump site) but small enough to make it institutionally feasible and attractive in the short run.

1.5.12 The CER Project study area would make an excellent meso-scale restoration region. This would serve as a logical prelude to a site-level project, although ideally the two would be undertaken in conjunction with one another.

1.5.13 The CER Project study area would make a good long term ecological study area for future research.

1.5.14 The next level, and the broadest conceptual plan within JNP itself, would be a restoration plan for the entire montane ecoregion. This would provide a clear, visual representation of what is possible in the future, and would serve as an excellent communications tool.

1.5.15 Park staff should become involved more directly in activities of the Society for Ecological Restoration, including attendance at annual conferences and regional gatherings. These are crucial venues for the exchange of information about the management of protected areas.

1.5.16 Restoration projects, because they are regarded by so many as positive initiatives, could provide a solid foundation on which to build collaborative initiatives.

1.5.17 JNP needs to stake a strong, formal and cooperative commitment to research. Greater resources are required to encourage external research. In increasing the amount of co-operative

research, Park staff will need to loosen the reins of control slightly to allow for meaningful participation by outside researchers.

1.5.18 Parks should encourage new external research projects by allocating a pool of start-up funds from JNP's research budget;

1.5.19 A joint citizen-university-JNP research advisory committee should be created to advise on research policy and support;

1.5.20 Support in whatever ways are possible should be provided for the creation of a permanent research presence at the Palisades Centre.

1.5.21 Parks should establish a research staff position in JNP, possibly funded jointly with the University of Alberta, which would be responsible for encouraging research projects, making appropriate connections with staff in JNP, lobbying within the organization for improved resources, encouraging effective use of the Palisades Centre, assisting with arrangements for the accommodation of researchers as well as their labs and field stations, maintaining a database of active and past research, and ensuring the accessible dissemination and archiving of research results.

1.5.22 Parks should encourage and support the signing of the formal memorandum of understanding between JNP and the University of Alberta.

1.5.23 Parks should lend support to the creation of a non-profit foundation for research.

1.5.24 Given a traditional and ongoing overwhelming bias in the Parks Canada system toward natural science, Parks should encourage vigorously and solicit actively the research of social scientists in what needs to amount to a kind of affirmative action program.

1.5.25 On the understanding that the failure to support basic research in the short term will yield long-term problems, Parks should recognize the importance and value of all types of research—basic, applied and mandated.

1.5.26 Parks should establish a formal system of staff support for external research projects, complete with a written agreement that states the mutual expectations of researchers and JNP. Each external project should have assigned to it a member of Park staff whose best interest is served by expediting the successful completion of the project.

1.6 Structure of the Full Report

This Executive Summary serves as an overview and summary of the CER project as well as Chapter 1 of the full report. The full report comprises the following chapters:

- 1 Executive Summary
- 2 Background and Context
- 3 A Restorative Model for JNP

- 4 The Culture, Ecology and Restoration Project
- 5 Description of Component Projects
- 6 Implications

A complete reference list is included in the full report as well as several Appendicies listing project accomplishments.

The print version of the full report is available by writing to:

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Or you can download an "Adobe Acrobat" electronic version from our web site: http://www.arts.ualberta.ca/~cerj/cer.html.

2 Background and Context

> I would like to end by stressing the importance of and the need for more historical-geographic research on land-use history and landscape change in our national parks and elsewhere. Our memory of what we have done with the land is remarkably short. Historical-geographic research helps to dispel the fog and provide the basis for a more rational approach to contemporary land-use problems.
>
> J.G. Nelson. (1970) [our emphasis]

2.1 Remembrances of Landscapes Past

Sitting on the deck behind the Research Centre on a cool summer morning prompts memories of landscapes past. The Centre is an old house, built in the 1940s by Arnold Wilby for his property manager. It has been expanded, upgraded, remodelled, and used for years as the home of the avalanche rescue dog handlers in JNP's Warden Service, yet it still bears the marks of an old house. Little that we do as researchers, its latest denizens, seems to change that fact. Take a moment to squint your eyes. Imagine the present pushed to the edge of perception, and the long history of this place takes temporary hold of our imaginations. Gaze around as though time had taken a rest, and bask in an utterly different landscape.

One hundred years ago, in 1899, sitting in this exact spot, what would we have seen? Instead of a dense thicket of aspens, spruce and fir, one's view would be transfixed by Pyramid Mountain. A few monumental Douglas firs would be visible, and probably some standing, dead trees, waiting for the next major windstorm to bring them closer to rest. Fires had raced through the area a decade earlier, clearing out many of the trees, and leaving the characteristic sense of openness that Ross Cox described seventy-five years earlier, in early June 1817:

> ... we had an extensive view of the surrounding scenery.
>
> The genial influence of a June sun relieved the wintry perspective of snow-clad mountains, and as it rose above their lofty summits, imparted a golden tinge to the green savannahs, the open woods, and the innumerable rivulets which contributed their waters to swell the Athabasca. It was indeed a landscape of contrarieties, scarcely to be met with but in the Alpine regions of the Rocky Mountains. (Cox 1831: II,202-03).

Over our right shoulder, perhaps a few hundred yards distant, were the few buildings that Lewis Swift and his family had erected just a few years earlier, in 1895. The sounds of their daily activities—the wind of a crosscut saw, or the voices of children—might be audible. Working the dry land, Swift had begun an irrigation system to feed the market gardens in the fields a short distance away. An old trail ran along his (the west) side of the Athabasca River Valley (ARV), the river itself flowing but a short walk away. Following the trail north and east would bring us to the doors of several Métis families—the Moberlys, Joachims, Finlays (now Findlays), and Adams—who had for a couple of decades after the decline of the fur trade been farming in the valley. Travelling south and west would yield few encounters with people, just some old fur trade buildings "mouldering" away. It was just at the beginning of the period of alpine adventure in the region; few were coming this way yet.

More remarkable still are the features we would not have seen one hundred years ago: the town of Jasper, the Dominion Forest Preserve (later, JNP), and all its associated infrastructure, the Yellowhead Highway (Hwy. 16), two railway lines, telegraph, telephone, and fibre optics cables, oil and gas pipelines, campgrounds, motor courts, fire roads, tote roads, sewage and water treatment lines, hiking trails, hikers. None of this existed on a quiet, cool summer morning in 1899.

How you interpret these changes is very much a matter of perspective. Some will lament the loss of a wilderness. Others will see the loss of pastoralism (although this is a view just beginning to surface as we understand better the history of the ARV). Still others will see a logical sequence of developments culminating in present conditions, an inevitable reflection of a wider culture. Irrespective of viewpoint, visible to any keen observer are both the extent and the rate of change. The changes are mind-boggling. In less than one hundred years, the complexion of this valley has changed irrevocably. This is a simple fact we sometimes neglect because of the incremental quality of the changes. Taken as one piece, the sweep of history ought to incite a consideration of the future in the thinking of Park managers, scholars, citizens, and visitors; or so one would think.

The problem, perhaps the central one, arises when we try to arbitrate different interpretations of history. There are those who see a dim future, a wilderness ensnared by fences and developments, a grand and greatest-of-all theme park; then there are those who walk optimistically into a world of greater amenities, carefully designed ski areas, outdoor hot-tubs facing snow-swept peaks, and more opportunities for visitation. We may call these, respectively, the incarcerated and the cornucopian futures. Adherents to the former will try their utmost to prevent further development and to de-commission existing operations. The battle will be a tough one because the perceived adversary—the power of amassed capital and the patterns of technological development—is deeply entrenched. The focus is on setting aside whatever remains intact, and keeping it safe from hordes of despoilers. Adherent to the cornucopian view believe with equal fervour that wild places and human visitation are compatible, that amenities are precisely what makes the world better. Yes, there will be problems, but each and every one can be solved as it arises. Theirs is a truly cornucopian vision. Its critics see it as short-sighted, financially motivated, and intent on breaching the limits of ecological integrity. These critics believe that such a vision for national parks, far from being cornucopian, is deluded and malignant.

This dichotomy represents a fundamental confrontation of cultural values. On its own terms, each world view is consistent; each has its stalwart supporters. Skirmishes will be fought regularly—a road might be ripped up, the proposal to expand the size of a hotel outside the townsite will be granted (when push comes to shove, it seems that the cornucopians are winning this particular day). Such confrontations help throw into relief the fact that national parks are shaped by our cultural values. Once realized, that fact obliges us to acknowledge that cultural values change; they do not tend to resist time well; like us who make them, they are mutable. We don't allow hunting in JNP today; we did once. We didn't have three million people driving through the Yellowhead Pass twenty years ago; now we do. With the current trajectory, certain kinds of development will continue in JNP, although perhaps under much greater scrutiny. That scrutiny must be informed by a satisfactory understanding of how we got to where we are.

The point is simple: the future holds terrors as well as possibilities. We have authored the landscape to this point with commercial activities, Park amenities, and communication programs; moreover, we have inscribed the landscape with a plethora of human intentions. In the future, as in the past and present, we will continue to be authors. What kind of authors will we be?

There may be a third way of looking at the future, and this is the motivation behind our study. By contemplating the legacy of change in JNP, we all can imagine a different kind of place in the future. What if we were to take a different lesson from historical change? What if we understood the many changes as contingent, as mere blips on a longer timeline? We might then

wonder whether it is possible to make equally large changes in the future, yet do so with greater conscious intention than ever before.

We often hear that the Yellowhead Highway is with us for good. Perhaps it is. Yet, there is no reason why, over the course of several decades and with a change in popular values, the highway would not be phased out. It seems unlikely now, but who knows what will happen with transportation technologies? Cars were barely rolling off the dreams of inventors in 1899, one century ago. Perhaps we'll adopt a scheme of placing all vehicles on rail cars for a trip through the Park, or limiting travel within the boundaries to shuttle busses. Who is to say whether JNP's boundaries will remain fixed? They have shifted several times over the course of the last century, mostly by shrinking. However, the bold vision of the Wildlands Project (its Internet address is http://www.twp.org) and changes in economic activity might create the conditions for expanding the responsibilities of JNP and, thereby, bringing it into closer connection with the working landscapes surrounding it.

The third way of conscious intention is ecological restoration. The definition of this as used by the Society for Ecological Restoration (its Internet address is http://www.ser.org) is "the practice of assisting the recovery and management of ecological integrity." Ecological restoration compels us to regard the past and the future with equanimity. The past provides information about reference conditions, patterns of disturbance, and both models for healthy activity and lessons about destructive activity. Historical knowledge is used to set goals for the future, goals that inscribe our intelligence on the landscape. Our goals will not be perfect. We should aim at the very least for respect of ecological and cultural patterns and processes. As authors, we must strive to do our very best work. It is important to realize that people will look back on our efforts with the circumspection with which we now regard the work of those who came before. If we do our very best, then, we trust, people looking back will say that we had the right idea, that we sparked a new way of thinking about the management of precious wild areas.

We need to gaze one hundred years into the future and ask what we think JNP should—not will—be like. The image will be vague and difficult to resolve at first. Because it is subject to new knowledge and shifts in value, it will change. It is bracing to realize that we have both the capability and the responsibility to act so far into the future.

2.2 Objectives of the Culture, Ecology and Restoration Project

The Culture, Ecology and Restoration (CER) Project, which ran for three years, from 1996 to 1999, aimed at advancing a restorative model of park management. It was cast as a pilot project, one in which new ideas and approaches could be tested.

Two insights guided the project. The first involved binding together ecological and cultural knowledge. These have traditionally been regarded by most protected areas managers as two separate spheres. Such a perspective on ecology and culture reinforces what anthropologists refer to as the nature/culture divide. In the context of this first insight, it did not make sense to ignore human activities and processes. Why? Because we know that aboriginal management has been ongoing for roughly ten thousand years, and that our own activities in the twentieth century have created new ecological configurations. Without making immediate value judgements, how can we intertwine such historical/cultural data with ecological data?

In so-called wilderness national parks such as JNP, the tendency has been to segregate ecological information and cultural resource information. Ecological data are the core around which management programs are based. Cultural resources are important in so far as they honour particular past events and contribute to a broader appreciation of the park, but they are seldom brought into correspondence with ecological data; thereby, opportunities are lost for a richer understanding of landscape change. It is often the case that cultural resource management is sidelined by the fiscal priorities of ecological husbandry.

The second insight guiding the work of the CER Project was that history, in all its myriad forms and topics, is vital to successful Park management. We do not claim this as a novel observation. The relatively new field of environmental history, led by scholars such as Richard White and William Cronon, has promoted the study of human history as though ecosystems mattered and as though accounts of human-nature relations have practical value. From our knowledge of ecological restoration, and especially the insight that goals are tied inextricably to knowledge of past conditions, we gained a new appreciation for historical information about human activity, and saw it as a priority. Thus regarded, history is more than a curiosity; it becomes a set of guideposts to the future. Once we begin using those guideposts, the machinations of present circumstances fail to provide a satisfactorily broad context for the setting of goals.

These insights were made possible by adapting wisdom from the ecological restoration movement. What ecological restoration thinking counsels is the combination of historical knowledge—cultural and ecological—with goal setting. This produces long range, conscious choices that simultaneously respect ecological integrity and acknowledge the role of people in caring for, and sometimes living with, landscapes.

Two questions have guided the research of the CER Project during the past three years:

1. What are the extent, character and ecological influence of past human activity in the montane valleys of JNP?
2. How can such historical knowledge of landscape change influence ecological restoration and management?

In reading this report, you will see how these questions came to be refined. As in any complex project, especially one that is both interdisciplinary and intersectoral, the CER Project refined these questions in response to personnel, budgets, unexpected roadblocks, new ideas, technology, and opportunities. The following *three* determinants were decisive:

2.2.1 Scale

We took it as given that the montane ecoregion is the one most requiring careful attention: it is JNP's richest ecoregion, and more people use it or pass through it than any other ecoregion. Our choice was recently reinforced by the attention accorded it in the draft *Jasper National Park Management Plan Concept: January 29, 1999*. We settled eventually on a 64 km^2 study area that accommodates a wide variety of montane ecosystems (see below, Chapter Four, "CER Study Area"), and one especially that typifies most of the human influences that JNP exhibits: archaeological sites, riparian alterations, mine pits, roads, trails, and many others.Given our ambitions to conduct a pilot project to test new ideas, we backed away from tackling an historical review of the entire montane ecoregion. At roughly 800 km^2, the area was too large to permit a careful review of landscape change. As early as 1996, JNP staff indicated that they would be undertaking a detailed review of the town of Jasper and surrounding areas, what is now called the Three-Valley Confluence (of the Athabasca, Maligne, and Miette rivers). The research of the CER Project would, it was decided, be more productively centred outside that zone of distinctive influence. Finally, because of the benefits

derived from specificity, we wanted to focus at 1:20,000, not 1:50,000, the latter being the predominant scale for map and aerial photography coverage in JNP.

2.2.2 Integration of Disciplinary Knowledge

The need for using ecological data, derived from dendrochronology, palaeoecology, wildlife ecology, vegetation surveys, in arriving at management decisions in protected areas is well established; by contrast, integrating these data in a comprehensive portrait of a region, and especially blending them together with cultural history, is relatively rare. In fact, the gulf separating the social and natural sciences is considerable, greater than we had imagined at the beginning of the project. Not only were we experiencing the legacy of academic compartmentalization, but also we were facing the strong traditional bias of Park managers toward research whose focus is ecological. This bias extends well beyond the usual marginalization of cultural resource information to include all manner of social, economic, cultural, and political studies. (Clearly, one of the main sources of bias is the requirement that those entering the Warden Service hold a natural science degree.) One could argue safely that socioeconomic information—knowledge about who is using JNP and how they are using it—is at least as vital to the setting of long-term management priorities as ecological research. But, as Richard White has put it in his deft discussion of how environmental history should be conceived and written, the focus needs to be the relationship of natural history and human history, not the two subjects themselves: one must "do more than write a human history alongside a natural history and call it an environmental history. This would be like writing a biography of a wife, placing it alongside the biography of a husband and calling it the history of a marriage" (White 1995: x). In many ways, the CER Project was an affirmative action program for social science, a way of bringing into the open some of the techniques and insights that emanate from history, anthropology, sociology, and other disciplines. In some cases, we were not sure how much difference certain kinds of data would make, now or later, and how much background material and personnel would be available. We were testing and experimenting. The possibilities resolved into two major projects—the Bridgland Repeat Photography project, which provides unprecedented information about biophysical change in the twentieth century, much of it the result of decisions made by humans; and the Human Activity Mapping project, which deploys the technology of computer-based geographic information systems (GIS) to track historical human activities—as well as several minor projects, including pilot studies in oral history, palaeoecology, and archaeology. We have woven these together to produce a composite view of change in the ARV, but this marks just the first step in a continuing process of study.

2.2.3 Information Resources

The team of researchers that initiated the project in 1996 were stunned by the state of information resources in JNP. Years of budget cutbacks and, prior to the early 1990s, the discouragement of externally-managed research activity had left a gaping hole where one supposed there to be a repository of reliable data. No functional core library was in operation. Materials about JNP were scattered among libraries and archives across the country (some of what proved to be the most useful materials were uncovered at the British Columbia Archives and Records Service, and the National Archives of Canada). Recent coverage by aerial photographs proved either unavailable or of a quality below that necessary for our studies. Digital cartographic data were unavailable. (JNP was one of the last areas in Canada to receive such coverage. Many of the data gaps resulted from federal-provincial jurisdictional problems; provincially-initiated projects often stopped at the border of JNP, and federal programs frequently ignored national parks.) Both natural and social scientific research were sparse, except in a few fields (e.g., geology). Everywhere we turned, the news was bad. We spent the first year building an information database to gather

together materials about the ARV in the hopes that no one else would have to repeat our struggles. We collaborated with JNP staff, and with the valiant and growing Jasper-Yellowhead Museum and Archives (J-YM&A) to encourage further development of the library at JNP (thankfully, it is working well), and to establish uniform databases for collections. We made contact and developed relationships with local historians and those with long experience in JNP. The development of improved information resources is one of the significant legacies of the CER Project.

These three determinants shaped our research, and guided it down a discernible if often serpentine path from inception to conclusion. The two initial questions have been answered in various ways and are reported in the pages that follow. The CER Project proved to mark the incipience of a new era in research about JNP, an era that has entailed:

- the establishment of cohesive research facilities at the Palisades Centre,
- the crossing (at first, the trespassing) of borders among disciplines,
- the spawning of a number of new research projects,
- the placing of emphasis on cultural and historical data,
- the striking of a delicate balance between basic and applied research, and
- the delineation of a new approach to long-term management through ecological restoration.

But it is just a beginning. There is much work to be done, whether in mapping the cultural history of the entire montane ecoregion and the rest of JNP, in developing new spatial models that integrate cultural and ecological data, in extrapolating the results to the working landscapes surrounding JNP, or in conveying the results of the CER Project to a wider audience. As some of us remarked last summer on the back porch of the Research Centre, "our work will be successful if we're still involved in twenty years."

3 A Restorative Model for JNP

Nine decades have passed since the place we now know as JNP was first managed for protection and enjoyment. The National Parks Act, the legislation that determined JNP's mandate, has changed to reflect shifting public and political priorities, just as the borders of JNP have shifted, mostly inward, on several occasions. Park staff, reflecting prevailing values and also driving decisions with their own values, have shaped JNP into what it is today. Surely the Park warden of 1920 would have had difficulty imagining two million visitors per year, just as a warden of today would express disbelief (if not disdain) for predator kills, elk extirpation, and cottage developments. Throughout this century, a succession of paradigms have guided Park managers. The point of this chapter is to present a new paradigm for Park management, one that goes beyond the natural regulation paradigm which has been dominant for several decades in North American wildlands parks, and extends the reach of ecosystem management, the most recent of paradigms.

3.1 A Succession of Paradigms

Paradigms are always easier to identify after the fact, and the older they are, the easier they are to criticize. Paradigms describe the confluence of different beliefs. A broad review of Park management paradigms reveals that an *intervention* paradigm prevailed before the 1970s. Direct manipulation of animal populations, construction of fire surveillance networks, fire suppression, logging to provide building materials, and the development of facilities were accepted as normal. By the 1970s, concern about the pressures of development tempered most kinds of active intervention. The policy of fire suppression was being seriously questioned and there was a move towards the establishment of a more "natural" process via fire prescription. Some roads were closed. The lessons of ecology began to inform new approaches that sought to maintain places such as JNP as oases of natural diversity amid a desert of human artifice. The public was asked to "leave no trace," and Park managers enacted policies that as much as possible enshrined wilderness values. Some would argue, especially from the example of Banff National Park (BNP), that development continued (even accelerated) in the 1980s and 1990s. This is true, but the explanations for it are complex: the resolve of Park managers to support ecological integrity was often outweighed by powerful political and development processes.

David Graber, writing about national parks in the United States, suggests that a paradigm of *natural regulation* was in full swing at least by the early 1980s:

> The unifying principle of national park management today is the perpetuation of native ecosystem elements and processes. That is: keep all the native species; seek the free play of fire, water, wind, predation, and decomposition, the processes of the ecosystem; fend off alien organisms; and then permit the ecosystem to sort itself out. As a management policy, it is rarely if ever fully expressed, but it has been a goal at which managers could aim. (1995)

The *natural regulation* paradigm nicely matches public values about wilderness at the end of the twentieth century. It reinforces the notion of national parks as sanctuaries from the buzz of technological civilization. Management policies based on minimizing the impact of people involve the cleaning and maintenance of campsites and trails, the impositions of limits and quotas on the

useof campsites and trails, and the effort to minimize incidents of conflict between horse packers and hikers (Graber 1995). The visitor experience is one of solitude and escape. Ironically, the activities of managers themselves begin to appear overbearing, as wardens keep a watchful eye from their saddles, control animals with the assistance of helicopters, maintain backcountry patrol facilities, control traffic, and so on.

Recent scholarship concludes that "wilderness" is a social construct—a romantic idea that emanates from our shared consciousness—that has achieved a deeply-rooted place in North America's urbanized and industrialized culture. Superficially wilderness refers to something real, to ecosystems perhaps. At a deeper level "ecosystems" are models we have built to explain reality. Wilderness is nature without people, natural cathedrals for spiritual reconnection with things other and greater than ourselves. No doubt, places such as JNP meet these ideals, and people's epiphanies when communing with nature provide important perspective on technological excess. Such a view, however, ignores the peopled character of landscapes, including the long history of aboriginal activities (hunting, clearing, burning, and agriculture). How do we square our knowledge of such aboriginal practices with contemporary notions of wilderness? We suppress the former in favour of the latter or relegate the former to historical notes.

The problem with wilderness and with the natural regulatory paradigm that reinforces it so ably, is that the notion promotes irresponsibility. It suggests that wildness exists within the gates of parks and not without. Whatever is not wilderness (that is, whatever lies outside areas so designated) is a paler form of nature, nature that can be wracked and modified without particular regret or respect. As William Cronon observed, "the core problem of wilderness is that it distances us too much from the very things it teaches us to value" (1995: 87). Wilderness is always in the backcountry, at the end of a long drive, or in decline. It disables our capacities to appreciate humble natural places which are badly needed in a world so laden with human artifice. Again, Cronon:

> But the trouble with wilderness is that it quietly expresses and reproduces the very values its devotees seek to reject. The flight from history that is very nearly the core of wilderness represents the false hope of an escape from responsibility, the illusion that we can somehow wipe clean the slate of our past and return to the tabula rasa that supposedly existed before we began to leave our marks on the world. The dream of an unworked natural landscape is very much the fantasy of people who have never themselves had to work the land to make a living—urban folk for whom food comes from a supermarket or a restaurant instead of a field, and for whom the wooden houses in which they live and work apparently have no meaningful connection to the forest in which trees grow and die. (1995: 80)

Cronon's criticism of wilderness is well placed at least in so far as it forces recognition of historical amnesia and of escape from responsibility. Cronon joins a growing list of anthropologists and ecologists who champion the idea that people have been part of ecosystems, even those we now regard as "wild." There is a danger in taking this line of thinking too far, however, for it diminishes the grandeur and power of places such as JNP, ignoring their fragility in the face of rapid development, or presuming that all places at all times were being worked by people (such universalizations, either in support of or resistance against aboriginal involvement, miss the subtleties of regional and local variation). Gary Nabhan provides a gentle corrective:

> There is now abundant evidence that hundreds of thousands of acres in various bioregions of North America were actively managed by indigenous cultures, while millions of additional acres were scarcely exploited. The entire continent was not a Garden of Eden cultivated or hunted by Native Americans, nor was it all pristine. Many large tracts of the North American continent remained beyond the influence of human cultures and should remain so. Nevertheless, it is clear that the degree to which North American plant populations were consciously managed—and conserved—by local cultural traditions has been underestimated. (1997)

Unveiling the myth of wilderness helps show why the natural regulation paradigm needed reworking. It is not so clear that these more recent critiques are the ones driving the current shift away from natural regulation. More likely, it was a combination of acknowledging, on the one hand, the need to intervene in natural processes to counteract previous actions or inactions and, on the other hand, of a search for stronger scientific bases for park management.

3.2 Ecosystem Management

In Canada, a shift to a new approach was evident as early as 1988 with amendments to the National Parks Act that stipulated the priority of maintaining ecological integrity: "Maintenance of ecological integrity through the protection of natural resources shall be the first priority when considering park zoning and visitor use in a management plan" (C. 48, s. 1.2). The integration of science-based management with a commitment to shoring up declining ecological integrity constituted a shift to *ecosystem management.* This approach predominates today, although the transition from the natural regulation paradigm is only now in its final stages. The early glimmerings of ecosystem management can be read back in the literature almost three decades if one counts the creative fusion of planning, design, and ecology (McHarg1969; Dorney 1989). In universities, integrated environmental studies programs were graduating students in the 1970s who later influenced environmental policy. The challenge was clearly evident before the end of that decade: what would planning and management be like if ecosystems were taken seriously? By the second half of the 1980s, the ecosystem management movement was well under way, at least in the scientific and research communities (Agee and Johnson 1988; Noss 1990). A thorough review and prospectus for ecosystem management appeared in 1994 (Grumbine 1994).

Making ecosystem management work on the ground involves a supportive institutional philosophy (which Parks Canada had in place after the 1988 amendment to the National Parks Act), clear guidelines for implementation, and a receptive staff in the field. It is remarkable to remember the distance travelled in little more than a decade. As Zorn, Stephenson, and Grigoriev (forthcoming) observe,

> [t]raditionally, Parks Canada's approach to managing national parks has been jurisdictionally insular, focused within park boundaries, and oriented towards specific natural features or species. Managing for visitor use and satisfaction and natural resource conservation was of equal concern to park managers and was largely pursued independently.

As recently as five years ago, in 1994, it was clear from an outside perspective that JNP's shift to ecosystem management was in an early stage, driven by a few far-sighted managers and field

staff. Change in the management structure of JNP, including strategic positioning of new staff and the formation of the Ecosystem Secretariat, provided the necessary foundation. However, the development of comprehensive processes, including guidelines for management, a tight research focus, longer-term budget allocations, and monitoring programs, remains uncompleted. Intense development pressures, the timing of management plans, and devastated budgets perpetuate a defensive institutional posture.

Parks Canada has been a main player in developing ecosystem management programs. Stephen Woodley, a senior staff member in Ottawa, advanced a systematic program of monitoring based on ecological integrity (1991). This work was advanced and broadened to reflect a ground swell of interest in ecosystem management emerging in the early 1990s (1993). Rising to the need for systematic research and monitoring, and responding to direction from Ottawa, managers in individual parks across Canada developed new approaches, all of them under the aegis of ecosystem management.

Zorn, Stephenson, and Grigoriev (forthcoming) have reviewed these initiatives and described the approach taken to ecosystem management in national parks in the Ontario region. There, a set of ecosystem management guidelines was developed (based on Grumbine 1994)—an assessment of the strengths and weaknesses of current approaches to research and management—and with a commitment to tangible activities and outcomes. Ecosystem management revolves around core concepts including hierarchical context, ecological boundaries, ecological integrity, data collection, monitoring, interagency cooperation, organizational change, adaptive management, humans as part of nature, and values. Zorn *et al* are clear: it is not necessary to return to square one each time a new project is undertaken or a development is proposed, and organizational continuity from one park to another creates a reservoir of skill. The ecosystem management paradigm promotes

- an extension of ecological and cultural inventories outside a park's boundaries to the greater ecosystem,
- an insistence on cooperation with agencies and groups bordering the park,
- taking stakeholder concerns seriously,
- development of an integrated science program,
- the determination of effective measures of ecological integrity, and
- setting up communication programs that ensure that the public has some sense of how their park is being managed.

3.2.1 The Rocky Mountain Parks

The appearance of a rational planning and management process for national parks in Ontario marks an important development, but it belies the bedazzling institutional and ecological complexity of national parks. The mere presence of an approach constitutes only the formal beginning to a long and probably bumpy path towards implementation. The circumstances for JNP and the contiguous mountain national parks—BNP, Kootenay, and Yoho—are very different. The growing awareness of ecosystem management coincided with dramatically increased development in BNP and, to a lesser although significant extent, in JNP and the two smaller parks. At the same time, the federal government was cutting its support to all national parks, sometimes in annual double-digit percentages. A cooperative agreement was formed to manage the four mountain parks as a management block. This initiative certainly promoted greater exchange of information and, in some cases, made for cost savings and greater efficiencies. As with any significant change in local management cultures, the transition was not always smooth, especially in the context of staff reclassifications, down-sizing, and the introduction of new financial systems. At

best, the period since 1992 has featured experimentation and, at worst, the end of the tradition of managing parks with local, internal consistency and predictable policy. From the perspective of university researchers, the situation has been confusing: research partnerships and lines of communication had constantly to be altered to keep up with changes instituted by Parks.

Despite the administrative move to link these parks as if they were equal, in every sense BNP has always been the older sister. It is better funded than JNP, even though JNP is substantially larger. It is a cultural icon, drawing attention internationally. To be superintendent of BNP is to hold the most demanding and challenging field job in Canada's national parks system. A rivalry of sorts has existed for years between BNP and JNP. On the one hand, staff and residents in JNP are glad not to be dealing with the burgeoning crowds and a congested, commercialized town. Yet there is invigoration in the programs and plans that BNP has been able to enact. BNP was the first to organize and implement large prescribed burns, to host several major carnivore research studies, and to exhibit a convincing commitment to the management of information resources (BNP has a well-established park library as well as the privately-funded and widely-regarded Whyte Museum of the Canadian Rockies).

BNP reached a crisis point in 1994 as a result of increasing pressure for development. Some said BNP was dying as a wilderness area, while others, perhaps in a dramatic gesture, were urging that BNP be de-listed as a World Heritage Site. The federal Heritage minister called for a temporary moratorium on all development and funded a multi-year, multi-million dollar study of the state of BNP—the Banff-Bow Valley Study. In many ways, it was this study that defined the character and approach taken to ecosystem management, and it cast a long shadow on initiatives outside BNP. For JNP, it meant taking a back seat and waiting.

3.2.2 Jasper National Park Management Plan Concept

While the Banff-Bow Valley Study set a number of high-water marks in terms of the comprehensive investigation of ecological and cultural processes, and helped indirectly to focus attention on the montane ecoregion of JNP, the main influence over management in JNP came from BNP's most recent Management Plan. Drafted painstakingly by Park staff amidst a blizzard of complications and pressures arising from the Banff-Bow Valley Panel's work, the draft plan was released in 1996 and approved in modified form in 1997. The plan is a careful exercise in vision and compromise. It sets in motion some significant changes in the extent of growth of the town of Banff, decommissions a number of developments in key ecological locations in the Bow River Valley, and severely limits any facilities outside the townsite. Building on the base of the Banff-Bow Valley study, and with a clear commitment to ecological integrity, will, it is hoped, forestall or eliminate the worst depredations from an ecological perspective. At the very least, it buys time to breathe, take stock of the future, and proceed prudently.

Given the rivalry between the two parks, it was a shock bordering on an affront that JNP's management planning process, delayed for several years in the wake of the Banff-Bow Valley Study, was to be based literally on BNP's Management Plan. (The Jasper National Park Management Plan Concept was released on 29 January 1999, and was revised following the receipt of public comments and the addition of detailed actions. Approval and release of the final plan is anticipated early in 2000. The Plan Concept set forth general principles and suggested action. At less than forty pages, it is an abbreviated version of the full Management Plan.) There is an eerie similarity between the two plans. For example, the chapter titles—"A Place for Nature," "A Place for People," and so on—follow an identical format. Although, in large measure, the managers and staff of JNP have followed closely BNP's template, there are obviously many differences to meet local needs and concerns.

What is the approach to ecosystem management followed in JNP's Management Plan Concept? Ecological integrity is front and centre. The Core Vision mentions the need to limit development, to improve partnerships and understanding of JNP, "to reduce stress on park ecosystems[,] and to restore natural processes" (here we detect a throwback to the paradigm of natural regulation). In what is not surprisingly the longest section, "A Place for Nature," the maintenance and restoration of ecological integrity are featured as the overall goal: "[t]his includes maintaining natural biological diversity and maintaining or restoring physical, or non-living, aspects or the natural environmental such as air or water." Ecological integrity has been compromised through direct and indirect human activities (i.e., limiting or interrupting natural processes), resulting in a loss of biodiversity. Maintaining and restoring biodiversity at several levels—landscape, community, species—is the point from which all the proposed actions proceed. While the concept of indicator species is not mentioned explicitly, two of the six pages in the "Place for Nature" section feature a profile of the Grizzly Bear Habitat Effectiveness model.

Ecosystem management, featured in the preamble, "recognizes that national parks cannot survive as islands. Species and ecological systems in national parks depend on the long-term sustainability of regional ecosystems." JNP's Management Plan Concept is well aligned with the broad outlines of ecosystem management. Over the last few years, progress has been made in connecting JNP more closely with its neighbours, including the Foothills Model Forest (http://www.fmf.ab.ca) and in viewing the future of JNP in the context of the regional landscape, which bears the name, Greater Yellowhead Ecosystem. There are better schemes in place for understanding and monitoring change in various ecological characteristics, although almost everyone would admit that there is ample room for improvement.

However, the concepts of *ecosystem management* and *ecological integrity* are plagued by the same problem: both lack a clear sense of direction. Consider ecological integrity: at least in theory, an ecosystem whose long-term history does not exhibit a long-term history of untouched nature can still possess integrity. Integrity depends merely on the successful functioning of vital components, not on the necessity that all the components be natural. Similarly, while ecosystem management conventionally incorporates advanced thinking about how best to integrate and organize knowledge for managing complex ecosystems under stress, it does not make explicit the need to consider historical conditions as a point of reference on which to plan for the future of an ecosystem. It may be argued, of course, that both these concepts constitute major advances in the way we think about the management of protected areas, and that they are at least sympathetic to historical reference, but ecosystem management applies equally well where historical reference is not a factor, as in mimicking wildfire processes through the harvest of large sections of boreal forest (such an application has been made in northern Alberta), or, at another extreme, as in an utterly contrived ecosystem such as Disney's new billion-dollar theme park, Animal Kingdom.

The problem of lack of direction is solved by ecological restoration. Ecological restoration rests on a foundation of historical knowledge. No matter how scant the historical data, the decision about what to do in the future must appeal for its authority to the knowledge we collectively possess about the past. Restoration, according to the Society for Ecological Restoration, is "the process of assisting the recovery and management of ecological integrity." Further, ecological integrity "includes a critical range of variability in biodiversity, ecological processes and structures, regional and historical context, and sustainable cultural practices." Ecological integrity, accordingly, is given direction from the historical range of variability. Whether ecological restoration constitutes a new paradigm for management of protected areas, or serves only as an addendum to conventional notions of ecosystem management, the important point is that restoration and historical knowledge are consciously connected. Together they provide stability, which a turbulent world of practices and values badly needs.

3.3 The Challenges of Ecological Restoration

Cliff White, long a warden in BNP and a specialist in prescribed fire techniques, has used the term "freak landscape" to describe the condition of a region that has been extensively altered. Most of the planet now qualifies as freak landscape in this sense. BNP and JNP are among the less altered, less freakish, parts. But even in them, alteration by humans has been significant. Aboriginal people have used the ARV for almost 10,000 years. Hunting and trapping to support the active fur trade from 1810 to 1870 introduced a greater influence on ecological conditions. The largest disturbances, however, have come in the twentieth century, most of them since JNP was declared a protected area in 1907.

In the past century, especially in the last couple of decades, the rate of ecological change in JNP has far exceeded the long-term rate of change for most ecological processes. The causes include human influences ranging from site-level disturbances to global climate change. Some of the results are open sores such as unreclaimed gravel pits. Others are more subtle; fish stocking, for example, is hardly noticed although it has endued many lakes with a community of organisms radically different from what would have been observed prior to stocking.

In the valleys, the biggest factor has been fire suppression and prevention. Before this century, JNP's montane ecosystems constituted a patchy landscape. They were shaped by several processes, including wind, flooding, insect infestations, and aboriginal cultural practices, but the dominant process was uncontrolled wildfires of varying intensities and frequencies. Since JNP became a national park, such fires have been suppressed and this practice, along with a suspected reduction in natural fire incidence and perhaps other factors over the last century or so, has produced a landscape very different from that existing in the previous century. According to the natural regulation model, wildfires as part of natural process should have been tolerated. But because our cultural upbringing associates uncontrolled fire with destruction, Park managers have intervened, suppressing fire to limit damage but producing thereby a heavily altered, freak landscape (Higgs 1999).

In these circumstances, what should restorationists be doing? If, to remember the Society for Ecological Restoration's definition, restoration is "the process of assisting the recovery and management of ecological integrity," and if ecological integrity "includes a critical range of variability in biodiversity, ecological processes and structures, regional and historical context, and sustainable cultural practices," then in a heavily altered landscape, restoration may be taken to mean getting things back to a condition with integrity, a condition less distorted by human intervention. But what condition is that? To restore, say, a painting obscured by years of grime, is to bring it back as closely as possible to its original condition. But what if the artist adjusted the painting several times after its initial creation; which "original condition" is the proper goal? (Higgs 1997). Ecosystems pose even more difficult problems because they are dynamic. There is no original condition for an ecosystem, fixed at one point in time. As a result, restorationists increasingly spurn the use of "original" in favour of terms such as *reference conditions* (White and Walker 1997).

The choice of a reference condition for JNP's montane valleys demands recognition that these places have always been both dynamic and affected by humans. Which human activities should be incorporated in a restored system? If First Nations' use of fire contributed significantly to historical ecological conditions, should this too be reintroduced? This is difficult, value-covered terrain. Traces on the montane valleys were left by small-scale, mostly subsistence agriculture and trapping around the turn of this century. Should this human influence be accorded the same stature as subsequent and more noticeable human influences? Should it be placed alongside ecological

influences, blurring the distinction between nature and culture? Do the old categories, *nature* and *culture* still make sense? As to fire, after decades of fire suppression, will simply letting any new fires burn bring about a return to natural conditions? Or will it bring about conflagrations that burn hotter and farther than ever before?

For many reasons, JNP managers want to reintroduce certain processes (most notably, fire) into the landscape, but not every reason has been articulated clearly. The most obvious and easily justifiable of them concerns the loss of ecological integrity, often expressed by the precipitous decline of a particular species, for example, the Grizzly bear or the Harlequin duck. Some managers also want to right wrongs: it is difficult but not impossible to convince people that suppressing fire in the montane landscape was wrong and that it needs to be corrected. Others who know JNP intimately are aghast at the prospect of freakishness: they cannot abide the thought that nature is a monstrosity of our creation.

But avoiding our own creation is not entirely possible. Consider prescribed fire in the montane ecoregion (several fires have been introduced on a very limited basis, notably at Henry House, the Colin Range at the base of Mount Hawk, and more recently across from the Palisades Centre). Fires must be prescribed in order to protect valuable human infrastructure and to minimize the risk of enormous, runaway wildfires. In some settings, recurring prescribed fires will be necessary in perpetuity, while in other areas, farther removed from human activities, a modified approach—natural and prescribed fires—is possible. Some argue that fire may not be sufficient, that thinning of forests is necessary, as well (Feeney et al. 1998). What is the goal of such prescriptions? Are the conditions that existed immediately prior to the establishment in 1907 of Jasper Forest Reserve (the precursor to JNP) a good choice at which to aim the restoration? If that date's profile does become the goal, then exhaustive historical ecological studies would be required to document the conditions at that time (probably more grasslands, less forest cover), and techniques would be needed to bring these conditions into being.

An obvious problem with this approach is that only a program of regular management will ensure that the ecosystem remains within a narrower range of variability (presuming that people want greater stability, predictability and buffering from the unusual; again, cultural values enter the picture). As well, the year 1907 may not be a good choice because settlement and fur trading before that year, and railway construction beginning only three years after it all exerted significant influences on the montane ecosystem. However, the solution does not necessarily lie farther back in time, for, to push back past 1800 begs the question of aboriginal land management practices: would we want to return these anthropogenic practices to the ARV? Any desire to do so depends significantly on the extent to which we can piece together the cultural record of activity along the valley. Such study would require a blend of oral histories, history, ethnology, archaeology, and palaeoecology, all of which are presently in short supply for the area covered by JNP.

In all cases, restoration runs the risk of imposing on the landscape yet more influence, a higher level of freakishness. Would this be restoration, if by that we intend a returning to some past condition or dynamic state, or would it amount merely to enlightened meddling? Whether we pick 1907 or 1800 as the reference point, whether we continue fire suppression or simply end it, whether or not we use prescribed fire as a transition measure, we are making choices that reflect our values and culture, or, worse, the values and culture of some of us. Meanwhile, the landscapes of JNP have resulted from decades of cultural belief and practice; restoration will not overturn this state of affairs.

Setting appropriate goals involves a creative fusion of scientific and cultural knowledge. It will always depend on value judgements, no matter how much we cloak our judgement behind a veil of scientific precision. Deciding what percentage of JNP's montane valleys covered by grasslands is appropriate, is rooted in historical knowledge about the distribution of grasslands and underlying

ecological conditions. It is also informed by the likelihood that aboriginal burning practices created and maintained a particular, changing vegetation pattern. Included in such a decision will be economic concerns about the maintenance costs as well as judgements about how much change visitors are willing to accept. More difficult still is the challenge of comprehending and managing for a turbulent future. Climate change, the result of human activity, bears on all other considerations. Setting goals must also mean adapting to change.

3.4 Patterns of Ecological Restoration

What is now known as ecological restoration is famously said to have begun in North America at the University of Wisconsin Arboretum at Madison under the tutelage and inspiration of Aldo Leopold. Of course, no one truly invented restoration. It grew slowly out of multiple practices and ambitions. At the most general level, restorative activities were occurring around the world each time someone undertook a deliberate task of bringing a compromised ecosystem back to a state of health that resembled historic conditions. Elements of land reclamation, revegetation, and certain kinds of bioengineering all contributed to making restoration a recognized practice by the early 1980s. The term, *restoration*, did not come into widespread use until the early 1980s, and it remains in the regard of some a lamentable choice (Jordan et al.; see Historicity, below). *Restoration and Management Notes* began publication in 1983, and was followed by *Restoration Ecology* in 1994. The Society for Ecological Restoration began in 1989, and now numbers well over 2,000 members worldwide. On any account, restoration is in its conceptual and practical infancy.

According to Hobbs and Norton (1996), in their germinal paper about the conceptual foundation of ecological restoration, there are four goals that motivate most restoration projects:

- to restore highly degraded localized sites (e.g., abandoned mines),
- to improve productive capability in degraded production lands,
- to enhance conservation values in protected landscapes, and
- to enhance conservation values in productive landscapes.

The first three of these four goals are applicable to JNP. Sites in JNP such as old borrow pits are highly degraded, and could stand restoration. Obviously, enhancing conservation values in protected landscapes where such values have been compromised is central in the Management Plan Concept. Gains through managing for enhanced conservation value are possible, as well, in the working landscapes that adjoin JNP, where the possibility arises of collaborative projects between JNP and provincial government agencies, extractive industries, and non-governmental initiatives such as the Yellowstone-to-Yukon Wildlands project.

Worldwide, restoration is gaining ground, so to speak. Numerous trends are evident. It is celebrated by some as a new paradigm for biological conservation, a way of invigorating people's imaginations which have been numbed by the defensive and often depressing struggles of environmental resistance. That increasing attention is paid to theory and principles, indicates a maturity in practice, as well. Even when narrowly conceived as a branch of applied ecology, restoration is attracting the attention of scientists who view it as a way of developing insights through experimental manipulations. There is a shift from site-specific projects to landscape-scale projects. The challenges of putting the pieces—the structures, patterns, and processes—back together even for small sites can be daunting. With new approaches, especially those that forego historical precision and focus on historical range of natural variability, the scope of projects is expanding (Cummins and Dahm 1995)

Over the course of the past decade, a distinctive expansion in the reach of ecological restoration has occurred. Conceived originally as a way of restoring ecological integrity, it is now widely regarded also as a means of rejuvenating cultural practices and beliefs. Even the official definition of restoration now incorporates "sustainable cultural practices" as one of the core principles of ecological integrity. There are several reasons for the expanded scope (Higgs 1994). First, many projects depend on subsequent management of the site—weeding, burning, pruning—to ensure long-term viability. Second, ecological restoration, especially in traditional and aboriginal communities, has the capacity of renewing or fortifying practices that are vital to cultural survival (Martinez 1991; House 1999). Third, in many regions of the world, including JNP, today and historically, people intensively manage ecosystems according to traditional symbiotic relations. To restore such ecosystems, often referred to as "agroecosystems," means bringing back not only ecological features but also cultural ones. It is the cultural basis of ecological restoration, a synthesis of ecology and culture, that provides many of the conceptual challenges and the prospect of a new direction for ecosystem management.

3.5 The Ecological Restoration Paradigm

Reed Noss, president of the Society for Conservation Biology and former editor of the journal, *Conservation Biology*, recently addressed a meeting of ecological restorationists in Victoria. Making light of the taxonomic relationship between conservation biology and restoration ecology by speculating about which one might subsume the other, he offered a clear message: ecological restoration is pushing the boundaries of conservation biology and ecosystem management. David Brower, the "archdruid" of contemporary environmentalism in the United States and, a decade ago, an opponent of ecological restoration because he thought it might deflect attention from preservation, has recently coined the term "global CPR"—Conservation, Preservation, Restoration—as the key mix of activities necessary to advance a global environmental agenda.

For some, restoration carries narrow or negative connotations. It is often viewed as a technique for remedying site-specific damage, such as returning vegetation communities to an abandoned gravel pit. What Brower has done, although his recent work builds on a widespread movement, is to show that restoration is a necessary partner of preservation and conservation. Given the extent of despoliation, the need for restoration has become preeminent. Some have worried that a focus on restoration will deflect attention and commitment from the traditional and crucial tasks of protecting ecosystems from destruction: at best, resources will be drained from conservation and preservation, and at worst the technology of restoration will be used as a justification for further destruction. The argument for that justification runs as follows: if an ecosystem can be restored, then either (a) it can be damaged and fixed later, or (b) another ecosystem can be restored to compensate for its loss. This thorny problem is one of compensatory mitigation (Higgs 1993).

These worries are legitimate. The legacy of land reclamation, for instance, which adopted a frequently cynical approach to solving problems by greening a landscape without necessarily ensuring ecological integrity, has left in people's minds the image that restoration is merely a matter of sugar-coating the landscape with attractive vegetation much in the way that many municipal garbage dumps were dressed up with landfill and grass seed. The scientific pursuit of restoration, while laudable and important, has set up restoration as another arrow in the technical quiver of conservation biology. Given the problem of land-swapping and mitigation, these are cultural and moral issues that all environmentalists and restorationists must take very seriously.

The worries arise in part from a terminological and conceptual confusion at the heart of restoration. The terms *restoration ecology* and *ecological restoration* are commonly confused. In keeping with contemporary convention, *restoration ecology* needs to be understood as the ensemble of scientific practices that contribute to ecological restoration. *Ecological restoration* is the total set of ideas and practices (social, scientific, economic, political, and so forth) involved in the restoration of ecosystems. *Ecological restoration* is a much broader term, and it helps to answer many of the worries and challenges about scope, viability, and potential. It is more than a technique, more than a technical fix, more than a salve to heal the wounds inflicted by overzealous development.

Ecological restoration can push the paradigm of ecosystem management in four main ways:

- by insistently attending to historical reference conditions;
- by taking goal-setting seriously at all levels, from site to landscape;
- by integrating cultural and ecological processes in management; and
- by enlarging the imaginative view of what is possible.

This last point cannot be overstated. Ecological restoration provides a forum in which to think hard about future possibility. Is it possible to increase ecological integrity in JNP? How much of this will depend on technical implementation, and how much on changes in people's values and practices? In the Introduction, the reader is asked to gaze back a century to contemplate what the ARV must have been like before roads and rails and a town occupied it. We shall see below that ecological restoration encourages thinking about landscape history in a comprehensive way. History is a good tonic for thinking about the future. Into the past we can either read ceaseless strife, damage, and complication, or see hope in the magnitude of change, and then work toward something better.

3.5.1 Historicity

Ecological restoration requires historical study and reflection. To restore means to bring something back from the past, and in the most literal sense it means to manipulate something to resemble, moreover to *be*, what existed at some time in the past. The most obvious and at the same time one of the most difficult questions that ecological restorationists must address is: Why turn to history for answers to ecological integrity? What justifies an insistence upon history?

Earlier in this chapter, a conventional and straightforward sense of art restoration was discussed. Art restorers are those who take works of art that have been damaged by exposure to corrosive environmental conditions, harsh lighting, and years of grime and soot, and return them to their *original* condition, that is, the condition intended by the creator. Like the restoration of a dynamic entity, art restoration is not always straightforward. Marcus Hall uses the example of the restoration of the Sistine Chapel, where restorers debated long and hard about exactly what the final restoration should look like. One paramount concern was that the restored original might look too bright or garish to the contemporary eye. Clearly, normative judgements are implicit in any kind of restoration (Hall 1999).

A chief distinction between art (and architectural) restoration and ecological restoration is that ecosystems are dynamic. It would be naïve at best and careless at worst to identify any single "original" condition for an ecosystem. Determining goals for restoration depends on making careful judgements about:

- the kind of damage that has occurred to prompt the restoration,
- the way in which the ecosystem functioned prior to the damage, and
- the particular conditions—processes, structures, and patterns—that ought to be returned.

Ecological *damage* is defined in a number of ways. Frequently, it refers to a loss of biodiversity (in effect, a change in ecological processes) that has occurred with reference to a defined scale. For example, in the montane valleys, JNP managers are concerned about the encroachment of forests onto grasslands. The development of a close-canopied, forested landscape, in effect a process of homogenization, yields lower biodiversity. A mix of ecosystems provides more living conditions for more species. Damage also means discrete, heedless actions that result in the biophysical disruption of a site. For instance, an access road creates a physical disturbance that exerts well-documented ecological disruptions on the land. There are two components in identifying and assessing damage, conventionally thought of as the distinction between objective and subjective knowledge. A road creates unassailable ecological disruptions. However, such disruption might be of relatively little concern to the team who installed fire observation towers in JNP in the 1940s. For them, the necessity of controlling fire was worth the disruption. Half a century later, access roads mean something very different to most managers. They constitute a scar on the landscape, and serve as the conduit by which people gain mechanical access to remote sites. Moreover, if we take an ecocentric instead of anthropocentric view of damage, what matters to a Grizzly bear or whitefish might not be of significance to people, and vice versa. We tend to be motivated by open scars on the landscape, the fear of catastrophic fire, the loss of charismatic species, and, more recently, an overall decline in biodiversity. A Grizzly bear might not care much about an old road as long as traffic is negligible. A whitefish might be much more concerned than we are about impounded water. Values and point of view play decisive roles in determining what constitutes damage, so we need to ensure that we reach beyond our own species' perceptions of it. A careful review of history provides a good antidote to parochial thinking.

Assessing damage and prior conditions necessitates historical study. At a cultural level, we want to return to a time before the abuses began, to an unsullied wilderness. The positive goal, then, is to return to "natural conditions" (whatever we decide constitutes these); in other words, if an ecosystem functioned in a particular way according to long-running processes and variability within defined boundaries, and then suddenly went off the scale as a result of human activities, the goal would be to bring it back to its previous conditions, to its natural conditions. Natural conditions have the weight of time on their side. If recent human activities lie beyond the long-term range of variability, then we have pushed the ecosystem beyond its historical limits.

However, assessing exactly what is meant by *natural* is more difficult than it appears. Obviously, native species, processes, and patterns interacting over evolutionary time define *natural.* In JNP, the relevant period is post-glacial, which focuses attention on roughly the last 10,000 years. However, determining the relevant evolutionary environment depends for some on a temporal scale fifty or one hundred times that of the longest-lived ecological dominant (Covington et al 1999). Much depends in this case on whether one is a zoologist or a botanist; the ecological dominant for the zoologist is the Grizzly bear, while for the botanist it is the Douglas fir. There are practical limits in resolving accurate palaeoecological data back as far as 10,000 BPE.

The *historical range of variability* approach, just described, is only one way of determining reference conditions. As described earlier, it is possible, as well, to focus on a particular instant in time, and to set restoration goals to, say, 1907, the date of the creation of what is now JNP. The glaring problem with such an approach, which explains why it is less favoured by restorationists at present, is the difficulty in developing a defensible and logical rationale for one temporal point over another. This is the *static* approach used in art restoration. It does not work effectively or defensibly in ecosystems because it results only in a more elaborate, perhaps more enlightened, kind of meddling, and one that many will regard as self-interested because apparently arbitrary.

Another alternative, the *time slice* approach, also involves selecting a particular temporal point, but, rather than managing the ecosystem for constancy, the ecosystem is reset to historical conditions and allowed to follow paths of ecological succession. There are merits in this approach, especially when critical contemporary problems threaten long-term integrity and conditions have precluded or rendered very difficult opportunities for subsequent management. It is also an elegant approach: it focuses attention on a single point in time, which provides managers with an easier target.

Popular now is the historical range of variability approach, as evidenced by the Society for Ecological Restoration's definition. Most restorationists in practice and theory are wrestling with how best to understand and define range of variability. What attributes should be measured, and over what period? The greater range of choices constitutes an onerous challenge to Park managers who would have to deal with a widened range of thorny questions about values. Moreover, what if it is discovered that current conditions lie within a long-term range of variability? Does this mean that degraded environments would be tolerated? Suffice it to suggest that not all the bugs are yet worked out—or in.

Restoration using the historical range of variability approach depends on the determination of reference conditions, that is, ascertaining historical markers that guide our efforts. Climate, vegetation patterns, animal population data—indeed, any significant evidence can be used to piece together prior conditions of a site. These historical data can then be compared with current conditions to determine the amount of difference. Much can be learned from study of adjacent or nearby sites that manifest pre-disturbance conditions. Such sites comprise an excellent resource for creating a composite view of what the site to be restored might have looked like in times past. White and Walker (1997) argue as well that spatial and temporal scale must be carefully considered in developing an understanding of natural variability. The characteristics of variation depend on the kinds of attributes being studied, and also on the scale of observation. Too narrow a view, for example, will ignore landscape-scale processes, while inattention to micro-level variations will result in a restoration that risks a lack of nuance and sophistication.

Ecological restoration, more than any other contemporary environmental practice, compels us to attend to historical conditions. It is bound to do so by definition and, more importantly, by cultural values that eschew human damage to ecosystems and desire natural conditions. Within conventional models of ecosystem management, history is subsumed in attributes such as "hierarchical context" or "ecological integrity." The danger is that ecological integrity can be interpreted increasingly in term of contemporary needs and demands as people become inured to a hyperreal culture of Disneyfied nature. Historical knowledge sends us back to engage with a bigger picture.

3.5.2 Goals

Paramount in ecological restoration is goal-setting. Any competent restoration depends on establishing clear goals for intervention based on a blend of historical reference conditions and practical considerations, including biodiversity targets, public acceptability, economic limitations, aesthetic concerns, and so on. In its reliance on goals for its success, ecological restoration as an environmental practice is not unique, for ecosystem management of any kind relies on clear goals. The difference is that restoration is *inherently* goal-oriented because of a dependence on historical reference. What happens in the future is linked to the past. Ultimately, the discipline enforced upon us by historical knowledge prevents restoration from veering off into purely human directions, for example, the creation of a wilderness theme park that presents symbolic dimensions of "wilderness" rather than being keyed to the actual wildness that exists on its own accord.

Any attempt to set goals for a restoration project engages thorny questions. Often, these address fundamental issues that do not necessarily have discrete or obvious answers. This state of affairs often vexes natural scientists and Park managers, whose orientations to findings and results are frustrated by vagueness; no wonder that they often respond by dismissing or according low priority to such questions. In a number of respects, difficult questions about restoration compel us to set clear goals, goals that address directly some of these difficult questions. A sample of such questions, some of which have already been highlighted, follows:

- How important is continuity with other landscape elements; that is, is regional coordination necessary?
- What should be done if former conditions cannot be easily recreated?
- For whom and for what should a landscape be restored?
- How important is participation in restoration practice?
- How much management is permitted on restored sites?
- How important are cultural practices (e.g., agriculture, gathering, ceremony, tourism)?
- Who wins in most restoration projects and who does not?
- How seriously should aesthetic considerations be taken in the design of a restoration project?

Addressing and perhaps answering such thorny questions forms a vital part of goal-setting in restoration. Then, the goals themselves can serve several key functions:

- they set an appropriate trajectory for a project in terms of expected results;
- they highlight the values that are considered important (e.g., biodiversity, remediation, cultural beliefs);
- they provide a framework in which project evaluation can take place, by asking questions, such as, Does a project meet the intended aims across a series of criteria?

Goal-setting ought to be the single most important step taken in any programme of restoration. It should precede detailed site analysis, background research, or the allocation of resources.

Setting long-term goals in ecological restoration usually involves considerations that are primarily ecological. Does the restoration support regional movement patterns for wildlife? Is the restoration consistent with other similar restoration projects in the region? In the case of a wilderness national park, what connections are being made with the working landscape? There are other factors, too. The restorationist might integrate cultural practices or structures that have served a significant role in the past. Available funds might delimit the possible kind and extent of restoration. Public attitudes must be factored in. What good is it to plan something that does not attract sufficient support and creative involvement? What scale is appropriate for a project and how does the project's scale relate to other scales (e.g., landscape, meso-scale)?

Goal setting in restoration exposes the need for a judicious balance of scientific and evaluative knowledge. Personal values, beliefs, attitudes, and visions are to be foregrounded: these are ignored only at considerable peril to the long-term success of a restoration project. That this foregrounding needs to occur is hardly a new idea, but many attempts to incorporate values into policy and decision processes have failed over the last decade or two, and many more continue to ignore evaluative knowledge or pay it only lip service. Typically, decision-makers, Park managers, and members of the public are numbed by value-talk today. Great sighs attend the announcement

of a discussion rooted in values: not sighs of relief that "now we are really getting somewhere," but sighs of despair that "oh, here we go again!"

Apathy and resistance are growing in reaction to processes that emphasize goal-setting, development of vision statements, or arbitration of different value perspectives. What accounts for this trend? Perhaps it is a consequence of gaining a better understanding of ecological realities, which in turn inundates us with calls to change processes, behaviours, organizations, technologies, and partnerships. But then a process is launched without due consideration of the underlying values and beliefs that gave rise to the need for a change in the first place, and often without the necessary discipline and integration of operations to ensure success. We are in a transition period which does genuinely require new ways to join scientific and evaluative knowledge.

Sociologists and anthropologists who study science, and scientists themselves report that what we understood formerly to be a highly rational and fully organized process in generating scientific knowledge is in fact a contingent, complicated social process in which the values of individuals and groups shape (although they do not necessarily determine) the outcome of research. In the burgeoning field of risk analysis and management, it is now widely recognized that risk science *must* incorporate the perspectives of people who are affected by particular risks; probability of occurrence does not equal risk. Closer to the subject, the Banff-Bow Valley Study recognized the importance of solid scientific information, but also of the importance of understanding and appreciating that no amount of good science would matter if those affected by the study were not consulted and their views were not incorporated in the recommendations. Further, when it comes to the management of protected areas, a preponderance of ecological research, while crucial, must be balanced by and joined with sound research on social, economic, political, and cultural factors.

The challenge in finding an appropriate way of acknowledging and balancing scientific and evaluative knowledge is especially acute in restoration because our interventions in ecological processes and structures are deliberate and self-conscious. In them we are literally designing nature and doing so, we hope, with the best intentions and knowledge, and with the greatest degree of respect for biodiversity, integrity, context, and sustainable cultural practices.

3.5.3 Taking Cultural Practices and Values Seriously

The importance of history and of goals to ecological restoration has already been discussed. With the discussion of historical reference conditions it was apparent that knowledge about past ecological conditions is crucial, but so too is a picture of historical *cultural* practices. This awareness marked the initial impetus in tying together ecological history with cultural history in our research. If ecological patterns, processes, and structures can be represented historically through spatial analysis, then it is equally feasible to do the same with human activity. However, this approach can go beyond comprehending disturbance dynamics; in some cases, it reaches back to symbiotic relations between people and ecosystems. For example, the ways of life of First Nations peoples in the ARV may well have co-evolved with ecological structures and patterns. Thus, uniting ecological and cultural history also provides a sense of continuity, one that offers an awareness of how our activities today relate to our predecessors'. History, of course, teaches us lessons, some of which are salutary and many of which are disquieting.

There are two further ways, less well understood, by which culture and ecology come together in restoration. First, anthropologists have long recognized the inextricable connection between practices and beliefs. To comprehend cultural dynamics in a landscape properly, we must search beyond the physical effects of human activities to the systems of value that shape practices. Second, the success of ecological restoration depends on the restoration (or, at least, the regeneration) of cultural values and practices.

Ecological restoration has been undergoing a steady expansion in scope since its inception as a discipline. Initially conceived as a purely ecological practice, it has become a broader social movement. At the core of restoration practice remain ecological principles, expressed by Higgs (1997) as "ecological fidelity." Ecological fidelity incorporates characteristics familiar to all conservation ecologists: structural and compositional replication, functional success, and durability. All restoration projects operate within an economic system of constraints; that is, all are contextualized. If we aim at describing *good* restoration and not merely effective restoration, then economic factors should be taken into account. This expansion of context is tantamount to letting the proverbial horse out of the barn; once we admit a broader concern, then other factors require our attention. Thus, political, social, cultural, historical, moral, and aesthetic considerations all warrant attention in determining what counts as good restoration (Figure 3-1).

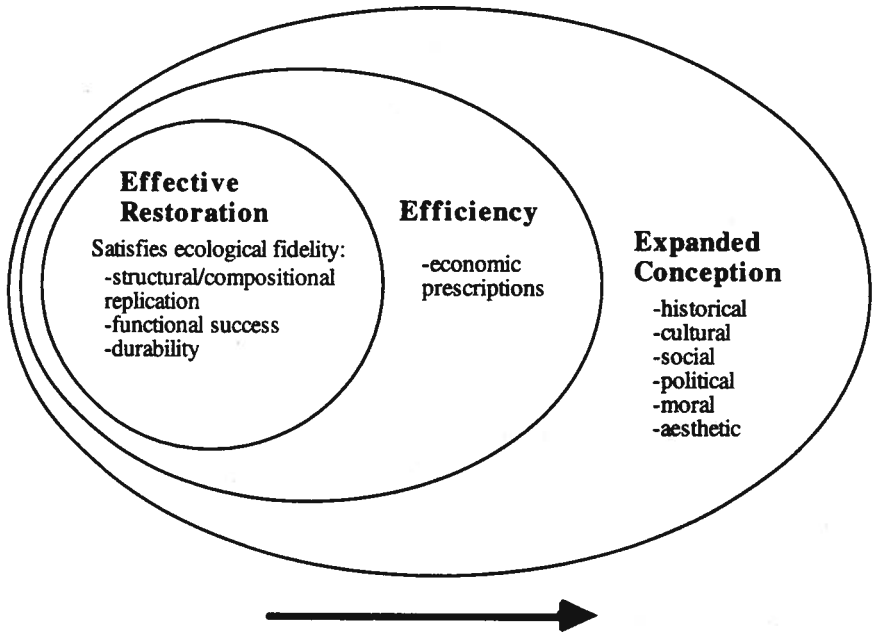


Figure 3-1. An expanded view of ecological restoration (Higgs 1997).

This model, as seems eminently reasonable, places ecological factors at the centre of concern. But does this orientation attend sufficiently to cultural practices and beliefs? The initial reaction of most ecologists and environmentalists is to sneer at the prospect of laying yet more human weight on top of the problems that are typically human in origin.

We know that cultural history provides important ingredients for good restoration. It makes explicit the kinds and significance of human disturbance that, in turn, makes possible exacting restoration to pre-disturbance conditions. This has in practice cut two ways. People have been excoriated as agents of landscape destruction, but there is not agreement about what constitutes landscape destruction, for the concept depends on one's values; for example, a coal-industry executive and a Park manager are unlikely to share the same view about coal mines as an example of landscape destruction. For the most part, those interested in preservation, conservation, and restoration view human agency as something to be strictly controlled in or eliminated from protected areas. In the last decade, however, in the wake of research in landscape ecology, it has become common to refer to ecological processes as disturbances. Fire, wind, insect infestation,

pollination, and flooding create disturbances on the landscape which produce a distinctive patterning. Referring to processes as disturbances points to an underlying perspective of punctuated dynamics, as though normal processes are somehow interrupted by disturbance events. Rather, the pattern of disturbances is one which ecological management and restoration seek to emulate. It is just a small step from that understanding to the inclusion of people as another category of disturbance. This step, by viewing people alongside ecological processes, creates the appearance of a holistic perspective. What it ignores, however, is the fact that people are complicated "disturbance" agents; they light fires, build roads, homestead, cut down trees, and rearrange water courses. By relegating human activity to the status of a disturbance, we are overly simplifying and obscuring a complicated reality. What is needed instead is a way of viewing human agency at face value by documenting and understanding the myriad ways in which people have lived on the land. For instance. could the characteristic vegetation patchiness evident during and prior to the nineteenth century derive at least in part from aboriginal land management practices? Without being certain of an answer, we can see that one implication is clear: restoring the ecosystems of the ARV may depend significantly on an understanding of cultural practices.

The cultural knowledge of people who live close to the land points to the possibility of salutary lessons. We learn that people can live without necessarily leaving enduring, overwhelming scars. It suggests caution, and at the same time pulls us forward to the idea that intervention in ecological processes, structures, and patterns is appropriate if (and this is a big IF) it is attended by care and respect. Perhaps what is needed is not so much the exclusion of human activities as the reconfiguring of practices that engage people with ecosystems. This engagement happens to a very limited extent to those who dwell in the backcountry for a period of time. For many, however, the opportunity for true engagement is cut off by the lure of consumer satisfaction: the short jaunt along a well-prepared trail and the use of roadside pull-outs. The "take only pictures, leave only memories, kill only time" prescription is flawed. It suggests that we are unable to come to terms sensitively and meaningfully with ecological processes.

This kind of thinking is heresy in a wilderness national park. There are simply too many people: each and every one of us cannot have or be compelled to have an engaging experience. Much more interpretation would be required. We wouldn't want to encourage engaging experiences such as the collecting of medicinal plants because it would quickly lead to widespread damage by thousands of people. It is therefore imperative that cultural values shift toward greater appreciation and respect. Yet, it is practically impossible to set successful, long-term limits on people's behaviour; short episodes of interpretation and education do help, but even these will be flooded by a torrent of counteractive cultural activities. Ecological restoration can help. It can demonstrate that intervention, undertaken with respect and care, can manifest the best that we are capable of, scientifically and creatively. People become entwined with ecosystems through volunteer programs—planting, planning, seeding, and pruning. The landscape of the ARV should become recognized explicitly for what it is: a peopled landscape. Of course, this recognition could easily spark a nightmare if caution is not exercised. Still, experience elsewhere indicates that when people are involved in ecological processes they become more, not less, aware of ecological fragility. Thus, Grizzly bears have a greater chance of flourishing if people understand, through participant experience, the conditions that enhance this animal's welfare.

3.5.4 Hope

Those entrusted with the care of wilderness parks—Park wardens, maintenance crews, interpreters, researchers, senior managers, and politicians—have an enormously complicated set of issues before them. Not only must hard decisions be made about restoring ecological integrity, but also changing public views about wilderness, nature, and parks need to be addressed. Parks serve

the important prudential function of securing and preserving habitat for species and ecological communities that would wither under less restrictive management policies. We know also that good-hearted attempts to manage them produce freak landscapes that do not provide the proper conditions for fragile ecosystems and rare cultural landscapes. At the same time, parks send out a potentially dangerous message to the public: rules for engaging with nature inside a park differ from those that pertain outside. One can support parks with cash donations, exult in the wild beauty of a natural place, and yet be an accomplice to the erosion of cultural values and ecological foundations, just by living in a technological culture.

The restoration of wilderness parks depends on knowing what we mean by wilderness. Notions and even ideas of wilderness are shaped and transformed by popular cultural images of nature. Not only must managers wrestle with the challenges of determining ecological integrity, but also they must sort out the dominant cultural values that shape public belief and imagination. Alexander Wilson has explained that the North American concept of nature is conditioned by the automobile, and by changes in mobility and vantage points, the aesthetic conditions of suburban living, the rise of formal nature and outdoor education, television and media programming and theme parks.

The best known and perhaps most pervasive influence is Disney's portrayal through films and television of anthropomorphized animals. Because Disney dominates the culture industry at the close of the twentieth century, Jennifer Cypher and Eric Higgs (1997) decided to study the Wilderness Lodge at Disney World. A group of designers at Disney sat down to decide what cultural values mostly North American visitors would associate with wilderness. They devised an exceptionally compact and grand view of wilderness in the form of a themed hotel. Is it possible that more people will learn about wilderness from Disney than from so-called wilderness areas themselves?

At one level its ambition is only to be a very accommodating hotel, one that attracts by constructing an attractive mythology of wilderness. But, in studying the Lodge in relation to real issues encountered in a real national park, one finds that another level becomes apparent: the consequences of artificiality and themed experience. Immersion in an atmosphere such as the Lodge, coupled with the power of media images portraying complicated, often contradictory messages about wild nature, results in a compounded problem. Not only is the myth of wilderness promulgated, with all of its attendant dangers, but also wilderness is rendered as something subject to our ultimate control. Wild things are all right as long as they are not too wild and the choices we must make to keep them wild are not too difficult to endure. As Jennifer Cypher quipped, it's wilderness "without the dirt or danger."

The restoration of damaged ecosystems in a national park such as JNP, an icon of Canadian wilderness, depends to a certain extent on the public values used in setting goals and in allocating resources to realize those goals. However, the very tendency to set goals or prescribe what natural places can or should do indicates an increasingly programmatic view of wilderness. Disney's Wilderness Lodge constitutes another kind of wilderness, one that compresses widely shared attributes into a very saleable commodity. This is the new, not-yet-articulated dilemma that Park managers in places such as JNP must engage. The public upon which they rely for political support could well become increasingly fickle about management alternatives and perhaps less tolerant of the discomforts of a real park.

The plight of JNP is a very real one. Nearly a century of management practices, rooted in traditional values of wilderness, have produced a freak landscape that threatens to rebuff attempts to conserve and restore biodiversity and create enduringly benign cultural practices. It is one thing for the public to be open-minded about prescribed burning as a way of reintroducing fire as a process in the landscape, but it is quite another to accept charred landscapes, extensive smoke, and the

knowledge that much remains experimental. The world of a real national park is not nearly so innocent as the world of wilderness represented by Disney.

In the next decade, people will grow increasingly preoccupied with electronic mediation in the form of computer games, virtual reality simulations, e-mail, internet browsing, and multimedia. Our knowledge is becoming indoor knowledge: fewer people extend beyond television and computer screens; biology departments are shifting from field to lab projects; students in universities (my university, at least) are receiving far less experience of the field or even direct hands-on education than they did ten years ago, and a smaller percentage of visitors venture into the backcountry of JNP. These are the physical manifestations of a very large cultural change in our disposition toward places and things we call nature. Most of us who see ourselves as environmental or nature writers eschew this virtual world, arguing, urging, and hoping that we can develop away from a technological path.

We need to move along another path, towards what David Orr (1992) called "ecological literacy," the knowledge of things known through felt experience. He urges what is anathema to the sound bite, the snapshot nature programme on television, the quick-fix textbook, the single-issue lobby group, or what people used to call indoctrination. Comprehension of the intricacy, "authenticity, indigenity, fierceness, and spontaneity, resilience and health above all" of wild places, wrote Stephanie Mills (1995: 17-18), requires personal, intimate, slow-paced knowledge. It is this knowledge that we are largely extinguishing in our institutions and our lives. The fact is that we are becoming endlessly proficient with geographic information systems (GIS) and progressively estranged from real places.

For reasons of geography and fate, JNP has experienced relatively modest human involvement with ecosystems, even in the heavily used montane valleys. Where we have a hunch that activity was significant in the distant past, with aboriginal management, traces have mostly disappeared. This disappearance is one of the explicit reasons for choosing JNP as a central example for understanding the challenges and limits of ecological restoration. It is a place we have not been able to bring under our control. Yet, it is also a place where the veil of wilderness has blocked our view of human presence. In a crucial way, it is not very constructed; its reality is palpable to those who choose it over television or some other mediated experience. It may in fact have "commanding presence and telling continuity" to a degree that, as Albert Borgmann (1995) suggests, is necessary for a firm grip on "real" reality, to a degree that its character penetrates even the window of an automobile or motor home. It challenges our notion of wilderness precisely because it is at once a remarkably wild place and a place marked and shaped by human activities for thousands of years. If JNP is under siege from escalating development, at least as important is the assault from Disney's Wilderness Lodge. Unless meaning is considered alongside action, there will ensue a diminished appreciation for the depth of meaning that such a place provides.

Can wildness be restored? Or does deliberate manipulation or continuous management contradict the very idea of wildness? At first glance, it does. The traditional notion of wilderness rests on a rejection of restoration: humans must be kept away. But an expanded view of restoration, which doesn't lock us into nostalgic renderings of the past, must account for the possibility that people can be part of wildness, and can participate in modest, regenerative, respectful activities over long intervals in precious areas. Our hunch is that if we can solve both the practical and abstract issues of restoring a place like JNP, the challenge in other locales will be expedited. Back in JNP, ecological restoration is synonymous with the restoration of hope; one century from now, the ecosystems will be more integral because cultural beliefs and practices are more respectful. The aim, then, is not to protect threatened reserves *per se*, but, rather, to change the imagination and ambitions of people; doing so will permit the flourishing of wild places.

4 The Culture, Ecology and Restoration Project

This chapter describes the aims, ambitions, and approaches taken by the CER team, including a description of the study area, methods for interdisciplinary research, an overview of the way we used spatial analysis techniques, the emphases we placed on communications and outreach, and the premium we placed on developing infrastructure for research in JNP (e.g., data management, the Research Centre, cooperative agreements with JNP). Description of individual research projects is taken up in the next chapter.

4.1 Specific Objectives

The CER Project had two principal aims. The first was to examine ecological restoration as a paradigm for the management of JNP. Restoration, as illustrated in Chapter Three, depends on history as a guide for the future: the condition of landscapes in the past should determine, to a meaningful extent, the condition of landscapes in the future. The practice and theory of restoration is advancing quickly. Because of the push for it within Parks Canada through the leadership of Nik Lopoukhine (chair, Board of Directors, Society for Ecological Restoration [1996-97]; and currently director, Natural Resources Branch, Parks Canada, Ottawa), and the work of the CER Project's principal investigator, Eric Higgs, who continues to serve as secretary of the Board of Directors of the Society for Ecological Restoration, it seemed an obvious and important challenge to pursue the question of ecological restoration with JNP. This aim became an hypothesis: Ecological restoration is a viable model for managing wilderness national parks. At one level, we would not have tackled such a challenge had it not appeared evident that restoration has much to offer; we are convinced that it behooves us to understand the past intimately; moreover, understanding it promotes systematic planning, forces us to acknowledge the extent of our interventions on the landscape, and provides a hopeful view of the future.

The second aim was to understand better the history of the montane ecoregion of the Park. The montane ecoregion is the one undergoing the greatest impact from people and it is also the most ecologically rich. In the same way that ecologists map the location, movement, and significant habitats of animals, social scientists can track the changing patterns over time of people. Here, we mean not to slip into ecological determinism, but to make the point that understanding people depends on some similar approaches to understanding ecological patterns and processes. If it is the case that people have been working the land in the ARV for millennia, and have been altering the landscape intensively for the last nine decades with the creation of JNP, then it is simply prudent to understand better the characteristics of their movements and influences. However, we wanted to go further than tracking human activity; we wished to understand how human patterns and processes interact with ecological patterns and processes. The way to do this, we reasoned, was through mapping. Park managers and ecologists have been using geographic information systems (GIS) effectively for mapping salient biophysical features and, in a coarse way, for human features (e.g., roads, development footprints), but the questions we asked were novel ones. What would happen if human patterns and processes received a detailed GIS treatment similar in scale and scope to that given to ecological research? Could ecological historical data be combined with cultural historical data? Would this combined historical knowledge—ecological and cultural—advance our understanding of ecological restoration at a practical and theoretical level?

This was a pilot research project and all such projects guide us in a new area. New ideas and methods are tested. Some initially exciting ideas fizzle, either because they turned out not to be sound or because they were ill-timed. Other ideas not even detectable at the beginning of the project turn out to be decisive by the end. Serendipity and sheer luck are part of the research process although we might try to claim otherwise. Because we wanted to give social science approaches a boost, the CER Project was a kind of affirmative action program. Few historians think of their materials in terms of spatial relationships and even fewer have worked with GIS. Anthropologists do not routinely consort with historians. The techniques and motivations of oral history and document-based history are typically quite different. Literary historians, too, have different interests in "reading" the past conditions of a landscape. Moreover, we wanted social scientists to interact on a daily basis with ecologists, in order to cross-fertilize ideas where possible. (A striking example of the conceptual disjunction occurred at one of our workshops when a sociologist exclaimed to an ecologist: "Oh, *that's* what you mean by community!")

Our initial ambitions were sharply curtailed by financial realities. Our core grant from the Social Sciences and Humanities Research Council of Canada (SSHRCC) was awarded at 50% of the initial request, because, although it achieved a top-ten ranking in the adjudications of the interdisciplinary committee, it, like nearly all successful grants, was cut back to half of the amounts requested, an allocation made necessary by a large pool of high-quality applications and a very small budget. We had expected to work over a larger area of the montane and to take our work farther in terms of modelling and policy implications. Instead, we went with a sound plan of work fully in keeping with our intentions of testing new ideas (the pilot aspect of our work) and of building a foundation for future research.

Some of us had an inkling of what it would take to launch such a novel project. The reality was much more daunting. The information resources upon which historical studies could be undertaken were in a state of disarray in 1996, and extensive work was required to upgrade them. We started from scratch on June 1st 1996 in a new field research station, the first of its kind in JNP. It has served us and other researchers well but it involved considerable effort to make it work. Digital data for our impending GIS did not exist in 1996. With the help of Jack Wierjchowski (Geomar Consultants), we built a rudimentary digital elevation model at 1:10,000 of our study area. We pushed for good aerial photography data: initially in 1995 (before the CER Project formally began), when JNP warden Mike Wesbrook and Eric Higgs developed a proposal for high resolution aerial photography of the montane valley, and then again in 1997, when we invited Ron Hall, a specialist in photogrammetry, to advise on the best options for montane digital data. These are just examples but they show that the CER Project built a solid foundation.

The CER Project was a pilot initiative in terms of cooperative research with JNP. As much as possible we wanted to break from a tradition of academic researchers conducting research either independently from Park staff or under contract to it. Independent research most often tends to basic research, which is valuable but often does not provide direct or immediate benefits to Park managers. Contract research is done for hire at the behest of Park staff, or is what is sometimes termed "mandated" research. Some of it is very good and enduring; some of it is of poor quality and short-lived. Our project fell into a third category, applied research, or research that is motivated by application to real world problems. We chose to tack between interesting scholarly questions and practical management ones, interweaving them as well as possible. We made it a priority to work with Park staff: first with Mike Wesbrook, who helped set the initial ideas for the CER Project in 1995, and later with John Taylor and Jeff Anderson. Jeff Anderson, in particular, has been a regular collaborator, involved at all stages of the research effort in his then capacity with JNP's Ecosystem Secretariat. Along the way, we interacted with, were helped by, and helped, over

two dozen Park staff as well as staff and volunteers at the J-YM&A. We realized at the outset that we were setting the stage for a much longer research program. These first three years are a pilot phase and, if successful, will instigate further research. This is already realized in Ian MacLaren's research on the fur trade in the ARV, Sandy Campbell's multimedia project on Métis history, and the Bridgland repeat photography project of Jeanine Rhemtulla, Eric Higgs, and Ian MacLaren. Ultimately, the work will be worth it for us, and successful in all other respects, if it is enduring, if some of us at least are still working on projects that trace their origin to 1996.

4.2 CER Project's Study Area

JNP (52°N, 118°W) is located in the Rocky Mountains of Alberta, about 400 km west of the city of Edmonton, and it occupies a total of 10,880 km^2 (Holland and Coen 1982a). The study site is located in the ARV, in the central region of the park, northeast of and downstream from Jasper townsite (Figure 4.1). It lies within the montane ecoregion, which occupies the lowest Park elevations (±1000 to ±1350m asl). The study area extends from Jacques Creek and Vine Creek in the North upriver to the confluence of the Maligne and Athabasca rivers in the South. Boundaries of the study site along the east and west walls of the valley correspond to the upper limits of the montane ecoregion. The study area is approximately fourteen km long by four km wide, occupying a total of sixty-four km^2 or 8.5% of the total montane ecoregion in JNP.

This particular region was chosen as the study site for a number of reasons. First, it was small enough to permit detailed mapping of historical cultural activities and ecological patterns, but large enough to permit analysis of underlying processes. Second, it contained a good sampling of the types of human activity which have been recorded in the montane ecoregion, including a number of identified prehistoric and historic archaeological sites, notably in the Vine Creek area. The Three-Valley Confluence (centred on Jasper townsite) was deliberately avoided because the high amount of human activity makes it unrepresentative of the rest of the montane ecoregion, and JNP began a major planning project there in 1997. Third, it was important that the Palisades Centre be included in the study area as its grounds have a long history of human use and a previous study (conducted in 1995 by Eric Higgs, Mike Wesbrook and Jo Urion) provided an important catalyst for the CER Project. The study area also lies within the bounds of the most intensive fire-history investigation yet conducted in the park (although, unfortunately, Gerald Tande's 1979 study does not include the whole of the study area). Finally, good coverage by aerial photographs was available for the entire area and several other data sets, such as detailed fire history mapping, provided at least partial coverage.

Several prominent sites in the study area include:

- Highway 16 (Yellowhead Highway)
- Canadian National Railway line
- an oil pipeline
- the Palisades Centre
- the Ewan Moberly property (Moberly Flats)
- the John Moberly property
- the Henry House and Colin prescribed burns
- the Snaring Campground
- the Jasper airstrip

- a trade-waste pit
- the municipal landfill
- a power generating station
- a large gravel pit
- the Wardens' Office and associated horse grazing area
- the historic Overlander Trail

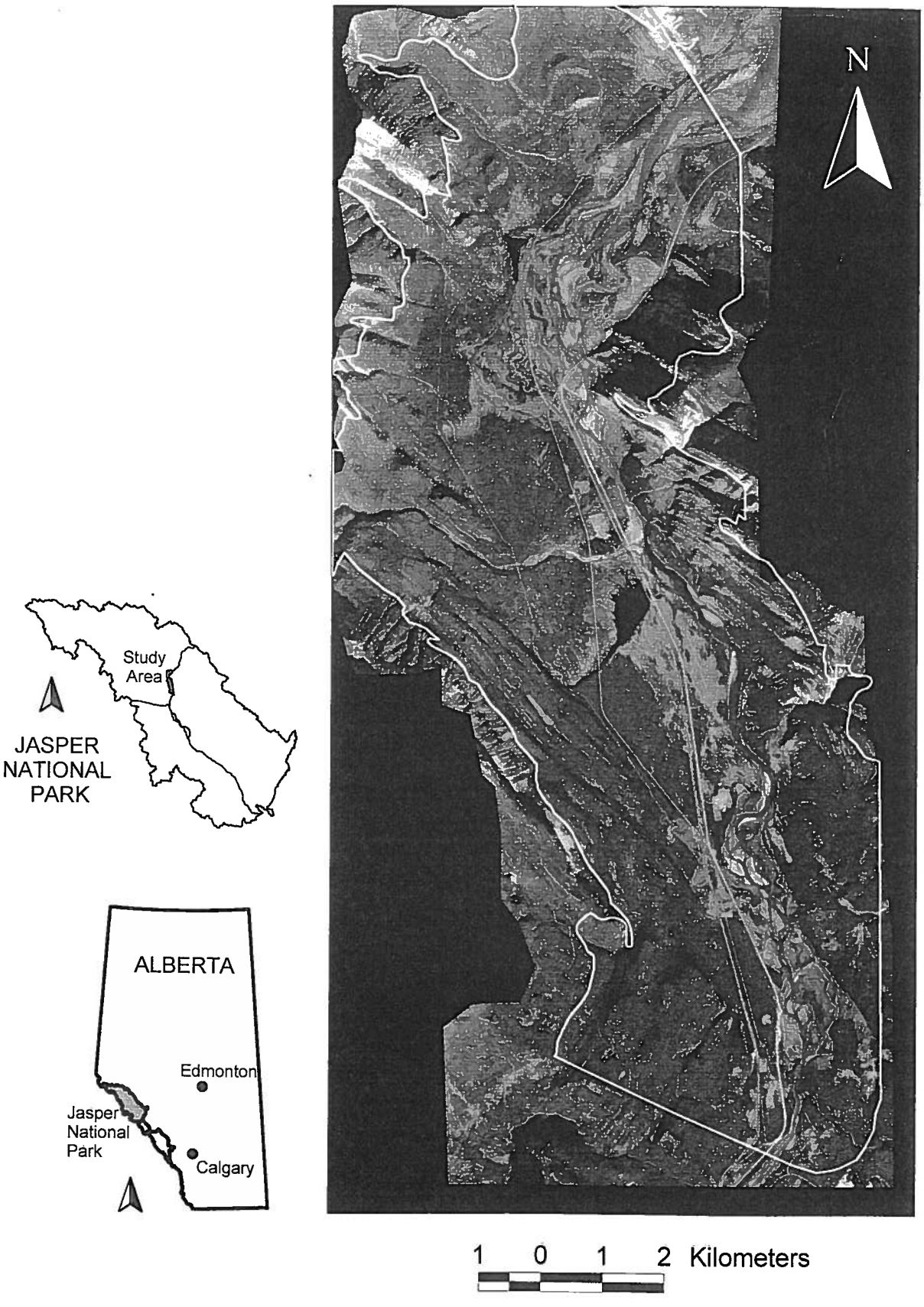


Figure 4-1. Map showing CER study area. White line represents the boundary of the study area in the montane ecoregion in the central area of JNP. Adapted with permission from Rhemtulla (1999).

4.3 Methods for Interdisciplinary Research

The CER Project was premised on interdisciplinary research, a concept that has become both vital and fashionable in the 1990s. The extreme compartmentalization of academic scholarship that resulted from decades of rapid specialization of subjects led many to comment (Klein 1990) that new approaches to research were necessary to glue together fragmented knowledge. Rather than "splitters," we needed "lumpers," those able to take the knowledge of several subjects and integrate them in a meaningful way for new and different audiences. The growth of institutional interest took place in the 1980s and especially in the 1990s, when granting councils, government agencies, universities, and corporations embraced interdisciplinarity. In Canada, a wholesale reengineering of academic research began with the announcement of the Eco-Research grants, large-scale funding for environmental research that depended on integrating the interests of natural, social, and medical scientists. All three granting councils in Canada—SSHRCC, NSERC, and MRC—developed funding programs in the 1990s to encourage interdisciplinary research. Universities, including the University of Alberta, staked commitments to interdisciplinary research and learning. It seemed as though a new era was upon us, and to a certain extent it was.

For those long involved with interdisciplinary research, however, such enthusiasm was greeted with some suspicion. Interdisciplinarity was promoted as a panacea for academic ills, both curricular and financial, which clearly it was not. The warm embrace by large institutions bespoke a fashion statement as much as a clear commitment. So many problems went unaddressed: Could traditional (sub)disciplinary academicians transform overnight to interdisciplinary researchers? Could the momentum of disciplinary activity be easily swayed? How broad does the scope of interdisciplinary connection need to be before it is counted as meaningful? (For example, does interdisciplinarity occur when cultural and physical anthropologists collaborate?) Is interdisciplinary work necessarily better work? Ironically, some small, grassroots interdisciplinary programs such as science and technology studies and Canadian studies withered during this era, while large, top-down initiatives gained strength. The typical approach, originated in the Eco-Research program, was to give large (often multimillion dollar) grants to a principal investigator and an interdisciplinary team of collaborators. While such projects produced interesting research, several of the CER Project's collaborators who were close to such initiatives questioned whether the productivity warranted the input, whether the monetary allocations allowed for a gradual and effective start-up, whether the relatively short time horizons were appropriate, and whether integration was really taking place. Large, interdisciplinary projects create a burst of institutional energy but do they nurture long-term commitments? Intersectoral collaboration has become an important prerequisite to interdisciplinary research. Notably, a number of strategic grants programs offered by NSERC and SSHRCC depend on industry and/or government funding for the award of a research grant.

It was obvious to the original CER Project's collaborators that an interdisciplinary mix was necessary to assist with some of the challenges facing JNP. Relatively few management problems originate and are reformed within a single academic sub-specialty. For example, knowledge about how to restore a damaged aquatic ecosystem depends not only on understanding lake chemistry but also on understanding the history of climate and organisms (palaeoecology), the contemporary complement of vegetation, fish and invertebrate species (plant ecology, fish and invertebrate biology, and microbiology), the history of human use, the current economic and institutional realities, and public attitudes. All of these subjects require careful study by people who have specialized technical knowledge, but none of these distinctive subdisciplines alone suffices to provide appropriate answers for Park management. Successful restoration projects require an integration of knowledge, and sometimes the integration depends on new combinations of subjects. Typically, integration does not concern the knitting together of knowledge—an additive model—but

the combining of knowledge in new ways to produce new syntheses and sometimes new approaches to study. Some claim that many significant innovations arise at the interstices of subjects, which offer occasions when problems can be viewed from different disciplinary perspectives (Klein 1990).

Ecological research is relatively well-established in JNP as a vehicle for helping to solve environmental problems, but ecological knowledge seldom successfully incorporates social science. Good ecological restoration depends on understanding human values and practices, economic and institutional pressures and opportunities, and political structures and processes. We knew that historical knowledge was necessary, but few historians had yet been enticed to work in and on JNP. The same held for anthropologists (less so for archaeologists), for sociologists, political scientists, and so on. Yet, merely encouraging interdisciplinary research was insufficient. When such scholars did venture into JNP to do their research, seldom did they connect either with others' work or with critical ecological problems facing JNP. Moreover, that social scientists seldom discussed their research with natural scientists in JNP (or vice versa), reflected the continuing cultural gulf that separates the human from the natural sciences. This state of affairs rendered interdisciplinary approaches attractive, especially amongst social scientists who otherwise only infrequently find opportunities for collaborative research projects. Because of the differing scholarly practices and the different institutional traditions of the social and natural science disciplines, it is much less common to find teams of social scientists working together than it is to find natural scientists working together.

The CER Project employed several techniques to foster interdisciplinary research. First, and perhaps most important, was the development of the Palisades Research Centre, a physical base for our activities as well as those of other researchers. There, students, academics, and Park staff were able to work, talk, eat, and socialize. Often, some of the most inspiring ideas developed over meals when people from different perspectives would interact. Second, the field teams were comprised of students from a wide range of backgrounds, including anthropology, archaeology, history, ecology, spatial analysis, and Native studies. This mix meant that the people from different disciplinary backgrounds were compelled to work, converse, and socialize with one another. Third, the project hosted a series of workshops that focused on data reconnaissance, data management, modelling, and spatial analysis. These gatherings encouraged focused conversation among a broad array of people, including both academics and JNP staff. Fourth, the Project built up a roster of collaborators beyond the original seven signatories on the SSHRCC proposal of 1996. These collaborators, sixteen in total, were formally connected to the project although their roles, responsibilities, and commitments varied widely. Finally, we developed a final report-writing team comprising a core group of collaborators to collate the information. General approaches were agreed upon, and writing and editing tasks shared. The effect was to stimulate reflection on the original aims of the research.

What did we learn about interdisciplinary collaboration through the CER Project? Perhaps the one critical lesson was that interdisciplinary projects require significantly greater resources than do mono-disciplinary or straightforward bilateral projects. Our experience shows that interdisciplinary projects are more expensive. For example, the CER Project hosted workshops, assisted with collaborator travel, and, perhaps most significantly, required more coordination to ensure effective communication and project delivery. Part of the problem stemmed from the CER project attempting to sponsor some "natural science" research on a "social science" budget. Moreover, there was less significant infrastructure—technicians, equipment, and project assistance—than would be available from most natural science field research projects; this was especially acute for our GIS-based components. There were other lessons learned, and these are endemic to interdisciplinary research: the techniques for bringing people with disciplinary perspectives together in conversations of mutual advantage had to be acquired and refined, as did

the effective ways by which researchers can be encouraged into what for them are new areas of study. We worked through these in the CER Project, and made significant headway.

4.4 Spatial Analysis

4.4.1 The Spatial/Temporal Framework

The CER Project attempts to combine work from several distinct disciplines, each with its own analytical approaches. Archaeological and historical considerations are combined with anthropological and social observations and with the work of conservation biologists, to identify human influences on a dynamic natural ecosystem, the goal being to inform future Park management policy decisions about cultural and ecological restoration. Each of these disciplines has its own discourse, and none has the discourse of the Park manager.

One framework for linking the observations from these diverse disciplines is explicitly to record their positions in space and time both within the study area (the ARV) and within the study time period (from pre-European influence to the present). Different kinds of observations can then be compared spatially, and in some cases analyzed quantitatively. While some observations, for example historical value systems, resist easy mapping on a space-time coordinate system—what is the boundary of the space-time polygon delineating the fondness of the European Romantic for the (tamed) parkland in the (untamed) wilderness?—the consequences of these observed data in the ecosystem may have space-time footprints—tamed wilderness gives way, in time, to luxury tourist accommodations, as with Jasper Park Lodge.

Geographical Information Systems (GIS) are data structures and data management tools for assigning, managing, and querying spatial information (and, to a lesser degree, temporal information) about data. To the degree that archaeologists, historians, anthropologists, sociologists, and conservation biologists can assign spatial and temporal dimensions to their observations, these can be included in a GIS database and analyzed using GIS tools.

4.4.2 Spatial and Temporal Uncertainty

Several important questions of precision and accuracy must be addressed for observations from each of the disciplines. First, to what degree do the observed data have precise locations and dimensions in space and time? Second, to what degree of accuracy do we know these locations and dimensions relative either to the other observations or to some observation base? Third, what are the spatial and temporal characteristics of the impacts of observed activities on the ecosystem?

4.4.2.1 To what degree do the observed data have precise locations and dimensions in space and time? Many human activities have relatively discrete boundaries. We like to border gardens, fence lawns, and wall residences (perhaps in part due to our fondness for tamed parkland in our untamed environment). Our roads have edges, our golf courses have roughs. Our fields begin on the day of cultivation, extend to the edges of the cultivated area, and continue until the last harvest. Or do they begin with the cutting of the first tree, or the removal of the first stump from the new clearing? Does their extent change season by season, with seasonally expanded clearings and with abandoned unproductive corners? Do they continue until natural successional species have again reclaimed the abandoned land, typically after a period in which the field serves as pasture?

Many human activities are not even that clearly defined. Where did logging occur in the ARV? In part, wherever a tree was cleared. But also on the river itself (at specific times) in the form

of log booms and at certain locations on shore (at specific times), where logs were taken to the river or collected from it.

4.4.2.2 To what degree of accuracy do we know these locations and dimensions, relative to the other observations, or some observation base? Oral historians may gather information about where and when people gathered berries, according to the space/time reference systems and the memories of the interviewees. How does one assign coordinates and dimensions on a 1:20,000 scale map for a fair raspberry patch, a short walk off the Moberly trail, just after the second stream, toward the Joachims' place?

If an historical incident has an ecological impact today, some continued evidence on the landscape must exist. If it does, its location can be recorded. While historical human activity in the fair raspberry patch may have represented a significant competition to the similar activities of specific individuals of the *Ursus* populations in the same seasons, the significance for ecological restoration probably has as much to do with the very presence of vegetation species and diversity within the region. These can be measured and mapped in other ways. The exact location of the berry picking of days past might not be critical to cultural and ecological restoration.

In some cases, however, the absence of a previously common event may have profound ecological impact. While forest fires occurred frequently in the ARV before the turn of the century, there has not been a significant natural fire in the area since the creation of the Park in 1907 (Tande 1977). The precise and accurate location of past events which have ceased to occur may be as important, in our database, as the precise and accurate location of those with a continuing footprint.

4.4.2.3 What are the spatial and temporal characteristics of the impacts of observed activities on the ecosystem? The spatial dimensions of the impact of humans activities tends to be most immediate on macroflora. While adult *Ursus americanus* (Black bears) have been encountered in the kitchen of the Research Centre, adult (or even juvenile) *Arctostaphylos uva-ursi* (bear berries) have not. The impact of paved roadbeds and pesticide-sprayed railways on most vegetation species can be precisely and accurately mapped. The impact of the same human activities on animal species depends on three factors:

- Sensory medium—species *Homo sapiens* has been observed to be visibly disturbed, although not directly physically threatened, by the sound of a train passing at a distance of approximately ten km
- Frequency—what is the effect of the increased number of vehicles along Highway 16 on wolves and how do we map it? and
- Scale—consider a wapiti *vs* a beetle standing between the rails when the train arrives.

The spatial impact of a given human activity is a species-specific and context-specific quantity, which might be derived from spatial data if the (organism-specific and eco-contextual) system is adequately understood and quantified. But the beginning of understanding the specific relationships must include the development of adequate spatio-temporal databases of human activities combined with spatio-temporal ecosystem databases.

4.4.3 Data Collection Cultures

Another practical difficulty exists in implementing an explicitly spatio-temporal database. The accepted data collection methods of several of the research disciplines involved in the CER Project do not include the recording of explicit spatial data to a scale of precision and accuracy that will permit spatial comparisons between the different data types. Practical methods for collecting

the spatio-temporal data must be designed, embraced, and implemented by the research practitioners.

4.4.4 Database Design Solutions

4.4.4.1 Base map selection. A base map is a dataset showing the locations of some fixed geographic features in a selected coordinate system at a selected scale. Collected data observations are assigned coordinates in the coordinate system and scale of the base map. Aerial photography is geo-referenced and ortho-corrected to the base map and the accuracy of coordinates is measured relative to this base map. If a digital base map at the required scale is already in accepted use for the study area, using that base map will provide data compatibility between the datasets of different studies. If no base map is available, one must be created.

An aerial photographic mosaic base map, at a scale of 1:10,000, was required for the CER Project's data in order adequately to identify locations of relevant physical features and human activities. The JNP data base is at a 1:50,000 scale, and an ortho-corrected aerial photographic mosaic was not available to the CER Project. We were obliged, therefore, to develop our own photo mosaic base.

4.4.4.2 Coordinate system. The CER Project's study area is small enough that a planar coordinate system is appropriate. A standard planar coordinate system for work at this scale is the Universal Transverse Mercator (UTM). The CER Project is in UTM Zone 11. In North America, survey data may use the North American Datum 1927 (NAD27), based on the Clarke spheroid of 1866, or, more recently, North American Datum 1983 (NAD83), based on the GRS80 spheroid. The base survey information for the JNP area uses NAD27.

All spatial coordinates of the CER Project data use the coordinate system of the CER photo mosaic base map. This base map was developed using reference points in the UTM zone 11, NAD27 coordinate system, with a working scale of 1:10,000.

4.4.4.3 Software Tools. A variety of software tools was used in developing and managing the spatial data. Database development was initially carried out in *Idrisi for Windows 2.0* (from Clark Labs, Clark University) and *ARC/INFO* (from Environmental Systems Research Institute, Redlands, CA). Digitizing was done using *GRASS 4.1* (from the US Army Corps of Engineers). Tabular data were managed in *Microsoft Access*. In 1998, a site licence agreement made it practical to work predominantly with the *ESRI* product line, and data formats were exported to the *ArcView 3.0 shapefile* format.

4.4.4.4 Initial data sets generated. An initial aerial photographic mosaic base map was created from scanned 1:50,000 aerial photographs. This was approximately georeferenced using thirty differentially corrected ground control points, collected with a *Trimble GeoExplorer GPS* unit, in the UTM Zone 11 NAD27 coordinate system. Stereo pairs of these photos were used simultaneously to create a Digital Elevation Model (DEM), and to ortho-correct the photo mosaic. This work was done on contract by Geomar Consulting. The resultant photographic mosaic map has 2.5 m cells. The DEM has 5 m cells with 1 m elevation increments.

The boundaries of the study area and the locations of major natural and human features were identified from a 1:10,000 scale printout of the photo base map, and then digitized. The photo base map was also used as the reference base for mapping the results of the vegetation change photo interpretation work.

4.4.4.5 Data compatibility with JNP's GIS. To make the CER Project's GIS data both compatible with the JNP data and, thereby, useful to Park managers, all the CER Project's spatial data layers were ortho-corrected to match the JNP layers, using a warping algorithm and identifiable control points. While the result of this operation probably reduced the precision of the CER Project's dataset relative to the earth, it does not alter the internal consistency of the CER Project's dataset itself.

4.5 Communication and Outreach

The CER Project has taken an unusually active role in public communication and outreach. It is typical of a scholarly research project both to develop new knowledge and to disseminate it directly to other researchers; as well, in the case of applied and mandated research projects, it is typical to disseminate it to Park managers and other users. Our commitment to communication and outreach has been greater than the norm for three reasons:

1. Research is usually a two-way process of interaction between researchers and those affected by the research. This is the typical model. We wanted to push further in a community setting toward genuine community involvement in the project. We accomplished this goal by forming a Community Advisory Committee and by having Jeff Anderson, a senior Park staff member, involved in all phases of the research.
2. Funding agencies, in our case the SSHRCC, are encouraging researchers to communicate their research more effectively and widely to a broader public.
3. Many of the collaborators involved in the CER Project have a strong belief that research, especially publicly-funded research, should find a direct path to a broader public, in order that scholarly activities should not be (nor be regarded as) a closed shop.

Our communications and outreach activities fall into *four* categories.

4.5.1 Community Advisory Committee

Involving the community—those people who live in and around the region and who are drawn to it by bonds of affection—is one way of returning the favour of cooperation in research. Much of our research, especially historical studies, involved the help and good will of local historians and long-time residents of the valley. It seemed to us early on, especially in supporting Andie Palmer and Cindy Dunnigan's pilot project on oral history, that an advisory group would be helpful. We envisioned this group as a body who could come together occasionally or offer individual help, to provide advice and guidance to researchers, and to allow researchers to test new ideas or follow new leads. In July 1997, Cindy Dunnigan organized a meeting of Advisory Group. She provided an evening of hospitality and introductions to the project. It offered an opportunity to showcase the work of the CER Project, but, more importantly, to build solid connections with people who have great knowledge of JNP. A list of members—the group is relatively informal and membership is open—appears in the Appendices. The primary practical function from our point of view was to smooth the way for inquiries about specific questions. Indeed, this worked effectively for one-on-one consultations since 1997, and produced an important consultation in September 1998 on the Human Activity maps. This particular group, and the format itself, is extremely useful and one that could obviously be tapped more extensively in the future. It would be especially useful to form and activate such a group at the beginning of a project to allow the advice of members of the community to bear on research directions and methodologies from the outset.

4.5.2 Publications

Publications are the stock-in-trade of scholars. The CER Project has, so far, resulted in several publications (see Appendices) and more are planned, including the human history of the ARV CD-ROM. Of special importance is the extent to which a broad-based interdisciplinary project can spin-off new projects and publication ideas, for example the book that Jeanine Rhemtulla, Eric Higgs, and Ian MacLaren are planning about landscape change and the work of M.P. Bridgland.

4.5.3 Media

Aspects of our work have captured the imaginations of a number of journalists. Work on different aspects of the CER Project have appeared in the *Edmonton Journal* (twice in major stories in the Insight section, with several newspapers across Canada picking up the story), and in *Equinox* magazine, the Discovery Channel's Great Canadian Parks series, and CBC-Radio's "Edmonton AM" show. We have recently had inquiries from CFRN television and CBC-Radio's "This Morning" and "Quirks and Quarks" programmes.

4.5.4 The World Wide Web

Clearly, the internet serves as an important medium for contemporary communication. We implemented the first version of a CER Project's web page in 1997, mostly as a way of explaining to people the background to the project and what we were undertaking. The web page, located at http://www.arts.ualberta.ca/~cerj/cer.html, has evolved and will become the primary vehicle for distributing this report. We started a couple of small listservers to stimulate conversation about project issues. Like so many listservers, these flourished episodically.

4.6 Data Management

The widely-differing degrees of access to existing information about JNP, together with the wide array of locations and agencies housing parts of it, have resulted in a fragmentation of historical and current knowledge about JNP. Our need (and, we think, that of Parks Canada, the towns people, and the public at large) was to replace a state of disarray with effective consolidation of the relevant information. The long-term goal is to ensure greater ease of access and of collation of data, whether it is documentary, photographic, cartographic; whether it is Parks Reports, reports of other government agencies, local history materials, scientific research articles about JNP; or whether the materials are physically housed together or held in various locales and made digitally accessible to researchers. Moreover, the specific needs and aims of the CER Project required a close attention to the development of researcher-accessible and researcher-supplemented computer databases, to the building of several public information and education instruments, and to the strengthening of connections and understandings among Park researchers and members of existing information resource agencies.

4.6.1 Background

In 1994, University of Alberta biologist David Schindler brought together a large number of collaborators to develop an Eco-Research grant proposal to the Tri-Council (SSHRCC, NSERC, and MRC) Secretariat entitled "Jasper National Park in the 21st Century: Sustainable Majesty." That proposal recognized that access to and control of information was key to the success of the research

project. Included was a proposal for a research information centre which would address the needs of researchers working on projects related to JNP. It is worth quoting at length:

> "The Palisades Research Information Centre"
>
> Information about Jasper National Park is scattered in many locations from museums to university archives and wardens' offices. Some material is organized and accessible, while much is not. Our planning exercises with Parks Canada showed that assembling this information and making it accessible must be a high priority if our project is to succeed. Easy access to well-organized information is a precondition of successful interdisciplinary research. *Developing adequate information resources is a significant part of our overall research program.*
>
> Jasper National Park sought consultancy advice and then committed large capital funds for reconstructing a major building at the Palisades Centre to allow for a state of the art Information Centre encompassing electronic information delivery, library, museum and archival collections and services. The Information Centre will develop in three stages corresponding to the three years of the program. The immediate phase will involve assessing user needs and identifying, at the collection level, resources currently available both at a local and regional level. A collections and management policy will be developed. Cataloguing and inventorying of collections will begin and basic information services will be supplied to on-site researchers.
>
> In phase two, services will be enhanced as more collections are catalogued and itemized and more research tools are acquired. Attempts will be made to trace local materials removed from the Park area. Reproductions will be made of key items for which the original cannot be obtained for the collection (including materials held locally, regionally and, nationally). Resource sharing agreements will be pursued with institutions which have complimentary research interests and collections. Services will be extended to include the general public as well as researchers and parks staff.
>
> In phase three, all required research tools and services will be in place. Acquisition, cataloguing, inventorying, preservation and conservation activities will be on-going. Educational services will be in place including instructional sessions for researchers and finding aids. Services and practices will be evaluated to ensure efficiency and usefulness. Our role in this program will be to assist in the rapid and efficient assembly of the materials necessary to complete our research. Long-term archiving will be undertaken by Park Service staff. A major challenge will be to secure a solid funding base through endowment for this public resource. (Schindler 1994: 6.22)

While the unanticipated disbanding of the Eco-Research grants program precluded funding of the "Jasper National Park in the 21st Century" proposal, the exercise of conferring over and drafting the proposal had identified some of the gaps in data management that have since been addressed through the CER Project. Apparently the "large capital funds" committed were not forthcoming. Several projects were undertaken to address specific data-management issues; many other issues remain to be addressed.

4.6.2 Review of CER Data Management Activities

4.6.2.1 Survey of Available Resources. The initial review of information sources related to the ARV indicated that the resources were housed in many locations and with varying degrees of

accessibility. While there was great desire amongst the CER Project's members to bring resources together in one place, doing so proved impracticable. Instead, a selection was accumulated of the most highly relevant and frequently consulted resources, and a bibliography of others, including information on where they are located, was assembled.

4.6.2.2 Survey of Archival Resources. University of Alberta historian Julian Martin undertook a survey of archival materials. It was necessary to identify and to make accessible the historical documentation that bears upon the CER Project's study area. This work included both secondary (retrospective and interpretative) histories and memoires of probable relevance and the extant primary records of government agencies, corporations, and individuals that have been involved with JNP and its region, and with the CER Project's study area, in particular. Such an initiative was an obvious prerequisite to the diligent assessment of the domain of information relevant to the CER Project. A familiarity with the textual evidence of human impacts in the study area lays a crucial foundation for our better specifying the range of determinants of ecological changes in the recent past.

A survey of the scholarly historical literature and of the extant archival deposits was conducted by a group of academic historians associated with the CER Project. The nature and scale of the problem were found to be much larger than has been presumed. There has been an almost total neglect of the JNP in the existing historical scholarly literature. One of the reasons for this lacuna is that the primary records remain in considerable disarray. In general, it is fair to state that documents have been randomly preserved, geographically dispersed, and insufficiently catalogued. They reside in a variety of public, corporate, and private hands, and researchers find different degrees of accessibility associated with them. The primary task of the archival survey was to assess the scale of the problem, to provide a finding guide as well as a preliminary general cataloguing of the principal documentary records of pertinence to researchers, and, in particular, to identify and discuss the records of federal government agencies, including the Parks Canada administrative records series. This survey amounted to a pioneering work, not attempted before. It was therefore not a definitive archival survey, but its completion has made possible the utilization of documentary evidences not otherwise known to exist.

4.6.2.3 Database. Having recognized the need to have a bibliographic database to bring together the literature related to the CER Project, collaborators needed to select a database management system. In consultation with key local information sources, *DB Textworks* was selected. In part, the choice arose from this software's use already by the J-YM&A and by the JNP Warden Office Library. Jean Crozier of Circ Information Systems was contracted to train several members of the CER Project, including Jo Urion and Mike Norton, in database development and data input.

Criteria for inclusion in the database were developed through discussion among the collaborators. While it was recognized that the most general criterion would be that the document related in some way to JNP, functionally, the primary criterion for inclusion was the recommendation of one of the collaborators.

The bibliographic database currently contains records for more than 800 items, many of them offprints held in the CER Project's collection (at the CER Project Room, University of Alberta [Tory Bldg. TB-50]). Each record in the database is created by filling in a template. The fields in the template are standard to a bibliographic database (e.g., author, title, publisher, date, keyword, abstract). The system creates a simple thesaurus as keywords are entered. As a default, the first keyword used to describe a subject became the thesaurus term for that subject. The system has a search function which allows for manipulation of the data. *DB Textworks* also allows for a read-only

version of the software to be incorporated with the data for distribution on CD-ROM. This makes possible distribution of the database.

Two additional parallel databases were created—one for administrative information and a second non-public database which contains information about sensitive resources such as archaeological site records and oral histories.

4.6.2.4 Resource pathfinder http://www.library.ualberta.ca/library_html/libraries/science/jnp.html. For items which could not be acquired, and as a general directory to sources of research information or a "pathfinder" about JNP, a web page was constructed and is maintained on the University of Alberta Library server by Sandy Campbell. The links on this page are general in nature and are designed to point users in the direction of extensive resources. The primary access to this page is through the University of Alberta Library's homepage. There, the JNP pathfinder is linked under "Guides to Resources by Subject" (see Appendix).

4.6.2.5 Library collections. The collection of library resources and offprints was organized and filed sequentially. This collection is represented, in part, by the contents of the database. The collection was moved each season from the University of Alberta campus to the field research house at the Palisades Centre. It is now housed in the CER Project Room on campus (Tory Bldg. TB-50).

During the duration of the CER Project, and in order to support the research being undertaken, the collection of the University of Alberta Library has also been systematically strengthened in the area of materials related to JNP.

4.6.2.6 Relationships with Parks libraries, J-YM&A, and other information providers. As a result of collaborations generated by the CER Project, a closer relationship has been established among the institutional information providers whose collections hold materials related to JNP. In particular, the relationships between the University of Alberta's Science and Technology Library and JNP's Ecosystem Secretariat Library, and between The University of Alberta's Science and Technology Library and the J-YM&A have been strengthened. A greater awareness of the availability of resources in all institutions has been achieved.

4.6.2.7 Scanning of photographs held by the J-YM&A. As a by-product of the multimedia project, several hundred archival photographs belonging to the J-YM&A were scanned and the images preserved on CD-ROM. (for details see the description above of the Multimedia Project).

4.7 Infrastructure

The CER Project has always held that infrastructure is a strategic component of the enterprise, and much time and attention has been directed to its development. For the purposes of the work of the CER Project, "infrastructure" refers to more than capital equipment or organisational techniques for enabling the "real" work (a common understanding of the term). For the CER Project, "infrastructure" is not essentially distinct from the work but it is an instantiation and structural reinforcement of core values, aims, and methods that characterize the Project as a whole: a robust interdisciplinarity; team work; coordination among academics, Park staff, other professionals, and lay persons; outreach and education; and the long-term sustainability of the general research enterprise.

The infrastructure component has been developed in three forms—physical, social, and corporate. The physical infrastructure includes the Palisades Research Centre, especially the

Research House there, and the CER Project Room at the University of Alberta (Tory Bldg. TB-50). The social infrastructure includes the interaction of scholars, the Jasper Foundation, the network of arrangements with agencies and individuals, especially in the JNP region, and our series of public workshops and seminars. The corporate infrastructure includes the Memorandum of Understanding between the University of Alberta and JNP. All three forms of infrastructure have been essential to the CER Project, and represent the basis of a permanent legacy for JNP, for Jasper townspeople, and for any future scholarly research initiatives.

The physical infrastructure is manifest most significantly in the physical plant and capital improvements made by JNP at the Palisades Research Centre. The Palisades Research Centre, distant some dozen km from Jasper townsite (and at the near-centre of the CER Project's study area), is Parks Canada's principal residential centre for short- and long-term training (of wardens and others). Extensive capital improvements have been made in recent years to upgrade its conference and seminar capabilities, with the provision of internet communications, meeting rooms, and so forth. Operational adjustments have been made to better accommodate the needs and schedules of academic researchers while continuing to serve Parks Canada's training and meeting needs. Prior involvement with the Palisades Research Centre by the principal investigator and several collaborators resulted in the inclusion of the CER Project in the process of identifying those needed upgrades, and the Project has been a heavy user of the facilities, often at subsidized rates negotiated by CER with the Park (an indication again of JNP's commitment to furthering the Project). In particular, CER successfully advocated for dedicated use of a large facility otherwise deemed surplus, now known as the Research House, which contains a fully-equipped kitchen, washroom, large common room, several research offices with modern internet capacity, and private bedrooms for the CER Project's field staff. The presence of an on-site dedicated living and research space for the Project has been of signal importance to the success of the Project. Obvious and substantial budget efficiencies have resulted from centralized housing, including minimizing logistical difficulties in arranging field sorties, offering direct communications among team members, and expediting contact with the Project's researchers by other parties. Less obvious, but equally substantial, are the positive effects for the CER Project's research of the social "architecture" that such a physical resource allows. The daily interactions of different disciplinary researchers foster extensive and intensive discussions, the sharing of skill sets, and an increasing understanding of others' approaches; the effect has been an efficient working environment that fosters interdisciplinary collaboration and ensures that particular initiatives are discussed, scrutinized, and validated from several different points of view. Moreover, the Research House has become a magnet for JNP researchers, generally, and is a site for interaction between groups of researchers and among researchers, Parks managers, and interested members of the public.

Notice must be taken here of the CER Project Room at the University of Alberta. This room also reflects the Project's development of physical, social, and corporate infrastructure. It is a large, dedicated, secure space, housing the Project's central photography, map, and textual resource centre, research work space, and advanced computing capabilities. It is particularly heavily used during the winter months. It allows the same kind of focused interactions for members of the CER Project that the Research House at the Palisades Centre offers the Project's field staff. It results from the commitment of the University of Alberta's Department of Anthropology to the success (and subsidy) of the CER Project.

The social infrastructure is further represented by the development of The Jasper Foundation, a non-profit society registered under the Societies Act of Alberta, the general purpose of which "is to advance research that enhances understanding, appreciation, and respect of JNP" (see Appendices: Jasper Foundation Constitution). The CER Project's principal investigator has

worked with many other stakeholders to create an institutional body that can serve as the ongoing focus for public efforts by all parties interested in:

- generating and distributing financial support and other contributions for research;
- providing an interdisciplinary forum to coordinate the delivery of applied research;
- providing appropriate facilities and infrastructural support;
- communicating knowledge to communities, scientists, managers, decision makers, and industry; and
- encouraging educational opportunities and community involvements.

4.8 A Research Foundation for JNP

The Jasper Foundation aims to give permanent structural form and basic coordination to the large number of like-minded stakeholders in Jasper National Park. The work of the CER Project required it to identify agencies and individuals (beyond the JNP staff) whose interests and experience could be of benefit to the Project and then to convince them that the Project was of benefit to them. The aim was to develop a functional network among all these parties for information sharing and the pooling of skills and experience. No prior "networked" resource for researchers existed. To this end, considerable effort was made by the CER Project to ensure that it had a public profile with Jasper townspeople and with a range of agencies (for example, the J-YM&A) and individuals by means of formal and informal meetings and by a regular series of information sessions, workshops, and public talks about aspects of the CER Project's research. The Jasper Foundation is a resource for the future that builds on the Project's experiences.

4.9 Memorandum of Understanding between JNP and the U of A

The corporate infrastructure is represented by the Memorandum of Understanding (MoU) between JNP and the University of Alberta. The MoU is a basic form of mutual recognition, an acknowledgement and delineation of shared goals and interests, and an outline of the ways to facilitate interactions between JNP and the University and between Park and University staff. This kind of corporate dialogue creates a long-term, stable framework for any particular interactions and projects that individual staff members or units may develop. No such protocol existed before CER Project members helped galvanize this corporate dialogue. The MoU is an important achievement; it declares new corporate policy, namely, a recognition of the mutual advantages that both parties see flowing from working together, and it outlines the general administrative structures and process for effective partnering. The MoU is both a document and a process: refinements and detailing are under way. The CER Project represents a prime example of such an interaction and the experience of those involved with the Project is significant in the MoU process. Concrete examples of how the MoU has aided the CER Project are arrangements to allow JNP staff to attend University courses, the development of a "most-favoured" status for potential overheads charged against JNP-related research budgets, and arrangements for the movements of monies and accounting procedures. Ron Kratochvil, former Associate V-P (Research), is leading the negotiations which should bear fruit in the first half of 2000.

5 Description of Component Projects

This chapter describes the main component studies involved in the CER project. Disciplinary approaches vary, and rather than trying to place each project into a particular format (i.e., background, methods & etc.) we opted to let the lead researcher choose the presentation approach. The projects appear in the following order:

- The ARV during the Fur Trade Era
- Vegetation Change in the montane ecoregion of JNP
- Human Activity Mapping
- Oral history
- The Restoration Pilot Project
- Multimedia Project
- Natural Disturbance Mapping in the Montane Ecoregion, JNP
- Archaeological Research
- Palaeoecological Research

5.1 The ARV During the Fur Trade Era

During the height of the fur trade period, 1811 to 1854, the ARV experienced intensive use, especially as a transportation corridor. It is well known by motorists today that the Yellowhead Pass through the Rocky Mountains by way of the Athabasca, Miette, and upper Fraser rivers, offers the second lowest elevation (1130 m) of all the passes in the lower latitudes of Canadian territory (Monkman Pass is the lowest [Smyth, 1984-85: 51]). This feature, together with another—that the Whirlpool River, a tributary of the Athabasca, takes its rise at a point on the continental divide unoccupied by a glacier—meant that the Athabasca River could serve as an efficient transportation corridor once the North West and Hudson's Bay companies expanded their business across the continent to the Pacific Ocean (Figure 5-1). The Athabasca Pass up the Whirlpool River Valley and the Yellowhead Pass up the Miette River valley provided access to the Columbia and New Caledonia districts, respectively. Returns of trade were carried over these passes when they first came into regular use, but after 1825, Fort Vancouver, located on the site of modern-day Vancouver, Washington, served as the Pacific hub of the operations of the Hudson's Bay Company (HBC), and the returns were sent from there to England by ship. However, brigades known as expresses or packets made trips west and east over the passes in the spring and fall of each year, carrying the paperwork of inter-district business and personal correspondence.

David Thompson, then of the North West Company (NWC), was the first white man on record to cross Athabasca Pass, when he reached the Columbia River from the Athabasca in January 1811. Other white men probably preceded him by as much as a half-decade (Schaeffer 1966). Because this pass linked two such prominent rivers and especially because the Columbia was navigable all the way to salt water with no portages of insurmountable lengths, the journey up the Whirlpool River Valley and down the Grand Côte to the Wood River and the Columbia at Boat Encampment became a speedy route to the Pacific Slope. Once brigades left the Athabasca and started up the Whirlpool, the crossing took about six days, depending on the level of snow in the pass.

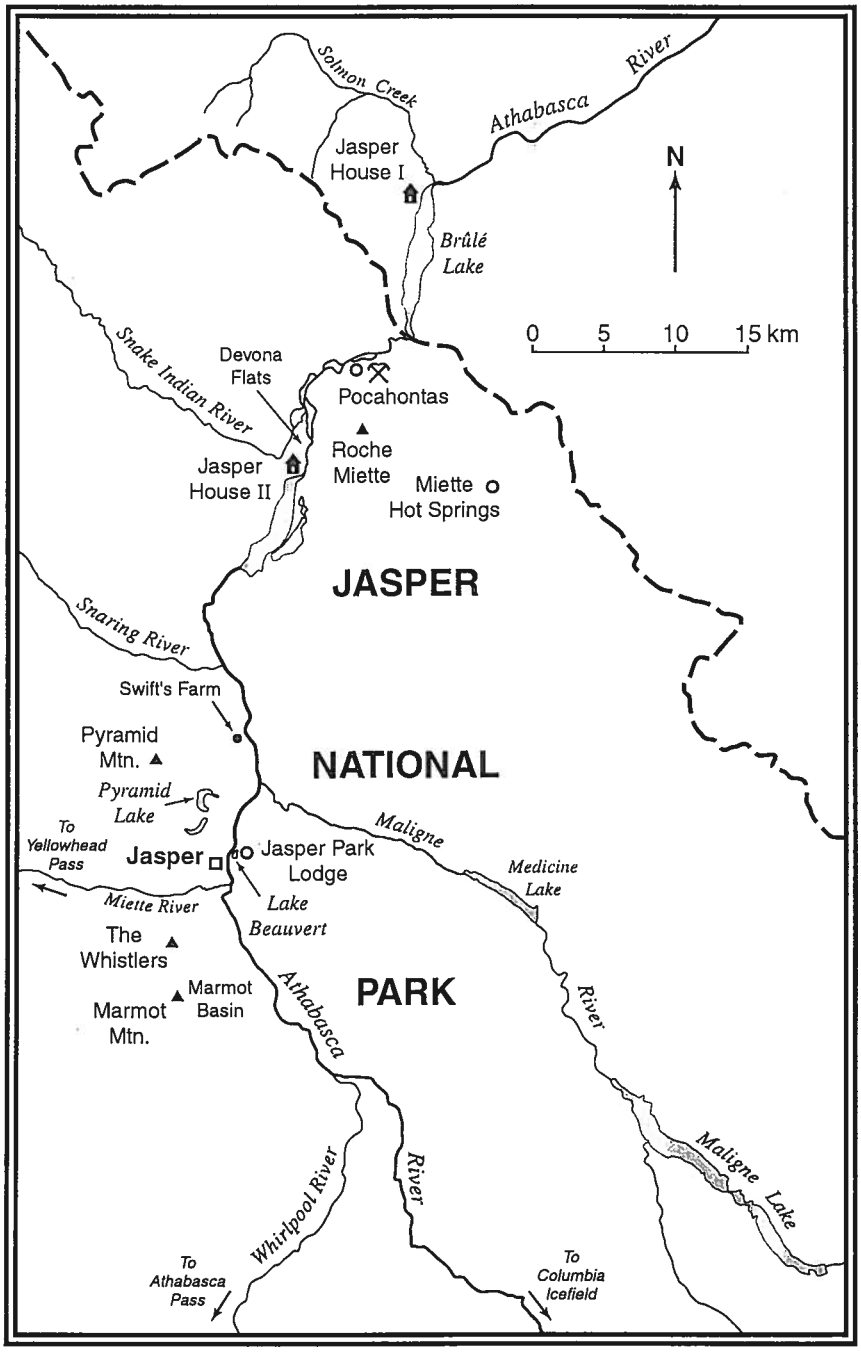


Figure 5-1. Map showing location of fur trade features.

The Yellowhead Pass is named for Pierre Bostonais, an Iroquois mixed-blood who came west with the NWC in the early years of the nineteenth century, and who was killed in New Caledonia in 1827. Because New Caledonia could not supply itself with sufficient amounts of leather, quantities of it were regularly taken over the route between Jasper House and Fort George, a distance of more than 700 km. For this reason, the entire route was occasionally called the Leather Track, and, after the fur trade had finished with it, the pass itself attracted the name Leather Pass. This did not supplant Yellowhead, however; rather, the common name remained linked to the fact that the pass led to Tête Jaune Cache. Perhaps for the first time, this name was anglicized on the Arrowsmith map of 1859 (Smyth 1984-85: 52).

Access from the Athabasca River to either the Fraser or the Columbia solved the obstacle of the Cordillera for the transcontinental fur trade, but, all the same, Athabasca and Yellowhead passes made arduous land bridges, the crossing of which needed to be made as quickly as weather and commerce would permit. As far as the focus of the CER Project is concerned, a major aspect of these logistical demands was the use made of horses by the fur trade brigades. The maintenance of a large number of horses at Jasper House represented an activity of high priority at this post in the first half of the nineteenth century. As many as three hundred were under the management in the 1830s of Jacques Cardinal, the best known of the horse keepers at the post. He grazed them in the montane between Jasper House II (on the bank of the Athabasca across and slightly upstream from Roche Miette) and the Snake Indian River, at Larocque's Prairie, and Prairie de la Vache, as well as, no doubt, at almost any other montane location around Jasper House and as far upriver as the mouth of the Whirlpool, about twenty kilometres upriver of the townsite of Jasper. At Jasper House, westbound brigades would change their York Boats, in which they had fought their way upriver to Jasper from Fort Assiniboine, for horses, and continue up the valley and thence up the Whirlpool River valley. Horses were usually left at the end of the Grand Batture, more than half-way between the mouth and the height of land at Committee Punch Bowl, but occasionally, they were taken up as high as Campement de Fusil (Gun Camp; now known as Kane Meadows), and right the way to Boat Encampment if snow conditions permitted. Once the horses were dismissed, men took to snow shoes and continued with these as far as necessary, usually at least to Wood River, between twenty to thirty fordings of which were often required before brigades reached Boat Encampment and could take to York Boats again. Meanwhile, the horses, if they were not immediately needed (often, they were) to conduct an eastbound brigade to Jasper House, were taken back down the valley to Campement d'Orignal (Moose Encampment), probably near the lowest set of flats on the Whirlpool River, and perhaps as far down as the Athabasca at Prairie de la Vache, a meadow which still goes by that name and which lies just east of the Icefields Parkway, two km south of the first bridge at which the highway crosses the Athabasca on its way south from Jasper townsite.

There are three identifiable grazing areas identified in fur trade writings, but it was probably the case that the horse keeper could avail himself of any portion of the rich grasses of the montane. And there appears to have been much more graze available during the fur trade period than today greets the visitor to JNP (est. 1907). It is widely understood how great an impact JNP's fire suppression policies have had in extending forest cover and limiting grassland and new-growth parkland. Several accounts of the valley during the fur trade period remark on, not the extensive forest cover, but the parkland or savannah-like appearance of the valley.

The location in wilderness of built structures also attracts the eye of the wilderness traveller, of course, and such was the case in the ARV in the early nineteenth century. The locations on the river of some of the fur trade posts (Henry House and Rocky Mountain Fort of the NWC, Jasper House I [also known for a time as Rocky Mountain Fort] and II of the HBC) remains a matter of conjecture and dispute, but it is certain that they existed. A widening of the Athabasca River is

known today as Lac Brûlé; it lies just outside the first range of mountains and, therefore, just outside the eastern boundary of JNP. Towards the northern (downstream) end of this lake, Jasper House I, or the Rocky Mountain Fort, was built on the west shore by François Decoigne of the NWC in 1813. Gabriel Franchère recruited at it in May 1814 (Lamb 1969: 162) and Ross Cox in June 1817 (1831: II,205), when it was managed by Jasper Hawes (Smyth 1985: 33-34), after whom it and the lake came to be named. Between 1829 and 1831 (see Thompson 1960: 18, and Stuart 1984 for various views on the date), that post was abandoned and Jasper House II was established farther upriver, across from and between today's two mouths of Rocky River. The next (upriver) widening of the Athabasca is the one known in this century as Jasper Lake; in its entirety, it lies well within the borders of JNP. The site of Jasper House II is readily located today. The HBC moved the post farther upstream probably because the new location afforded better pasturage for the horses (Ens and Potyondi 1986: 68). Because the HBC's abandonment of Jasper House in 1857 related to changes in the company's transportation strategies and not in diminished fur returns, it is not surprising to find that the post continued intermittently to trade in furs until 1884. However, the need for horses to transport semi-annual transmontane brigades diminished rapidly after 1853, when the HBC's Columbia and New Caledonia districts, which had hitherto been governed from the Northern Department's annual councils at Norway House, were joined under the new name of the Columbia Department, and administered from Fort Victoria and directly from London. Thus, the use of the valley for grazing purposes in any systematic way by the fur trade monopoly came to an end.

Probably by the second half and certainly by the last quarter of the nineteenth century, the population in the ARV seems to have shifted in favour of the descendants of the Iroquois and Métis of Iroquois descent whom the fur trade, and, particularly, the NWC, had brought west under short-term renewable contracts, and who began hunting in the valley in the late 1700s (Ens and Potyondi 1986: 38; Gainer 1981: 21; for further particulars, see Gainer 51-54, Stuart 1984, and Ens and Potyondi 16-38, 92-97). According to David Smyth, the first Iroquois came west in 1794, "with the period of greatest influx being 1800-04. As many as 300 Iroquois may have been brought into the Saskatchewan District by the North West and XY companies in just one year, 1801" (1984: 2). The arrival of the Iroquois did not alter a traditional use of the valley by Native peoples as a corridor in the same way as it would the fur trade and as it does both rail and highway traffic today. Archaeological evidence from several sites in the montane indicates that usage of the valley from both the west and the east, that is to say, both by Rocky Mountain Shuswap (Texqa' Kallt— "people of the upper reaches"—or Xexha 'llt—"those at the top" [Teit 1909: 455]), who crossed the mountains annually by the Athabasca and Yellowhead passes, and by way of the Snake Indian River valley, and by Assiniboine (Stoney), Sarsi, Cree, Kutenai, Sekani, Blackfoot, and Blood was common.

Little archaeological data from JNP can be linked to specific Peoples, although 225 prehistoric archaeological sites have been identified within the Park boundaries (Francis 1996). That some of these groups did not have permanent residences in what is now the Park, should not be considered as evidence of a lack of use of the lands in prehistoric times, but rather as a reflection of the migratory patterns of the game pursued therein. Parks archaeologists have not been able to confirm the identity of groups which once wintered in JNP, who were referred to by early European travellers in the area as Snake and/or Snare Indians, although this group may well have been Shuswap. The published and unpublished records of the ethnographer, James Teit, record accounts of "[y]et another band [of Shuswap], mixed with Cree, [who] live practically east of the Rocky Mountains, in the neighbourhood of Jasper house, and west to Tete-Jaune Cache" (Teit 1909: 451). Teit's record provides an indication that the focus on particular ancestries, such as Cree and

Iroquois, can potentially obscure the contribution of other groups, including Shuswap (also known as Sewepmec) to the heritage of the aboriginal people currently residing in and near JNP.

It is known that through the mountain passes such trade ornaments as dentalia made their way from the coast to inland tribes like the Blackfoot (see Karklins 1992: 125, 128), and the ARV would have been no exception. One archaeological site, in the vicinity of Patricia and Pyramid lakes, west of (behind) the townsite of Jasper, has been identified as "seem[ing] to be culturally and temporally affiliated with the Shuswap and Plateau Horizons of the Canadian Plateau" (Pickard 1986: 130).

HBC Governor Simpson had planned that Rocky Mountain Fort, which he ordered be established in 1825, would attract Shuswap and North Thompson traders, and the presence of Shuswap at Jasper House was not uncommon; Paul Kane sketched the portrait of Assannitchay or Capôt Blanc, a Shuswap chief, when there in 1846 and he met him again at Boat Encampment on the Columbia River the next year (MacLaren 1989: 67)—evidence that the Shuswap were accustomed to crossing to the eastern slope for trade purposes. It might well be the case that a notorious massacre of Shuswap by Iroquois freemen, Kootenay, and Saulteaux in the early 1820s (Merk 1931/1968: 21, 22) symbolized the fact that Jasper House itself was understood as a frontier between peoples vying for the upper hand in the trade, but too few such historical examples have survived for such an argument to be convincingly mounted.

Transhipment was a chief purpose for Jasper House, and so, although Cree, Iroquois, and Métis were employed as horse keepers, some trade was also always done, especially with French-Canadian freemen and Iroquois, and with Rocky Mountain Shuswap. It has been estimated that in the late 1820s the fur returns from Jasper House represented more than a tenth of the total beaver returns in the HBC's Saskatchewan District (Ens and Potyondi 1986: 20-21).

The common understanding today is that few Indians lived in the mountains, but that is a misperception based on the expulsion of permanent inhabitants by the federal government once dominion forest reserves and national parks began to be established in the late nineteenth and, in the case of JNP, early twentieth centuries. Partly for the same reasons that the valley affords an excellent transmontane corridor to travellers today and excellent environs for spiritual and physical renewal (Steinhauer 1985: 7), it has doubtless experienced the presence and influence of human activity as long as the species has occupied the northern Cordillera of North America. The fable of the mountain barrier is nothing more than a fable.

5.2 Vegetation Change in the Montane Ecoregion Of JNP

> And at this time we didn't have all the jack pine there is now—it was more open. Now, this undergrowth and things—that comes—between them days and now. You see the spruce and jack pine are quite tall now. If they once catch fire, well you can't do very much with them ....
>
> Edward Moberly, 1980 (forcibly relocated from Jasper in 1909)
> (Murphy 1980)

5.2.1 Overview

We have an unprecedented account of vegetation history. This is due chiefly to the unexpected recovery of a remarkable collection of survey photographs taken in 1915 by M.P. Bridgland, a Dominion Lands Surveyor who used them to construct the first topographic maps of JNP. It is due in a crucial respect to the efforts of Jeanine Rhemtulla, now a MSc graduate of the Department of Renewable Resources at the University of Alberta, who focused her thesis on the

study of vegetation change over the last century in the CER Project's study area. She first compared and analyzed the changes in vegetation between aerial photographs from 1949 and 1991 using standard interpretive and classification techniques. This work, by creating digital maps of vegetation from these two time slices, allowed direct spatial comparisons, thus yielding a quantitative and spatially precise estimate of what had changed and where the changes had taken place. Next, using similar interpretive techniques, she identified vegetation communities on the 1915 Bridgland photographs and on repeat photographs taken by her in 1997. Because of the hard realities of geometry, making quantitatviely accurate assessments of repeat photographs is not a straightforward task. A repeat photograph typically captures an image from an angle of view, often, in the case of Bridgland's work, from considerable heights (high promontories or mountain summits). In the foreground of these images, vegetation features appear larger in size than they really are, and in the background the features appear smaller. However, we were blessed with a systematic set of photographs that allowed us to push our analysis further than other repeat photographic projects have achieved. By analysing the same portion of the montane ecoregion from a variety of different photographic points, the overall average of vegetation coverage as estimated from the 1997 photographs correlated satisfactorily with the known values calculated from the 1991 aerial photographs. By extension, we can argue, at least tentatively, that the vegetation coverage for the 1915 photographs approximately represents the actual area covered by different vegetation types at that time. At the least, we are able to discern relative changes in vegetation cover from 1915 to the present. The next step, of course, will be to reconstruct maps of the vegetation from 1915 but this work requires further preliminary research.

5.2.2 Introduction

In June 1915, Morrison Parsons Bridgland, a surveyor with the Dominion Lands Survey, arrived in the Rocky Mountains of Alberta. He was charged with a formidable task—to supervise the creation of the first topographic map of the newly established JNP. He rose to the challenge: in the space of the next four months, he, his survey crew of five (an assistant, two horse packers, two cooks), and a team of pack horses, set up ninety-three survey stations on mountain tops, cliff edges, and prominent points at ground level (Bridgland 1924). At each station, Bridgland and his assistant composed a panorama by taking a set of photographs circling the horizon. Later that fall, he meticulously crafted these photographs, together with pages of theodolite measurements, into a topographic map covering 2300 km^2, almost one-quarter of JNP's area (Bridgland 1924).

The Dominion Lands Survey was pleased to have yet another piece of Canada mapped. Unknowingly, however, they had also created a legacy that has long outlived the practical utility of that first map. The Bridgland photographs, 750 of them in total, have become an extremely valuable visual record of the state of JNP in its early years. Systematically taken and comprehensive in coverage, they are unparalleled by any other early historical records in the area, and by few records series in the Rocky Mountain region as a whole.

In the summer of 1997, armed with a large-format camera and a single assistant, Jeanine Rhemtulla and Eric Higgs returned to a dozen of Bridgland's survey stations, and rephotographed the same views. Thus began a project to examine how the vegetation in the ARV has changed over the last eighty years. Using both these photographs and two sets of aerial photographs, Rhemtulla pieced together snapshots of the vegetation in the valley at several dates. Changes in vegetation structure and composition were analysed with GIS software. The results provide the first detailed documentation of vegetation change in the montane ecoregion of JNP, and can be used to help set goals for future management of the area.

5.2.3 Vegetation of the Montane Ecoregion

There is growing recognition that the vegetation in the montane ecoregion may have changed significantly over the last eighty years. Evidence from historical photographs and written materials suggest that, at the turn of the century, grasslands and open forests dominated the main valleys; today, many of these areas are covered with closed-canopy coniferous forests. Shaped for millennia by the regenerative forces of fire, flood, and wind, it seems that the twentieth century introduction of fire suppression and prevention, forced dislocation of native peoples, and the onslaught of modern human activities is affecting the composition and structure of vegetation communities in new ways.

Although lodgepole pine is the most common canopy-forming tree species in the montane, the ecoregion is also characterised by the occurrence of Douglas-fir, white spruce, and trembling aspen, interspersed with small amounts of grassland (Holland and Coen 1982b). The vegetation structure and composition are shaped by a number of different processes occurring at various spatial scales across the montane ecoregion. Factors such as avalanches, floods, wind, insect and disease outbreaks, and herbivory by large mammals can substantially alter landscape patterns (Holland and Coen 1982b, Westhaver 1987, Achuff et al. 1996). Periodic flooding and avalanches, for example, are important for the regeneration of aspen stands on alluvial fans and steep slopes; these same stands may be negatively affected by high browsing pressure (Bartos and Mueggler 1981). Insect outbreaks are particularly common in older coniferous stands (Westhaver 1987). Windthrow and other processes may be especially significant at the stand level.

Fire is generally regarded as the major disturbance in JNP, and much research effort has been devoted to understanding its effects. Most of the forests in the Three-Valley Confluence (centred on Jasper townsite) originated following major fires in 1758, 1847, and 1889 (Tande 1979). The historical fire regime consists of both frequent, low-intensity fires and less frequent, high-intensity fires. Burns equal to one-fifth or one-third of JNP's area occurred once or twice a century between 1600 and 1889 (Van Wagner 1995). However, fire has been negligible in JNP over the past ninety years (Tande 1979, Van Wagner 1995); this phenomenon is also apparent in Banff, Kootenay, and Waterton Lakes national parks, and in Kananaskis Provincial Park (White 1985, Masters 1990, Van Wagner 1995, Barrett 1996, Hawkes 1979). No fire-free periods of this length have been found in the fire history records of any of these five parks (Barrett 1996, Van Wagner 1995, Hawkes 1979). The reasons for this are much debated, but they include increased efficiency of fire prevention and suppression, and the forced dislocation of aboriginal peoples who may have used fire as a management tool (Heinselman 1975, Kay and White 1995).

The ecological effects of decreased fire activity on the landscape are becoming increasingly apparent. In the Bow River Valley, where fire has been almost completely absent since 1936, the proportion of area covered by younger vegetation types, such as herb, low-shrub and young conifer forests, has decreased greatly, and these types are being replaced by older, closed forest vegetation, particularly pine, spruce, and spruce-fir forests (Achuff et al. 1996). Most of the aspen stands are more than 100 years old and they are declining in vigour. In the face of a continued absence of fire, the vegetation not only will become older, more forested, and dominated by conifers, but also one-third of the vegetation types may be entirely lost from the landscape, with the result of a significant decrease in overall biodiversity (Achuff et al. 1996). Similar trends have been described elsewhere (Barrett 1996, Taylor and Hawkes 1997, Gruell 1983, Mast et al. 1997).

5.2.4 Objectives of the Study

In order to understand fully the effects of nine decades of vegetation change in the absence of fire in JNP, historical data are needed. Despite detailed data on fire history in JNP (that is, data about a process), few data exist on historical vegetation states (data about patterns). The primary

objective of this study was to analyse how vegetation composition and structure have changed in the montane ecoregion of JNP in the period from 1915 to 1997.

The study was approached in two ways. First, we undertook to return to the locations of several dozen historical survey photographs taken in 1915 and rephotographed the same views. The vegetation in both sets of photographs was identified in order to compare how the overall vegetation composition changed between 1915 and 1997. Second, standard techniques for interpreting aerial photographs were used to develop vegetation maps for 1949 (the date of the first aerial photographs taken in JNP) and for 1991 (a later set of aerial photographs). Changes in vegetation patterns across the landscape and within-stand structure and species composition were analysed with the aid of GIS software.

This represents one of the first studies to document historical vegetation change in JNP. It is, as well, one of the first to complete systematic, comprehensive repeat views of historical photographs in the Canadian Rockies, and one of the first studies anywhere to analyze such paired photographs *quantitatively*. Long-term goals for maintaining or restoring the ecological integrity of JNP can be meaningful only if they are grounded in historical knowledge of past ecological conditions (Higgs et al. 1998). This research is directed at increasing our understanding of the dynamic nature of this landscape.

5.2.5 Methods

The research included two components: repeat photography and interpretation of aerial photographs. A total of fifty-three historical survey images were selected for rephotography. Camera equipment was chosen to approximate as closely as possible that used by the original survey team. All pairs of photographs were subsequently analysed qualitatively. A method was developed to analyze the photographs quantitatively, and it was tested on twenty of the pairs. Paired photographs were interpreted in a manner similar to standard interpretation of aerial photographs, digitized, overlaid, and analyzed in a GIS environment.

Two sets of aerial photographs were selected for interpretation: the one from 1949 (the first set made) and the one from 1991. Standard techniques were used to interpret vegetation from the photographs. Polygons were transferred to transparent sheets of acetate overlaid onto the CER aerial photographic mosaic base map; the final geo-corrected composite acetates were digitized and analyzed using a GIS environment.

5.2.6 Results

The following section provides only a very brief summary of the results of this research. For complete results, please refer to Rhemtulla (1999).

5.2.6.1 Qualitative Analysis. The repeat photographs showcase a number of the trends in vegetation change observed in the study area between 1915 and 1997 (Figures 5-2 to 5-6). The greatest apparent change in vegetation is the dramatic increase in forest cover and crown closure throughout the study area (Figures 5-2 and 5-3). The 1997 photographs consistently show older, more closed forest stands in the ARV and along the flanks of the mountains which define it. There appears to have been a decline in the number of young regenerating tree stands (Figure 5-2). There has also been a decline in the abundance of deciduous trees (Figure 5-3). Forest encroachment into former grassland areas is apparent, although several core grassland areas in the Henry House Flats region persist in the 1997 photographs (Figures 5-4 and 5-5). Overall, the 1915 photographs depict a valley with patchy vegetation; that is, the valley features open coniferous forests stands, large grasslands, young tree regeneration, and the occasional stand dominated by deciduous species. The

1997 matching pictures suggest an increase in the homogeneity of the vegetation cover; much of the former patchiness has been replaced by uniform closed coniferous stands.

There has also been a major increase in the human presence evident on the landscape. New human infrastructure includes a borrow pit (Figure 5-3), a power generating station (Figure 5-2), campgrounds, and transportation and utility corridors (Figure 5-6).

5.2.6.2 Quantitative analysis. The results of the quantitative analysis of both the Bridgland oblique photographs and the aerial photographs confirm the qualitative observations. Overall, there was a general shift in the study area from early to later successional vegetation types. Total forested area increased from 1915 to 1997. There was a significant increase in crown closure within coniferous stands. Young tree cover virtually disappeared from the study area. Forest encroachment on grasslands was also apparent. Both herbaceous and shrub cover declined between 1915 and 1997. Total anthropogenic cover increased dramatically. Finally, the distribution of cover types in the study area suggested an apparent increase in homogeneity across the landscape as a whole from 1949 to 1991. In most cases, patch number declined and patch size increased by cover type or forest attribute.

5.2.6.3 Quantitative interpretation of oblique photographs. because of the geometry of oblique photographs—that is, they are not vertical images—it is difficult to determine absolute area measures; thus, analysis of these is generally limited to qualitative observations. As part of this research, a new method was developed for the quantitative interpretation of oblique photographs (the two sets of Bridgland images). Analysis of the accuracy of the method suggests that the results are dependable. Thus the Bridgland photographs and aerial photographs are directly comparable, and the quantitative results obtained from the two sources provide a good estimate of vegetation trends from 1915 to 1997. Further testing of the method is required, but the preliminary results are promising and may extend our ability to assess past vegetative states from historical oblique photographs.

5.2.7 Discussion

The results of Rhemtulla's study provide, for the first time, detailed documentation of vegetation change in the montane ecoregion of JNP during the past nine decades. The reasons for this change are difficult to distinguish one for another, but it is plausible that they include the combined effects of:

- decreased fire activity in the montane over this period,
- possible shifts in long-term climate trends,
- increased herbivory, and
- direct human activity on the landscape.

The ramifications of continued fire exclusion are serious, and include decreased overall biodiversity, the consequent loss of wildlife habitat, and the increased potential for both widespread fires and increased insect outbreaks.

The results of this work mark the first step in quantifying the historical range of variability of vegetation patterns in the montane ecoregion of JNP. While there has been general consensus that the current fire regime lies outside the range of variation observed over the last four centuries (Achuff et al. 1996), our knowledge of the accompanying changes in vegetation patterns is poor. We simply do not know if the current state of vegetation in JNP stands outside the historical range of variability. Analysis of soils on certain grassland sites in the montane, for example, shows that

Eutric Brunisols characteristic of forested areas were once dominant (Holland and Coen 1982b). Thus, what is today grassland probably was forest at some earlier time, and the forest encroachment that is currently occurring may lie well within the historical range of variability.

Much work remains to be done. While it is evident that the current fire regime is unprecedented over the past four hundred years, knowledge of conditions previous to that time is still lacking. Moreover, more detailed information is needed on the changes that have occurred over the last few centuries. Stand reconstruction techniques, for example, can be used to document past forest density and species composition (Fule et al. 1997). The work must also be extended beyond the boundaries of the montane ecoregion. Although research effort has been focused in the valleys of JNP, subalpine and alpine regions have not been exempt from change; yet we know little about them.

Applied research into potential restorative treatments is also needed. The introduction of prescribed burns has now been mandated in Canadian national parks. Emulating historical fire regimes, however, is a more complex procedure than the simple drop of a lit match, a matter well-known to the dedicated fire/vegetation specialists in Jasper National Park. Reintroducing fire onto the landscape requires a consideration of the effects of time of year and intensity of burn, in addition to the desired extent and periodicity of fire events (Baker 1994, Johnson and Miyanishi 1995). Moreover, the reintroduction of fire after a long absence does not always have the desired effects; in addition to prescribed burns, stand thinning and other treatments may be necessary to restore former conditions (Feeney et al. 1998). Douglas-fir stands, in particular, may require special consideration in a restoration context. Accumulated fuels may need to be removed from around veteran trees before fire is re-introduced. The issues of how best to re-establish and maintain both open-grown Douglas-fir stands, and Douglas-fir as a component of closed-canopy coniferous stands also need addressing.

Careful long-term monitoring of any restorative treatments is essential. The establishment of permanent plots (exclosures) and the consistent collection of data from these sites will go far in helping monitor the effects of our experiments.

Finally, research into historical human activity and the impacts of increased development on the landscape is also necessary, as is careful reflection on how this knowledge can be incorporated into decision-making. The reasons for the decrease in fire frequency this century likely include the displacement of First Nations peoples from JNP. If it turns out to be true that much of the historical fire regime has resulted from extensive fire management on the part of Native peoples, will we still view fire in the same way?

5.2.8 Conclusions

The results of this study document eighty years of vegetation change in the montane ecoregion of JNP. In the virtual absence of fire this century, there has been a shift towards late successional vegetation types on the landscape and an increase in crown closure in forest stands. Grasslands, shrubs, young tree growth, and open forests have decreased in extent, and closed canopy coniferous forests have become more prevalent. Anthropogenic cover has increased four- to eight-fold.

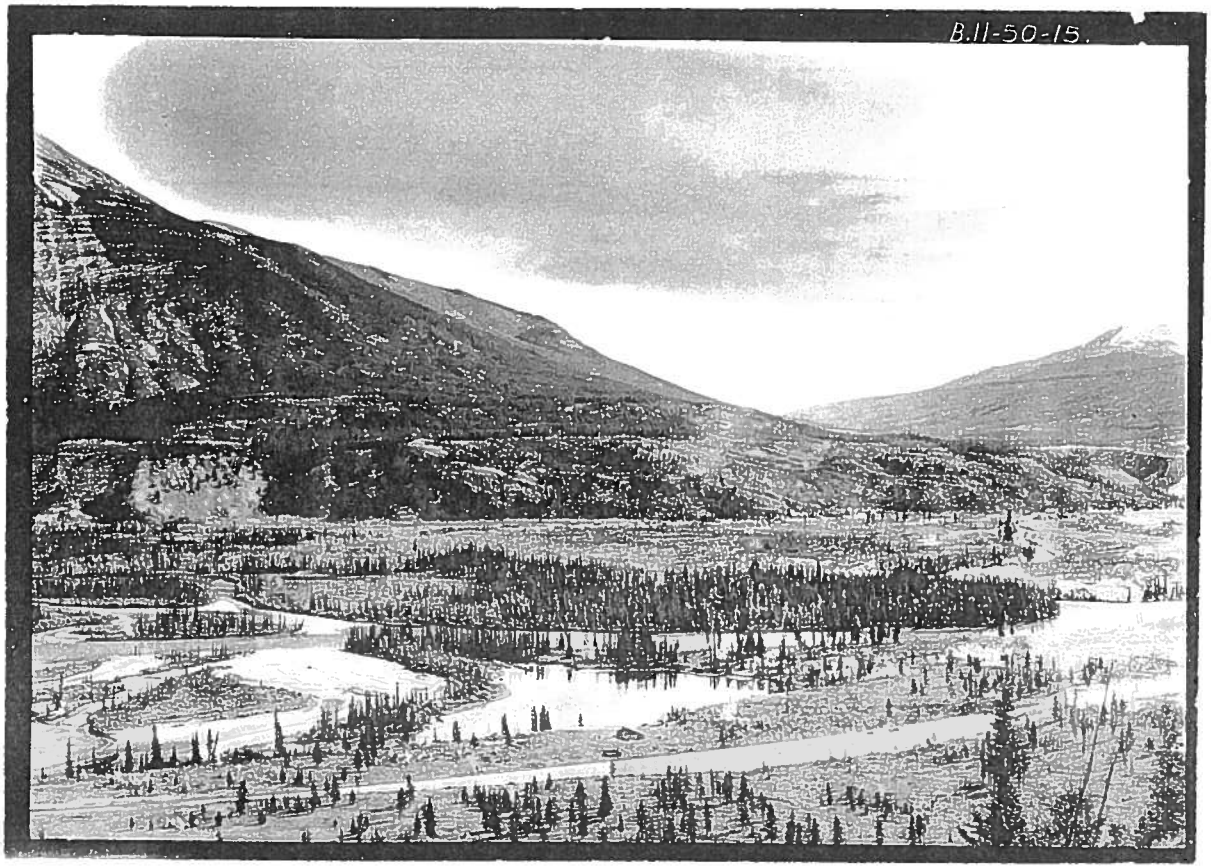
The implications for ecosystem structure and function are potentially quite serious, and they include decreased vegetation diversity, decreased habitat quality for several important wildlife species, and the potential for both widespread high-intensity fire and insect outbreak. The results of this work can be used both to define historical reference conditions and to help establish restoration goals for the montane ecoregion of the park.

When M.P. Bridgland arrived in JNP in 1915, he was charged with the creation of the first topographic map of JNP, to show people the wonders that lay amidst the majestic peaks of the great

Rockies. Today, it is time to reach back into the past and return to that work of mapping, mapping not the present but the future.

Figure 5-2: Athabasca River Valley, view E.S.E. (Station 57 – No. 462)

Historical photograph shows patchy vegetation throughout the valley. Sparse tree cover prevails. Dense young growth, likely coniferous, is evident behind dense coniferous stand centre-right. Coniferous species dominate, but deciduous trees are also apparent. Repeat photograph shows increased tree density throughout, especially in valley bottom. Deciduous component appears to have declined. Apparent homogeneity of vegetation overall on the landscape has increased.

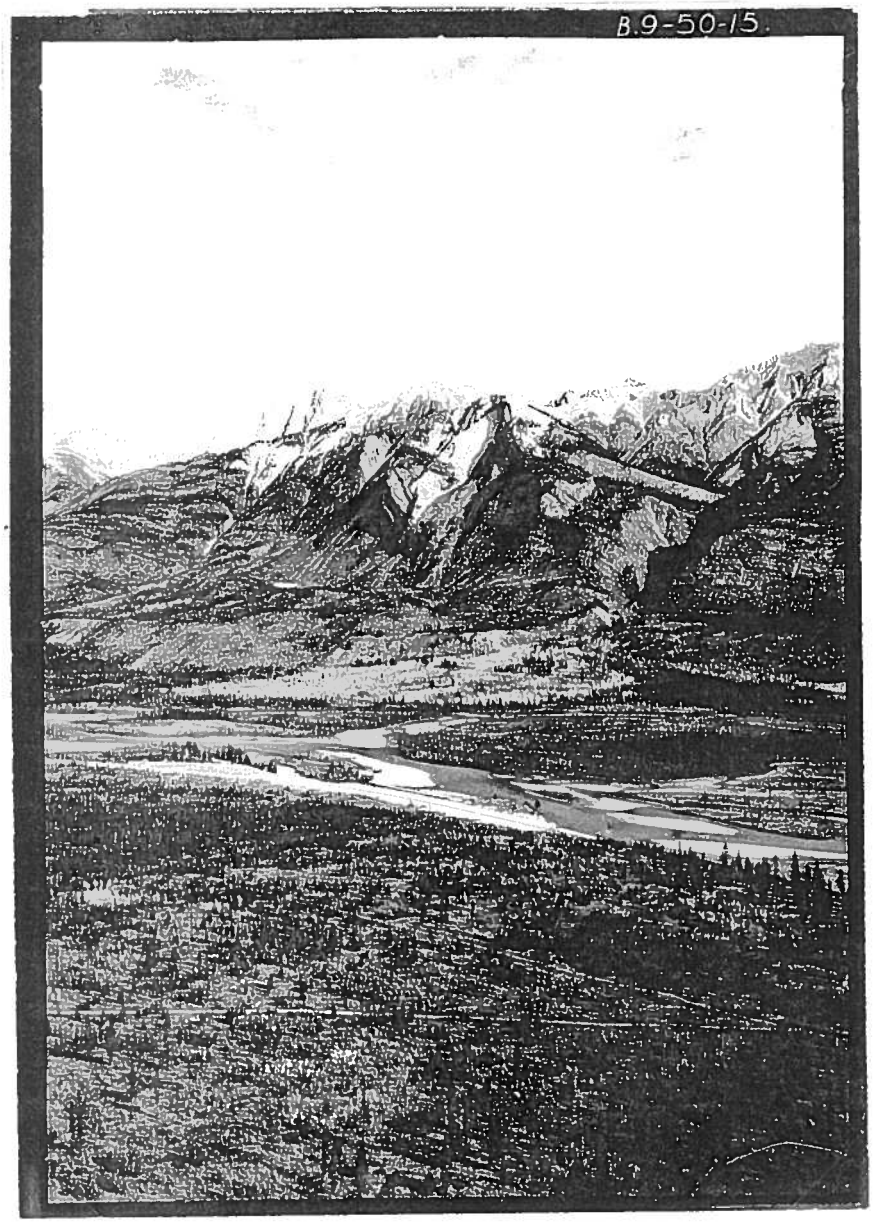


M. P. Bridgland, 1915

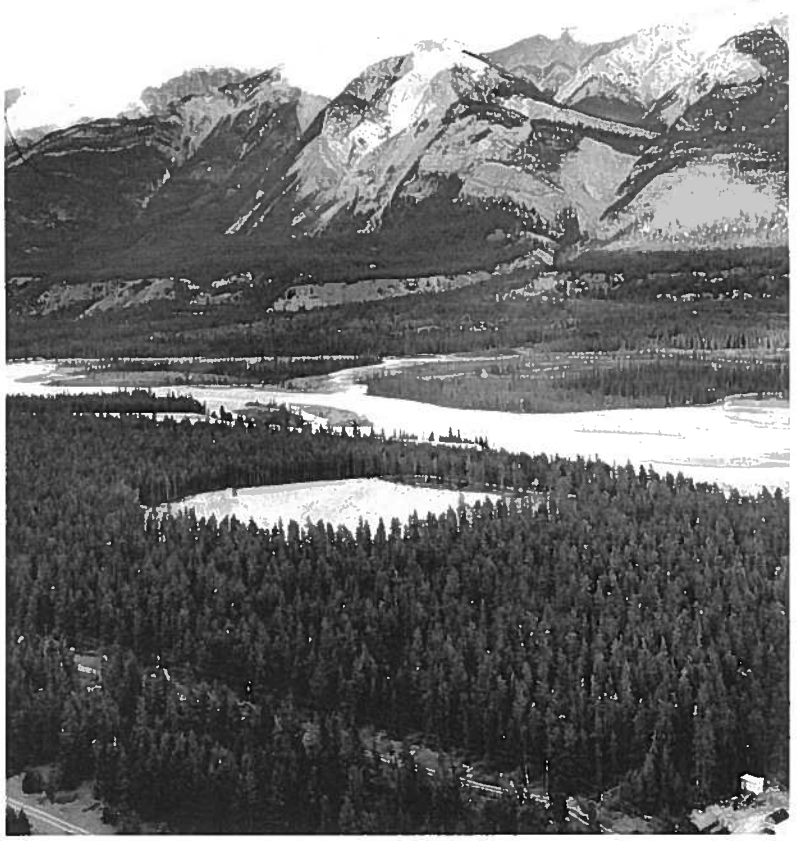
J. Rhemtulla & E. Higgs, 1997

Figure 5-3: Athabasca River Valley, view N.E. (Station 57 – No. 460)

Original showcases large alluvial fan with dense young deciduous growth (centre). Open coniferous forest with an occasional deciduous patch is evident elsewhere. Retake shows that the conifer component has increased significantly in the alluvial fan. Both the foreground and flanks of the Colin Range behind the river show a marked increase in tree density. Increased human activity is apparent in the borrow pit (centre), power line, and power generating station (bottom right).



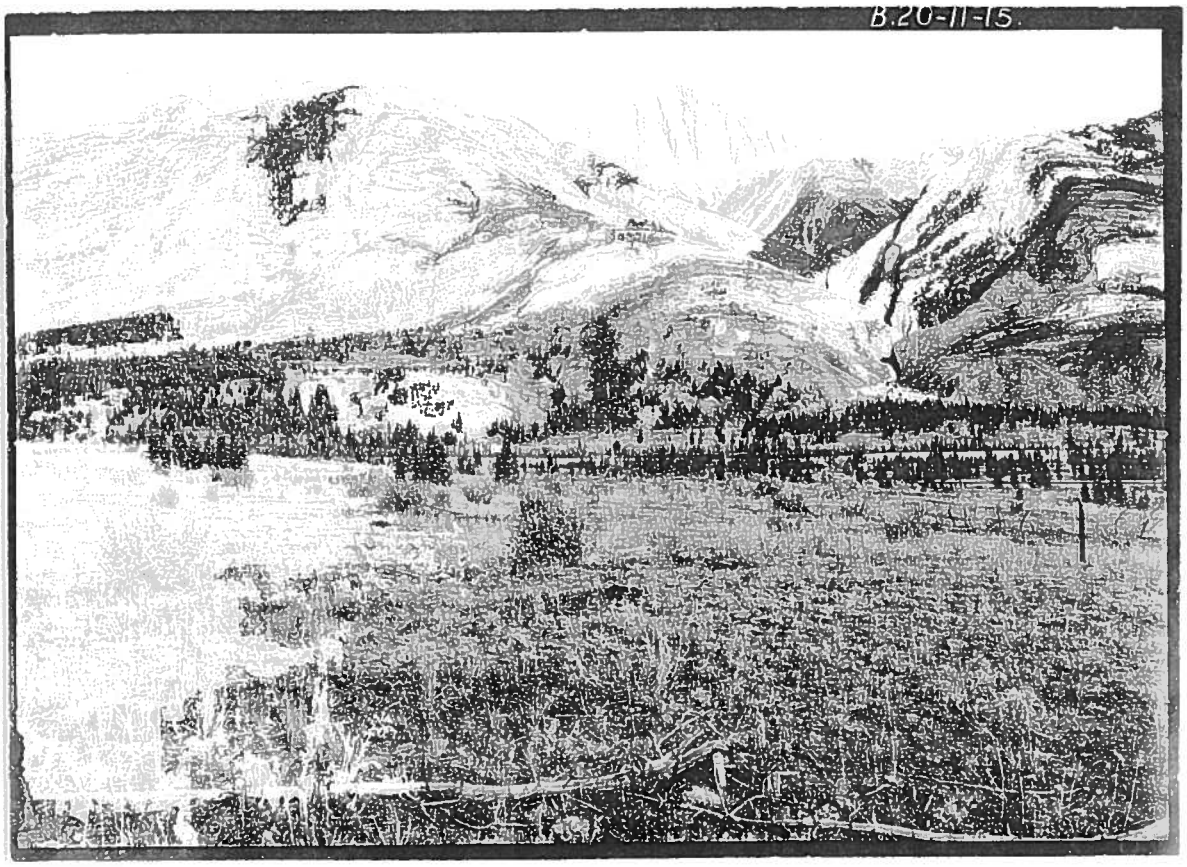
M. P. Bridgland, 1915



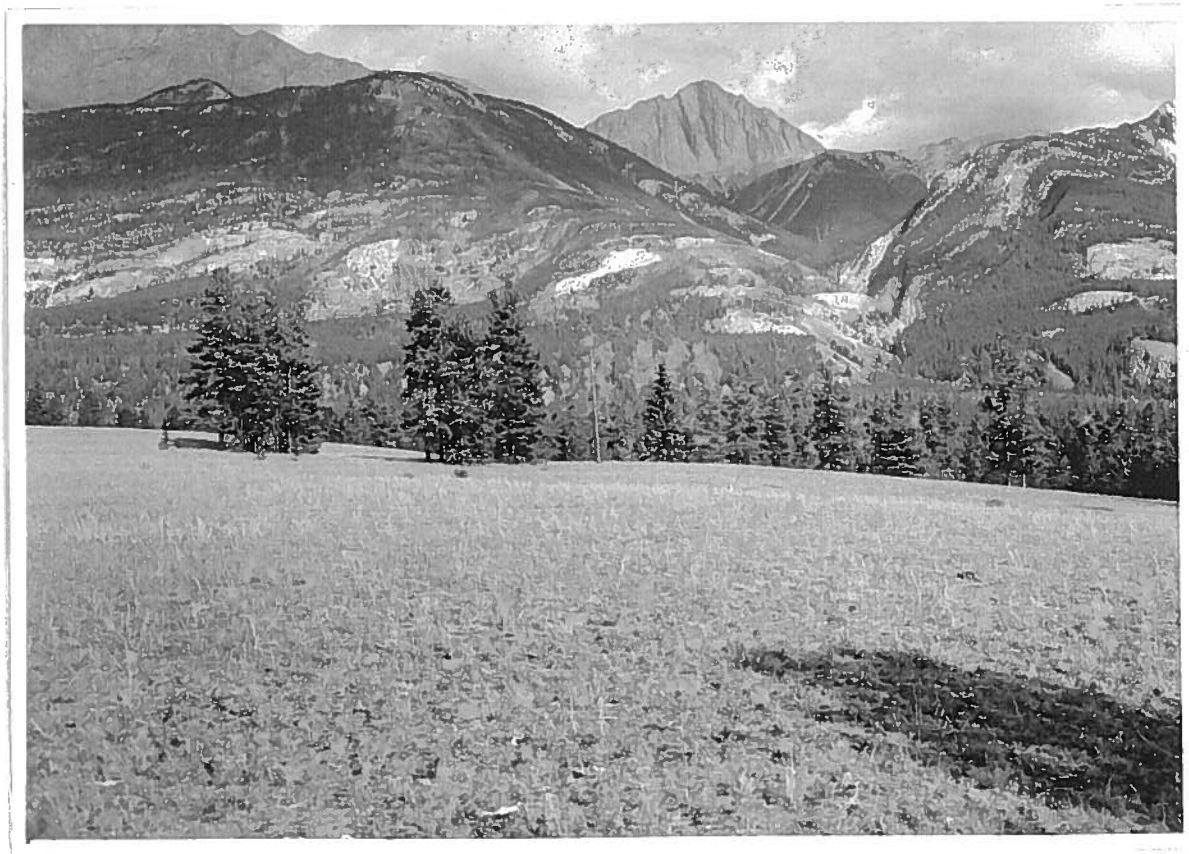
J. Rhemtulla & E. Higgs, 1997

Figure 5-4: Henry House Flats (Station 58 – No. 467)

Original photograph shows grassland in foreground with scattered bushes, likely buffalo berry (*Sheperdia canadensis*), and a fair amount of downed woody material. Grassland persists in retake, although shrub density has declined, and forest cover has increased. Tree cover has also increased markedly on the flanks of the Colin Range. Note that the two clusters of trees, centre left, are present in the original as young trees. (c.f. Figure 5-5 for a different perspective of the grassland complex.)



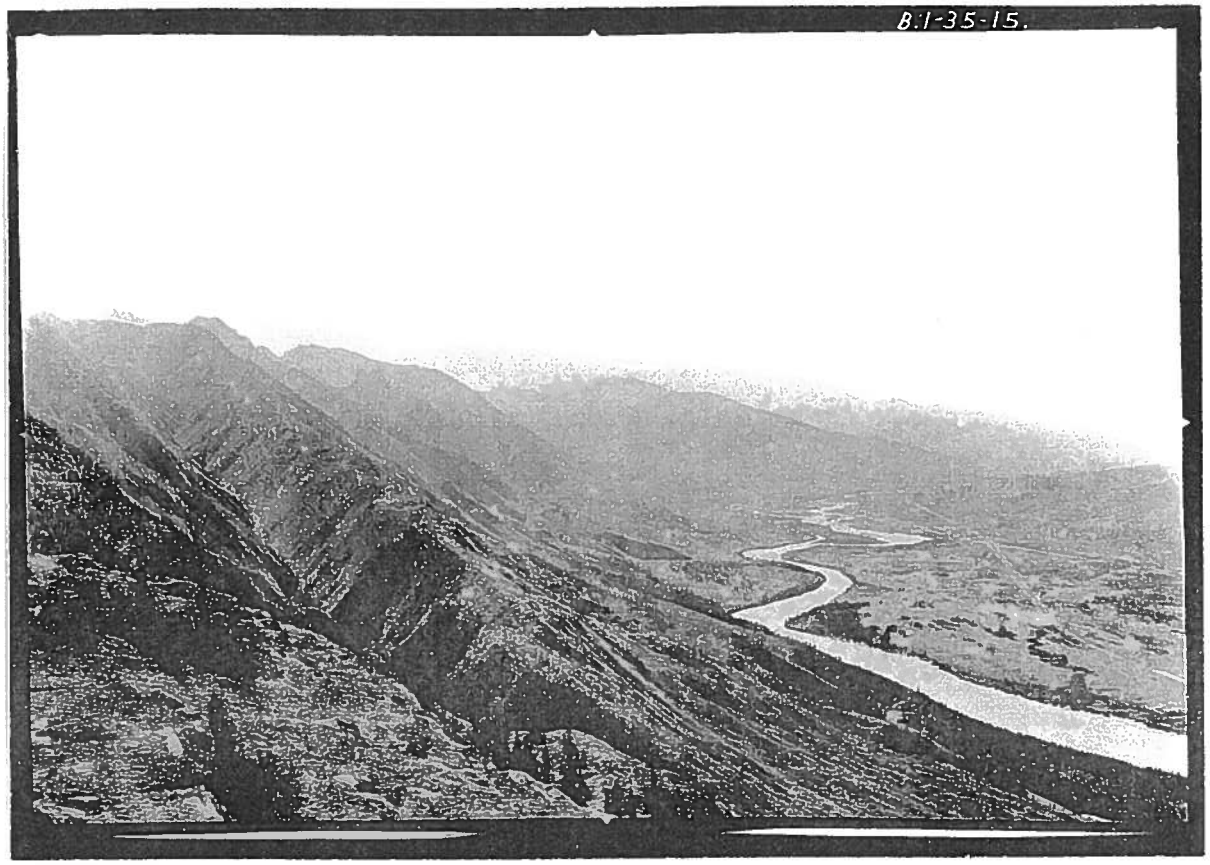
M. P. Bridgland, 1915



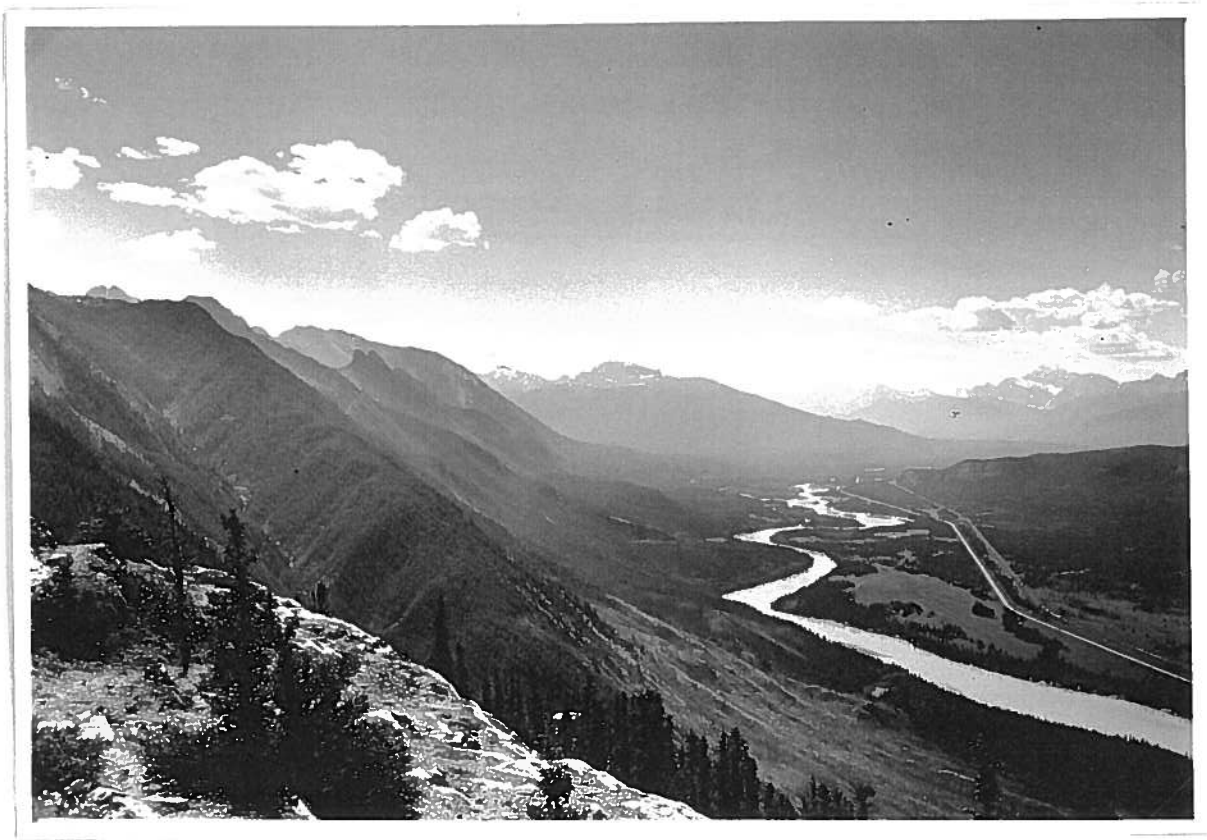
J. Rhemtulla & E. Higgs, 1997

Figure 5-5: Colin Range and Henry House Flats (Station 38 – No. 308)

Forest encroachment on grassland is evident in the Henry House Flats, centre right (c.f. Figure 5-4). Greatly increased forest cover is also apparent on the east side of the Athabasca River and the flanks of the Colin Range above it. The two rail lines in the original photograph have today been merged into one; the dismantled line is now used as a local road. Both of these are visible in the retake (local road just discernible along right edge of photo 3 cm above river), as is the highway which now runs along the railroad. The burned area at the base of Hawk Mountain (bottom centre), resulted from a prescribed burn set by park managers in 1989.



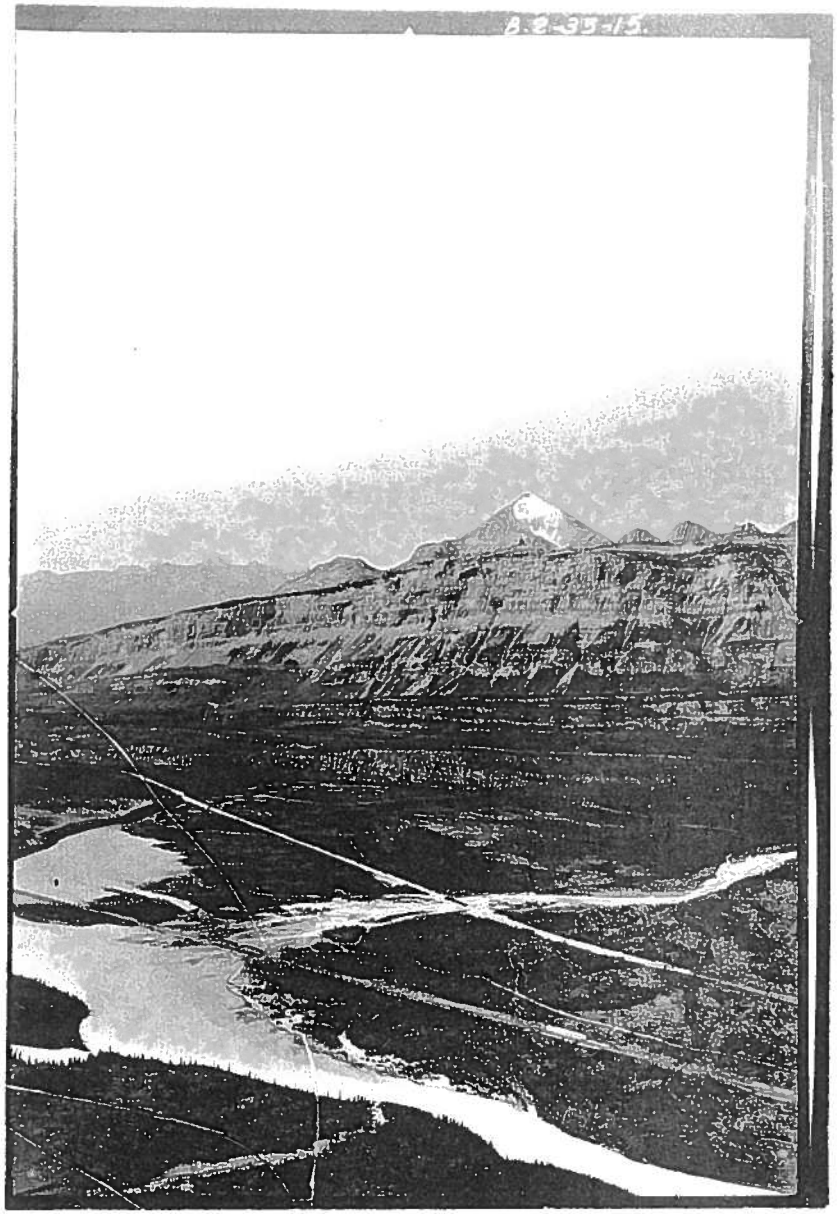
M. P. Bridgland, 1915



J. Rhemtulla & E. Higgs, 1997

Figure 5-6: Snaring River confluence (Station 38 – No. 309)

The paired photographs show that the width of the Snaring River has declined, likely due in part to the retaining walls constructed in the 1910's to prevent flood damage to the bridges. The original photograph suggests that the lake (left-centre) is connected to the Snaring River in 1915. The lake outlet to the Snaring has diminished significantly in the repeat photograph. Differences in the wetland complex are hard to discern due to the scale of the photographs, and may be due in part to seasonal differences in water levels if the photographs were taken at different times of year (dates of Bridgland photographs are unavailable). Shrub cover on the wetland area adjacent to the lake may have declined in favour of greater herbaceous cover. Increased human activity is apparent in the large rectangular overflow campground (lower right) and the new highway (lowest of three transport corridors). Cracks in the original are due to the breaking of the glass plate negative.



M. P. Bridgland, 1915

J. Rhemtulla & E. Higgs, 1997

5.3 Human Activity Mapping

5.3.1 Overview

Developed and led by Tim Martin, the Human Activity Mapping project is the centrepiece of our cultural history research. It comprises an innovative database of historical information about human activity in the CER Project's study area. We faced two main challenges in accounting for human patterns and processes on the landscape. First, how, we wondered, can the myriad data from oral histories, local historians, field observations, photographs, historical documents, reports, scholarly articles, and books be organized and integrated? Traditionally, an historian would sift these materials and digest them in a way that answers a particular scholarly question, or covers the development of a specific activity. In the last two decades, a new branch of history, environmental history, has arisen to combine an understanding of human activity alongside ecological change, thereby, as White has written, to accentuate the relation between the two. Our concern was that even finding a skilled historian to undertake a comprehensive study of change in the montane ecoregion (a doubtful proposition) would still not yield the kind of organization of materials useful from the point of view of Park management. Second, in order for cultural history to operate effectively in concert with ecological history (e.g., fire history, palaeoecology), it would need a common spatial reference. Thus, our database emerged in response to these two needs. It may be explained simply. Each discrete human activity is composed of a series of attributes that can be accounted for readily through any one of the sources listed above. A feature such as a horse paddock operated by JNP's Warden Service adjacent to the Palisades Centre would have spatial coordinates that would locate it exactly on a map, and have temporal characteristics that would place it within a particular time range. For both temporal and spatial characteristics, allowance would be made for uncertainty (providing for uncertainty proved to be one of the significant technical challenges in developing the database). This uncertainty is a boon for all concerned because it allows the identification of features that might otherwise be ignored for lack of data. However, since the database is easily updated, incomplete features await further research.

From the historians' point of view, two crucial fields in the database—source and notes—promote careful scholarship. For each feature, the source(s) of the information is required. For example, if an old-timer is interviewed and mentions the existence and location of an old horse paddock, then he is cited as a source. If, a few years later, in the course of reading through the old notebook of a warden, more specific timing is provided along with a detailed description of the location, then this source can be added and appropriate modifications made to other fields for that feature. The "notes" field allows the researcher or user to enter any kind of supplementary information as appropriate, including speculations about further sources for investigation, interesting aspects of that feature that warrant wider understanding, and so on. Hence, the database becomes a living document, one capable of advancing along with each new investigation. It is a key for further historical research, and has outstanding potential for use by local historians who wish to organize information in a systematic fashion.

The spatial characteristics of each feature correlate directly with any other spatial database for the area. This means that human activity information can be selected according to any combination of characteristics—activity type, time period, intensity of activity, uncertainty, and so forth—and laid over biophysical information. Thus, a map, or maps, of human activity can be interpreted with direct reference to vegetation, animal movements, landforms, and so on. The cultural and the ecological realms are thus brought into direct contact. The modelling potential arising from these combinations is considerable, but much of it awaits further research projects.

5.3.2 The Human Activity Database (HAD)

The HAD contains 273 records of human activity features in the study area. These include such features as buildings, stables, homesteads, fields, fence lines, roads, trails, and gravel pits. Wherever possible, spatial coordinates of these features were identified on the photo base map and digitized at 1:10,000 scale. If the location was no longer evident on the photo base map, these features were mapped using Geographical Positioning Systems measurements or by means of historical records. Three kinds of spatial uncertainty are recorded in the database:

- *locational uncertainty*--a relative rating of how confident we are that the historical feature was at the location specified on the map;
- *boundary confidence*--a relative rating of how confident we are that the polygon lines in the GIS layer identify the boundaries of the historical feature; and
- *boundary shift*--an estimate, in meters, of the variability in the boundaries of the feature over time.

The HAD also includes several fields of information dealing with the temporal location of the features:

- *start date*, recorded in yyyy.mm.dd format, is the date when the activity was initiated; and
- *end date*, recorded in yyyy.mm.dd format, is the date when the feature ceased to exist as a feature of the landscape.

Where it exists, uncertainty about start and end dates is reflected in four fields:

- *start date n*--the number of years before the stated start date when the feature might actually have begun;
- *start date p*--the number of years after the stated start date when the feature might actually have begun;
- *end date n*--the number of years before the stated end date when the feature might actually have ceased to exist; and
- *end date p*--the number of years after the stated end date when the feature might actually have ceased to exist.

To keep track of changing human activities in a specified location over time (for example, a railway being converted to a hiking trail), data fields for *previous use* and *next use* are also included in the database.

5.3.3 Methods—Spatial Analysis: The State of the Human Activity Spatial Data Set

When a GIS database is being developed, features are digitized (that is, drawn on a computer digitizing table) as lines, initially, with each line representing either a feature itself (for example, a trail or road) or the boundary of a feature (for example, a homestead.) Ideally, all spatial objects would be represented as areas, using a polygon topology—even trails have a width. To achieve this representation in practice, one must separate the digitized lines into two groups: polygon boundaries and linear features. The polygon boundaries must be converted directly to polygons, while the linear features must be *buffered* to a specified width, to convert them to polygons.

In this project, data were digitized by the interpretation of aerial photographs, by two different technicians, in different field seasons. The process of combining these two data sets, and buffering all linear objects to make a single polygon layer, remains incomplete. Secondary roads,

trails, and some other features are still in the database as linear features, while the railways and major highways have been buffered to polygons.

Several activities, recorded in the HAD, might be associated with the same location in space, either coincidentally or over a period of time. This possibility means that a *many to one* relationship exists between records in the HAD, on the one hand, and the line and polygon features in the GIS, on the other. Conversely, a single human activity might be represented by more than one line or polygon feature, in the GIS layers, resulting in a *one to many* relationship with the HAD. For example, several line segments might make up a hiking trail, while parts of that trail might also serve as a fire access road. The resultant *many to many* mapping tables, which link these two databases, have not been edited and verified. Some inconsistencies exist, with features in the HAD that are not identified in the spatial data set, and vice versa.

For these reasons, analyses of the human activity spatial data should be considered preliminary, and subject to unspecified error. The data can be interpreted for qualitative trends, rather than quantitative specifics.

5.3.4 Spatial Analysis: Cumulative Human Activities over Time

The location of human activities in the ARV can be demonstrated in several ways. Figure 5-7 is a map of the study area showing the locations of human activities, by the decade of origin. This information can be illustrated on a year by year basis, using animation.

Figure 5-8 is a graph of the total area of human activity, by year. This includes railways and major highways, but not secondary roads, trails, and other linear disturbances. These are preliminary data, so specific quantities should not be cited. However, a trend of increasing activity is evident. The graph could suggest that the increasing activity has not been linear, but was greatest in the first half of the century, and has levelled off in the last couple of decades of the century.

Figure 5-9 is a graph of the cumulative human activities that lead to linear disturbances, by year. Note that this does not include railways and major highways, but does include trails, pipelines, and other linear disturbances. Again, these are preliminary data; so specific quantities should not be cited. The trend of increase here is approximately linear, over time, until 1980, after which no changes are recorded.

5.3.5 Methods—Spatial Analysis: Cumulative Human Activities by Type

Questions of types or classes of human activities are also important. Figure 5-10 is a map of classes of human activities, in the ARV. Figure 5-11 is a bar graph of the spatial extent of human activities by activity class.

The activity classes are synthesized from the *use-code* and *use-fields* of the HAD. There is overlap between these classes; for example, the *dwelling* class is a subset of the *building* class. A horse corral might be included in *recreation*, *agricultural*, or *park management*. Prescribed burns were included in the *park management* class. The *transportation* class includes railways, highways, roads, trails, and the airport.

The largest areas of activity classes are related to transportation and agriculture. The agricultural areas are all historical, and the lands have been either abandoned or turned to other activities, typically recreation or Park management.

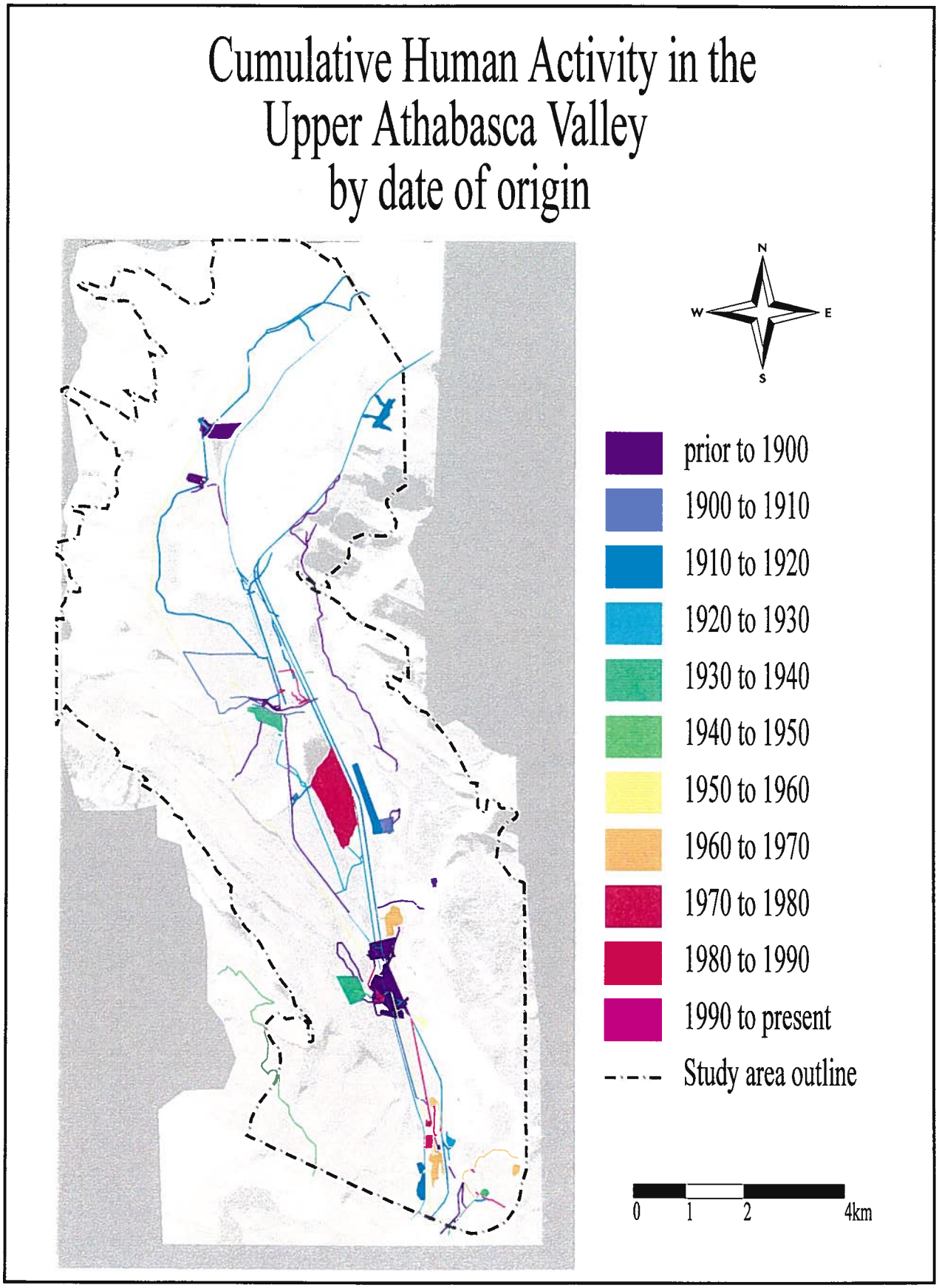


Figure 5-7. Map of cumulative human activity in the CER study area by date of activity origin.

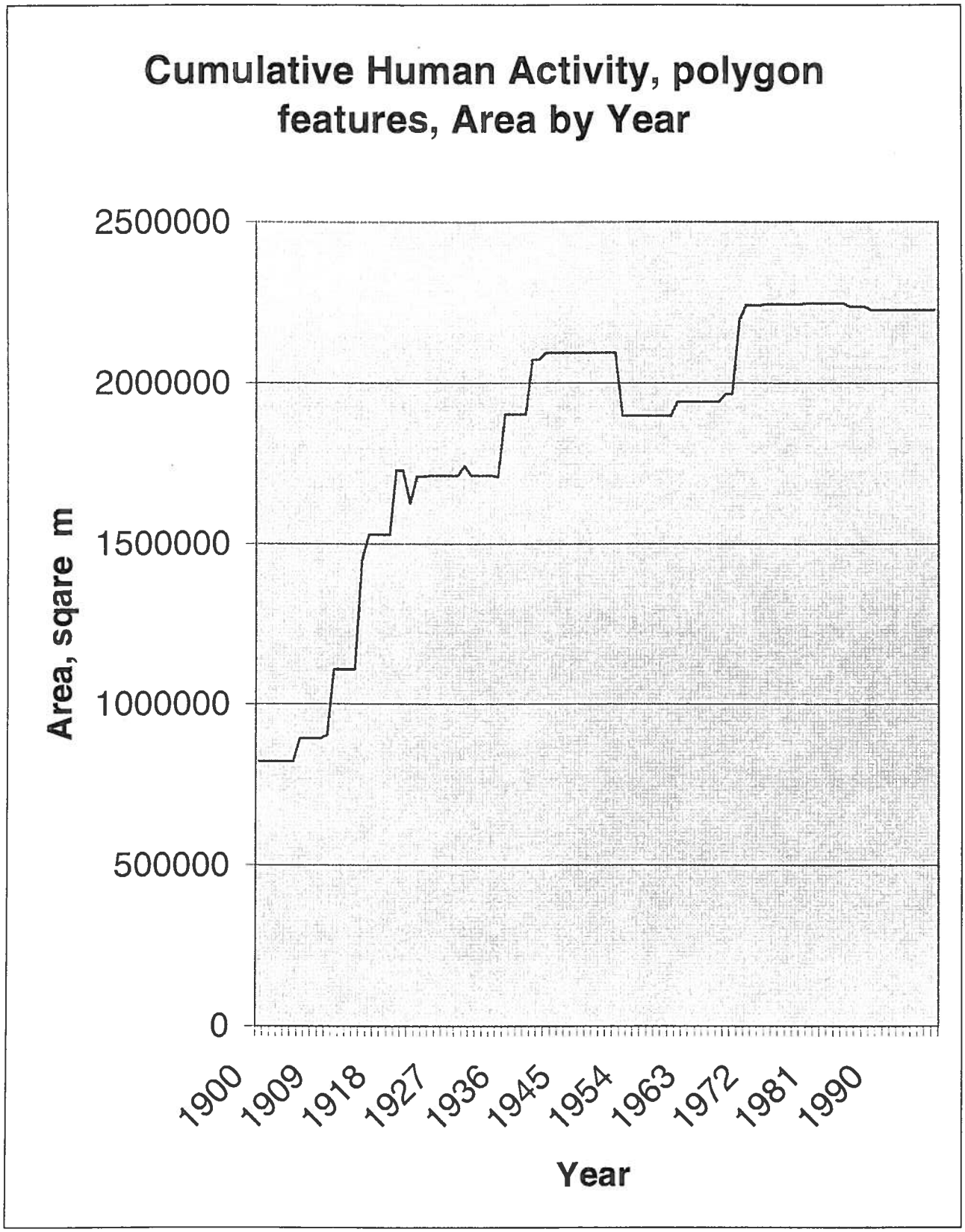


Figure 5-8. Graph of cumulative human activity by area over time.

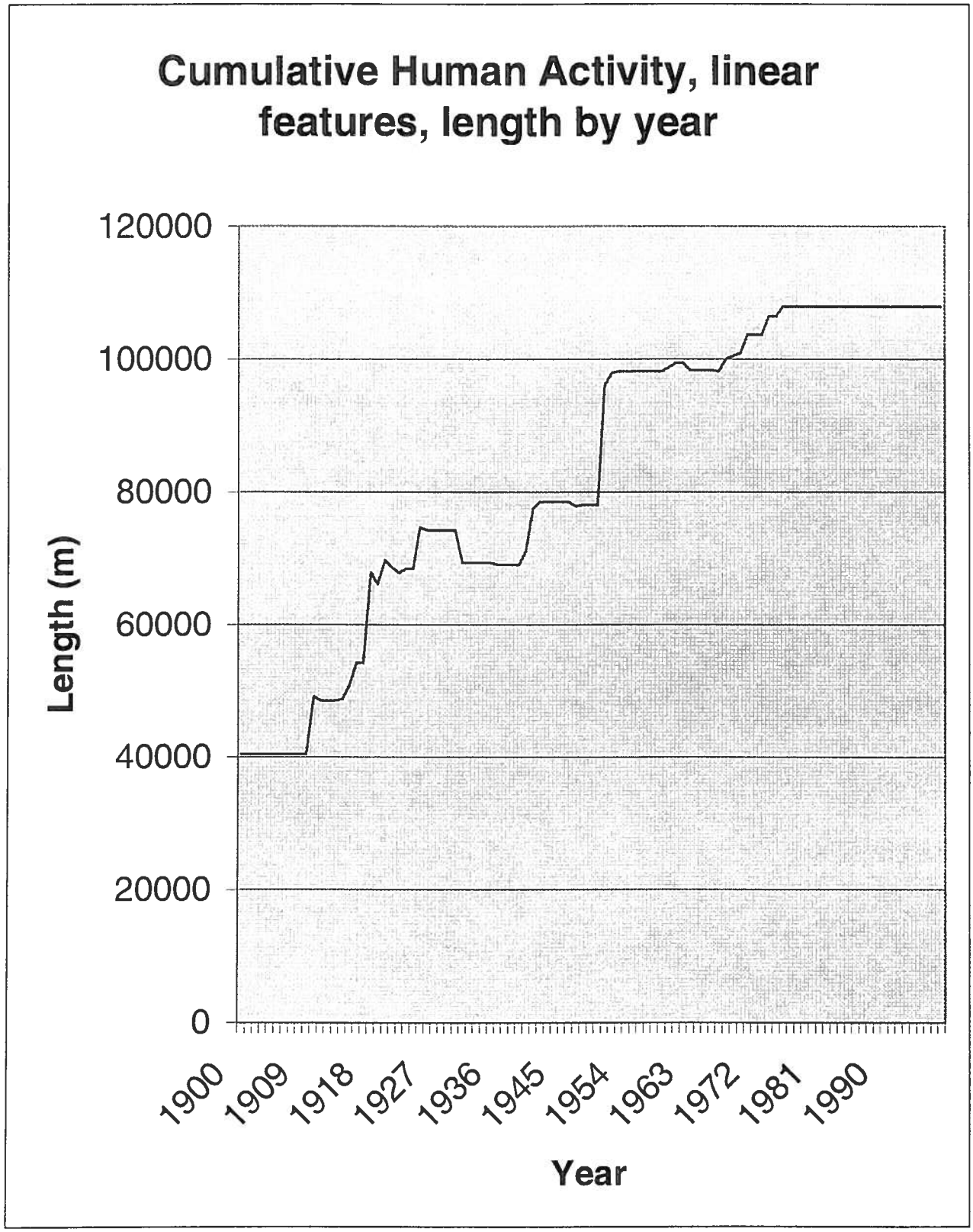


Figure 5-9. Graph of cumulative human activity measured by linear features over time.

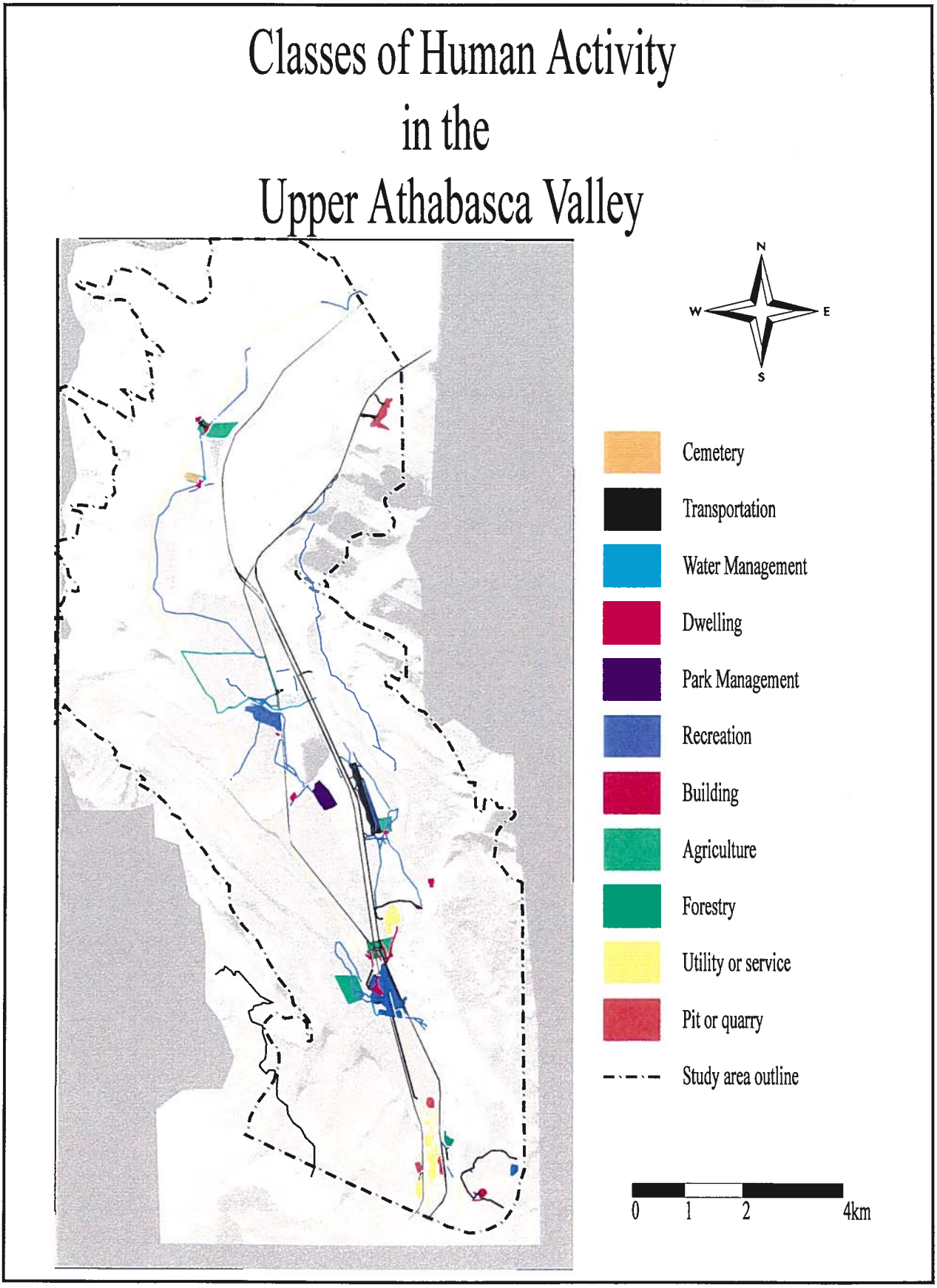


Figure 5-10. Map of human activity by activity class.

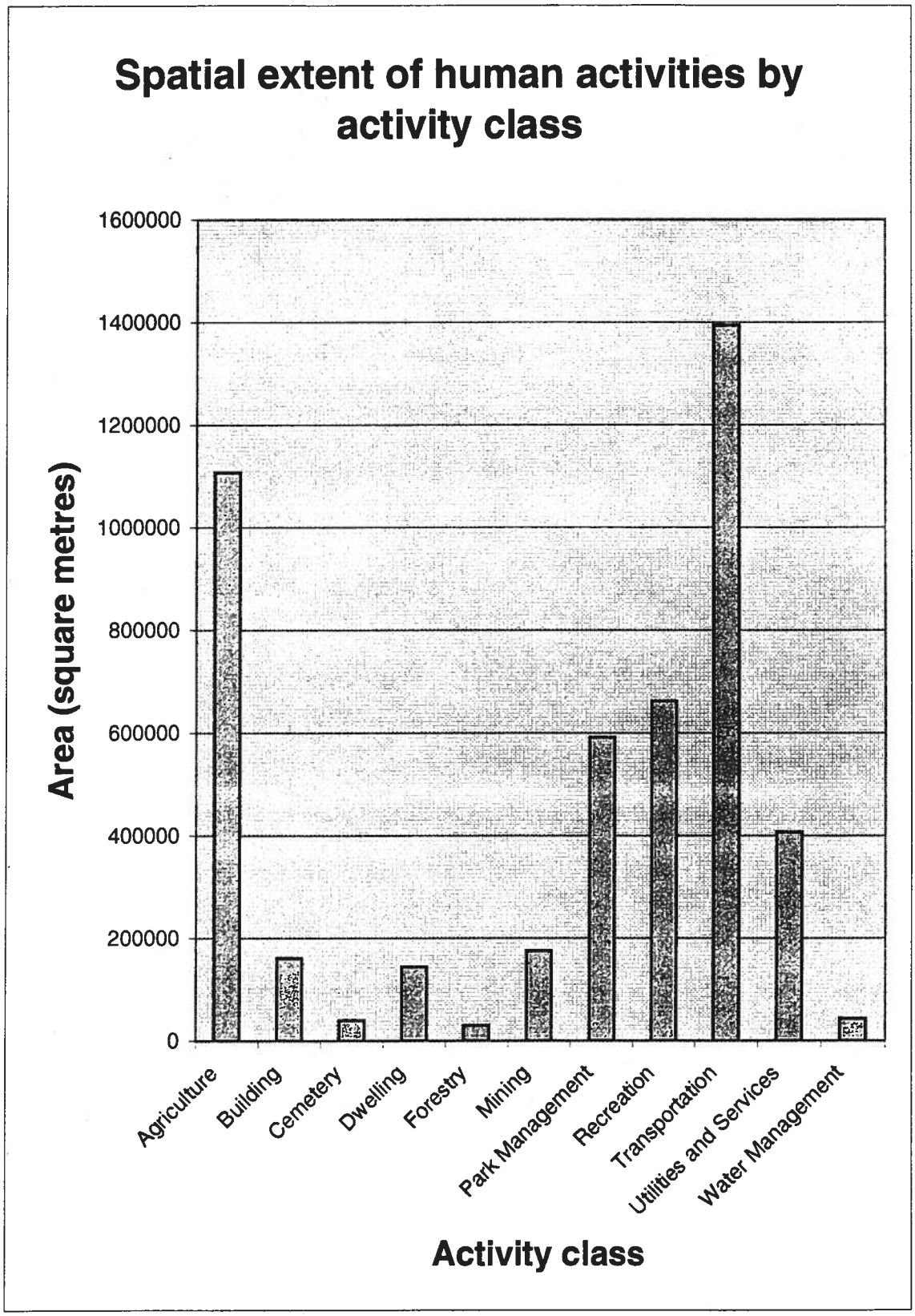


Figure 5-11. Graph of spatial extent of human activity by activity class.

5.4 Oral History

5.4.1 Overview

Oral history is a highly valuable source of information on the human uses and ecological character of the CER Project's study area, if it is collected and assessed with care. It is a means both to bridge between the human documentary record and the ecological data and also to enrich and to confirm trends and conclusions those approaches suggest. Group and individual interviews were conducted; pre-existing oral history taped records were incorporated to some extent, as well. Our oral history project differed in its intentions, if not in its scientific methods, from most oral history projects. It is typical that oral history collections aim to document an interviewee's life story (or a portion of it) as richly as practically possible, and the oral historian will arrange the records chronologically and by person. The CER Project, by contrast, had a pragmatic goal: to enrich our knowledge of particular sites and of the human activities at those sites. This goal is reflected in the way in which our oral history record is organized and deposited—not by interviewee but by site within the study area. Such organization and deposition lend themselves to tagging records so that can accord with the GIS mapping database.

5.4.2 Uses of Oral History for the Specific Goals of the CER Project

The oral history data recorded for the CER Project was collected to document changes in land use, the built environment, perceptions of landscape, and populations of people, animals, and plants at key sites in JNP. Oral history interviews were conducted with the aim of locating key sites of human activity and those of human observation, and mapping these to vellum for their subsequent entry onto GIS map layers. Most of the information was given by participants in response to questions about particular sites, and their own activities in those places. As such, much of the oral record collected differed from that frequently collected by oral historians, where the documentation of an interviewee's life story or portion thereof, organized chronologically, is the general goal.

5.4.3 Pre-Existing Oral History Records

CER Project members were fortunate to have access to J-YM&A, an important local repository of oral history tapes and transcripts. The J-YM&A includes taped interviews made between 1955 and the present, with older members of the Jasper community including those who have worked as colliers, Park employees, guides and outfitters, trappers, and railway workers. The transcripts and outlines of these tapes were reviewed by members of the CER Project to determine if any further information could be gleaned from them for its applicability to the goals of the Project.

Another key source of information for the CER Project was a Jasper resident and oral history researcher, Vicki Wallace, who generously directed CER Project members Cindy Dunnigan and Jo Urion to potential candidates for interviews; moreover, she made available for analysis summaries of interviews she had previously conducted in the Jasper area.

5.4.4 Methodology

Group and individual recordings were conducted in a variety of settings. Some interviews were conducted at the Palisades Centre, as the site itself was of interest to the CER Project. Conducting interviews at the Palisades Centre and by traveling to other key places could prove helpful in the evocation of remembrances of certain activities at them. Other interviews were conducted in the homes of interviewees, in order that they might be comfortable in their

surroundings, and have old photographs and other memorabilia close at hand that might prove useful for explaining past events.

The interviews were conducted during the summer of 1996 and in May and June 1997 by Cindy Dunnigan, an MA student in Anthropology at the University of Alberta. She designed the interview schedules in consultation with other members of the CER Project, and in consultation with the potential interviewees. Further interview questions were designed through the observation of group interviews. In group interview settings, where participants are able to ask each other questions, or to clarify and build on the comments of other interviewees, the labels used to identify certain places, ideas, or points in history can spring as much from the interviewee's categorization schema as from those of the researcher. The researcher thus attends closely to the ways of asking questions, and to categories that prove significant to particular interviewees, gleaning information that will help improve questions.

Interviews were audiotaped, where permission was given by interviewees, in accordance with the University of Alberta's ethical guidelines. The interviewees were also supplied with copies of the transcripts or summaries of their interviews, and with copies of the interview tapes if these were requested. Interviewees were invited to correct or supplement any information they found wanting in their accounts, and to delete any information in these records that they preferred not to make public. The deletion of material by interviewees was minimal and did not affect the analysis of information with regard to the stated purposes of the CER Project. At the request of one interviewee, only handwritten notes were made of her four interviews, conducted in her home and in travel.

Information from interviews that could be coded geographically was mapped to vellum for inclusion in the GIS component of the CER Project. The data recorded include references to:

- occupation of the land;
- perceptions of change;
- the location and history of sites associated with the transmontane pipeline, railways, the townsite, camps, pavement, and buildings;
- attitudes towards and practices involving local animals, including elk (including details concerning elk in town, elk slaughters, elk and the railway, and presence or absence of elk through time in particular locations);
- railway camps and construction; and
- the locations of berry-picking trips.

Information which lent itself to analysis less amenable to recording on maps (for example, perceptions of Jasper principally as a "railway town" and not as a tourist town) was also collected.

The interviewees were all older residents of Jasper or the surrounding communities, or they had long-standing ties to the Jasper area. All interviewees consented to be identified, and are gratefully acknowledged here:

- Verna Siga, Tom Vinson, Alf Burnstrom, June Burnstrom, Jo Baker, Delia Gray, Edith Gorley, Nora Findlay, Tom Peterson, and William Taylor.

In addition to multiple formal interviews with the participants named above, information from other individuals, including those participating in the community advisory group, was also sought on a less formal basis, and was not audiotaped. Information obtained in this way was also

productive of information that could be coded geographically, and of suggestions for further interview questions concerning human influence in JNP.

5.4.5 Future Directions for Oral Histories

Because one of the goals of the CER Project is to examine human influence in JNP prior to the keeping of written historical records, several additional avenues are being explored, and may be developed further in future projects. Under-represented in the interview group were the families of those who were removed from JNP at the time of its formation. An historic meeting was held at Palisades Centre in the Spring of 1998 between descendants of some of the families removed from JNP and Park officials. The newest plan for Park management arising from that meeting suggests that Park officials will consult closely with members of the Métis community to consider the history of their families in what is now JNP. In one's understanding of the history of these relationships, several sources are particularly helpful. Oral accounts in the J-YM&A of the expulsion of families provide information not found elsewhere, and the ledgers also held there provide a record of payments made to families removed from JNP. What has been largely missing from the published record, however, is the contempt for these people, and the disregard for their circumstances apparent in the letters written by certain officials in the Department of the Interior during the period of their removal, during the families' subsequent relocation to lands in the Grande Cache Grazing Division, and during their protests over their treatment and their accounting of the underpayment they received for the assets they were obliged to abandon. (The letters housed in the National Archives of Canada, RG 39 Vol 265 File 39578, provide a record of this treatment.)

5.5 The Restoration Pilot Project

This section began with a caveat about limited funding, mentioning specifically the initial ambition to take historical research and apply it directly to on-the-ground restoration projects. Since this formed such a large part of the design of the original CER Project, it was difficult not to try at least something along these lines. We were fortunate to have Ann Ronald, a former JNP employee and one of the first students in the University of Victoria's leading-edge Restoration of Natural Systems certificate program. Ann performed a detailed review of the literature on public participation in ecological restoration, identified prospective field sites requiring restoration, and brought together a group to investigate the feasibility of a comprehensive restoration planning project. In the end, the project did not get off the drawing board, due, not surprisingly, to funding issues but, more importantly, to the fact that a "culture of restoration" did not yet exist in JNP to support such an initiative. It is one of the projects, however, that set the tone for further research and implementation.

Among its original aims, the CER Project included a restoration planning exercise. The idea was to use higher-resolution historical data about cultural and ecological processes to set goals, the goal-setting exercise to be accomplished with a multi-stakeholder group of community representatives, Park staff, and university researchers. This aim encompassed insights that the principal investigator had garnered through his involvement with the Society for Ecological Restoration:

- that people have engaged in land management practices for centuries, and that these practices have contributed to patterns and structures of the landscape;
- that people can, under certain conditions, become respectful participants in a landscape despite prevailing views that people are always the problem in protected areas;

- that ascertaining an appropriate level of contemporary human involvement involves understanding historical conditions and also value judgements;
- that ecological restoration depends typically on active management, both to initiate appropriate changes to a degraded landscape and then to achieve defined goals;
- that cultural values will be inscribed on the landscape no matter how much our attempts to mimic natural processes or achieve ecological integrity aim to isolate the non-human from the human realms;
- that, to a greater rather than lesser extent, what matters to us now is what informs our decisions about the landscape;
- that because all management activities are historically contingent, it is crucial that historical knowledge temper contemporary actions;
- that broad participation is important in any restoration project because it alone can enhance the chances both that the project makes sense to all those who are directly, and sometimes indirectly, involved at the conceptual, site- planning, implementation, and monitoring stages, and that the project will realize long-term success;
- that an ecological restoration project must be attentive to scale, so that a site-specific restoration is undertaken within a larger plan or framework, one that appreciates that our regional/global ecological and cultural knowledge (e.g., concerns for the health of neo-tropical migratory birds, or understanding the impact on the site of extensive resource extraction at the edges of it) shapes how we regard the site; and
- that a variety of ecological and cultural goals should be represented, because attention paid to a specific species (e.g., Grizzly bear) or technique (e.g., prescribed fire) risks resulting over the long term in an impoverished or incomplete restoration.

In the summer of 1997, Ann Ronald researched background considerations for a restoration pilot project in the montane ecoregion of JNP. We decided on several criteria for success, criteria that extended beyond exclusively ecological factors to include:

- enhanced ecological and cultural integrity,
- the meeting of social expectations,
- a due consideration of the current political climate,
- the achievement of the work within financial constraints, and
- a consideration of the project's regional context in terms of broad relevance and application.

For any given project, extensive research on the following subjects would be needed to devise sound goals and craft a workable plan: physical parameters, social/political parameters, the ecological/cultural history of the site, the function of the system, the nature of the disturbance, available resources, the specific goals of the project, control site information both historical and existing, and the palette of appropriate and available restoration techniques (Harker et al. 1993; Nuzzo and Howell 1990; Jordan, Gilpin and Aber 1987).

Preliminary investigations concentrated on how to involve people of diverse backgrounds in restoration planning. In early July, we assembled a small stakeholders group comprising Park staff (Peter Achuff, Jeff Anderson, Rod Wallace, Jo Urion, and the late Jim Todgham), researchers (Ann Ronald, Jeanine Rhemtulla, and Eric Higgs), and members of the community (Joanie Veitch). After a broad description of criteria for restoration (e.g., size, priority, extent of human degradation), the kinds of goals that were of interest to the group, and potential sites, we agreed that the Henry House flats area, comprising the land on both sides of Highway 16 and including former prescribed burn

units, the airstrip, old roadways, and the old trade waste pit, was sufficiently streaked with degradative human activity that it afforded an excellent opportunity for testing restoration approaches and methods. The area was sufficiently large to incorporate a number of ecological types and therefore a number of distinctive projects, yet small enough to be tractable in both logistical and economic senses. By undertaking a comprehensive plan for this area, and then implementing it gradually, JNP would have a high-profile demonstration site and a living laboratory for ecological restoration research.

Such a vision for a pilot project on ecological restoration remains an exciting opportunity. Our group confronted a number of obstacles, not the least being the difficulty of assembling a working group during the summer months. The project would operate better during the winter when volunteers have more available time. We realized, too, that the financial resources involved to accomplish such a project were inadequate in the midst of political controversy over the air strip, widespread and demoralizing institutional changes in JNP, and the relative novelty of ecological restoration (as distinct from reclamation) in JNP. Such a project needs a full-time coordinator and strong institutional support from JNP. The groundwork is laid for such an endeavour, which could be readily initiated in the future.

One of the more intriguing ideas to emerge later that same field season (1997) was the concept of a regional restoration potential model. This would combine a map of degraded sites with priority rankings for restoration based on ecological factors, economic costs/opportunities, and restorability. Furthermore, it was acknowledged that decisions about such variables as priority ranking for restoration involved human-centred decisions: in restoration, what matters to humans may not be so significant for a Grizzly bear, a migratory bird, or a fish; therefore, restoration potential must incorporate a multi-species perspective, one capable of recognizing that cleaning up an old gravel pit matters much more to humans perhaps than to certain other species. Species-impact models could be layered on top of one another to help a restoration design team arrive at clear goals based on a much wider base of information. Such an initiative requires a larger GIS-infrastructure than the CER Project had available, as well as a shared mandate with Park staff.

5.6 Multimedia Project

5.6.1 Overview

Fusing historical research and a desire to communicate effectively to a wider audience, collaborator Sandy Campbell led the development of a separately-funded multimedia project. This project presents specifically the history of the Métis peoples who lived in the ARV in the first decade of the twentieth century, when JNP was established, and who were subsequently relocated. More generally, this project offers an account of the changing landscape of the montane ecoregion. A main intention was to provide a document, in this case an electronic one in CD-ROM format, that used the scholarly base of the CER Project's research to present the material in an innovative manner accessible to a broader public.

The multimedia project was designed as an experiment in using historical photography to create a multimedia presentation of the various kinds of land use in the ARV. It focuses primarily on the use of land by the Métis who resided in the valley before the creation of JNP.

The upper stretches of the ARV lie within the boundaries of JNP. Before the creation of the Park as a Reserve in 1907, the land was occupied by First Nations people and Métis, some of whom built permanent dwellings and kept livestock. After the creation of the Park, these people were moved outside JNP and the valley (most went to Grande Cache, AB), and the land was

allowed to return to a "natural" state. Visitors to the park today see very little evidence of these people's residence in the valley.

5.6.2 General Research Procedures

The first phase of this research aimed to identify and to scan archival materials related to the study area. Subsequently, an accompanying historical text was prepared and verified. Finally, all the visual and textual documents were loaded into the multimedia software. The product provides an important representation of historic human involvement with the river valley environment.

Historic photographs offer an untapped resource for understanding the breadth and extent of human influence on areas we often perceive as untouched. As visual records, photographs contain valuable information regarding the nature of human modification of the landscape, information not necessarily conveyed by textual documents.

In order to prepare this visual material, we first gathered the historical documentation related to our study site. Primary concentration was placed on identifying photographs and moving images, but attention was also paid to accumulating additional site reports, maps, and other documentation. Our second phase of work involved scanning these images and storing them electronically, in order to display them in a hypertext format which then can be queried for the history of the CER Project's study area. Then we were able to create an integrated multimedia display of the history of the site using *Toolbook* software.

5.6.3 Process

Early in the project, consultations were held with some of the CER Project's collaborators and with staff of the Academic Technologies for Learning Laboratory (University of Alberta), Parks Canada staff, and staff of the J-YM&A in order to develop a design for the project. Two students, Nicola Miller and Samantha James, were employed to work on-site in Jasper doing the historical research and the computer work, respectively.

5.6.4 Methodology

It was determined early on that sufficient visual materials to undertake the project were available at the J-YM&A. Once the appropriate photographs had been selected, they were scanned. The history related to the selected images was researched and brief texts were written to highlight each kind of land use and describe each image. *Adobe* software was chosen as the presentation software based on lesser cost and ease of use; into it were loaded image files and text files. Linkages were created between related images and text. A draft document was reviewed by a variety of interested parties, including CER Project collaborators, Parks Canada staff, Métis elders, and University of Alberta library staff.

5.6.5 The Products

5.6.5.1 Multimedia product. The primary product of this research is a CD-ROM containing more than seventy pages of interlinked images and text. The user of the product can choose to view the pages sequentially or to follow linkages through the product. Viewed sequentially, the pages are organized into two parts: the first consists of descriptions of the individual families who had permanent residences in the valley, and their uses of the land; the second is arranged thematically and introduces the user to each of the land uses.

Rather than approaching the pages sequentially, a reader can explore the product through one of several other linkages. A linked map at the opening of the document allows a spatial approach to the information about the Métis families. Linkages within the text of each page take the

user to related pieces of information elsewhere on the CD. These linkages do not lead the user through any particular prescribed path. Finally, a fully linked index allows the user to move directly to any required item.

5.6.5.2 Image discs. As a by-product of this CD-ROM project, digital copies were made of no less than about half of the photographs held by the J-YM&A, as well as a portion of those held at the Parks Canada Library in Jasper. These digital images were stored on CD-ROM at both 300 dpi (print quality) and 72 dpi (screen-viewing quality). Copies of the CDs were presented to the holders of the photographs.

5.7 Natural Disturbance Mapping in the Montane Ecoregion, JNP

5.7.1 Overview

In 1997, the CER Project entered into a cooperative project with Foothills Model Forest, a research consortium composed of Weldwood Forest Industries, the Canadian Forest Service, the Government of Alberta, and JNP, in order to map a history of forest disturbance in the half of the CER Project's study area lying in the ARV north of (downstream from) the Snaring River. The objectives of the project were to take dendrochronological (tree history) samples intensively in a relatively small area in order to validate a portion of the earlier fire history study of Gerald Tande, to push the limits of sampling and analysis techniques and to learn more about the montane ecoregion's history of ecological disturbances, such as fire, wind, and insects. Sampling took place in 1997 and 1998, and the data are still being analyzed at the Northern Forestry Research Centre in Edmonton (D. Andison, per. comm. 1999). We had hoped initially to use these historical data in expanding our own analyses, but this work awaits the next project.

Previous studies have suggested that the montane exhibits a complex history of ecological disturbances, including stand-replacing and stand-maintaining (surface) fires, insects, disease, and windthrow. The primary goal of the detailed disturbance history project was to refine and expand our knowledge of disturbance intervals and types in the montane ecoregion of JNP.

The work was conducted under the auspices of the Natural Disturbance Program of the Foothills Model Forest, with cooperation from JNP and the CER Project. This research program as a whole was established to describe and summarize the forest patterns caused by historical disturbances at a range of scales, from comparisons of different landscapes to studies of individual stands. It consists of three projects: an analysis of landscape disturbance regimes which takes in a broad area including JNP; an examination of island remnants conducted on a meso-scale; and a detailed disturbance history of the montane which addresses the complexity of disturbances in this ecoregion including differing fire intensities. It was the latter project that attracted the direct involvement of the CER Project.

Critical to all three projects is the analysis of patterns, conducted through a series of questions. For example, what patterns do crown-fire regimes leave on the landscape? How does one determine a "natural" pattern? In order to assess patterns of disturbance, it is essential to collect baseline data and to conduct simulation model analysis. When, eventually, these natural-disturbance data are combined eventually with the results of the CER Project's Human Activity Mapping project, a comprehensive portrait of natural and cultural disturbance will emerge.

5.7.2 Research Principles

An intensive and detailed study of the fire history of the forests surrounding the town of Jasper was completed by Gerald Tande (1979). The fire history study is to date the most detailed

investigation of fire in JNP. However, given the age of the study and an absence of documentation of the methods used to assign fire boundaries, there was interest in re-analysing the raw data. The natural disturbance project made optimal use of those data through re-analysis with new goals in mind. Because knowledge gained during Tande's work guided the development of methods, the continuity of data and results is ensured.

Sampling was conducted in 1997 to permit the relating of results to pre-defined vegetation types (these types were identified by the JNP Ecological Land Classification [ELC, Holland and Coen 1982) in order to maximize the potential for extrapolating the data to other areas. The study was focused on areas where ecological restoration activities and planning are most likely to occur in the future. The study area defined by the CER Project claimed priority for sampling, which began where Tande left off and moved north and east down the ARV.

5.7.3 Methods

Field methods were based on a combination of traditional fire history research (e.g., Arno and Sneck 1977) and newer methods designed to detect multiple disturbances (e.g., Veblen et al. 1994). The field work was intended in part as a pilot project to test field methods and analysis. Guiding its methodology was the principle of over-sampling, so that a minimum level of sampling could be conclusively identified for following years of work (as appropriate).

Initial work, undertaken from aerial photographs, involved classifying the montane first into coarse physiognomic/vegetative groups and then into finer vegetative classifications. An effort was made to draw a distinction between those stands which are clearly even-aged and all others, but this was not always possible. Plots were distributed along transects within each of the polygons identified from the photos; plot-spacing was 200 m (max) in uneven-aged or otherwise complex areas, and up to 400 m in even-aged stands, but additional plots were located at changes in forest structure. Sufficient information describing sites was collected at each plot to allow a correlation with ELC vegetation types.

Most dendroecological information was obtained from increment cores pulled from multiple individuals in each age cohort of each species. Additional samples were taken from fire- and insect-scarred trees to ensure accurate dating of disturbance events; cross-sections, or "wedges," of trees are the standard ways of collecting this information. (Ian Campbell of the Canadian Forest Service in Edmonton currently is processing the cores and cross-sections in his lab.)

CER Project members had hoped that the montane disturbance data analysis would be complete in time for incorporation in this report; however, delays in analysis have occurred. It is hoped, however, that follow-up work will combine the montane-disturbance findings with those of the CER Project to provide a comprehensive view of ecological processes and patterns in the montane.

5.8 Archaeological Research

During its first field season (1996), members of the CER Project gathered all known information about archaeological information and placed these materials in a strictly confidential database for subsequent spatial and historical analysis. JNP is rich with archaeological sites, and investigations are just beginning to provide a composite view of human prehistory. Studies have barely scratched the surface but we are fortunate to have a cooperative Parks-University of Alberta

archaeological field school to encourage research. Direct archaeological research lay beyond the scope of the CER Project.

An important component in piecing together the human history of the ARV comes from archaeological data. Evidence gathered in almost seventy reports about archaeological sites suggests widespread human activity in the CER Project's study area, including evidence of occupation and use stretching back to the last glaciation (approximately 10,000 years BCE). Important documentation exists also for the post-contact era, mostly in the form of fur trade-era sites from the nineteenth century.

Studies of human history (Ens and Potyondi 1986; Gainer 1981; Great Plains Research Consultants 1985) have been conducted primarily by consultants under contract to Parks Canada. Archaeological research in JNP has been conducted for the most part by Parks Canada archaeologists from Calgary and, to a much lesser extent, by contract to Parks Canada Archaeological Services, Calgary (now Cultural Resource Services, Western Canada Service Centre, Calgary). Until recently, archaeological research has focused mainly on archaeological surveys (not reconnaissance) and basic inventory work. Such surveys have involved extensive subsurface testing in many cases; for example, Jasper House National Historic Site, on the west bank of the Athabasca River down river from the CER Project's study area, was extensively excavated by Parks Canada archaeologists in the mid-1980s. Intensive excavations, and the availability of data sufficient to begin piecing together a comprehensive account of pre-contact era activities in particular, is now under way. In 1996, the JNP-University of Alberta Field School was a partnership set up by Parks Canada Archaeological Services (M. Magne/P. Francis), JNP (M. Audy), and the University of Alberta's Department of Anthropology (R. LeBlanc) to both provide a venue for the field school, and to augment the archaeological resource management programme in JNP (see Francis and Hudecek-Cuffe 1996; Francis 1997). During the 1996, 1997, and 1998 field seasons, the school, financed chiefly in the first two years by JNP and in the third year by the University of Alberta, came under the direction of Caroline Hudecek-Cuffe, a doctoral graduate from the University of Alberta, while Parks archaeologist Peter Francis directed the fieldwork programme. Teams of students were educated about archaeological field methods, and participated in the excavation of an important, stratified site near the mouth of the Snake Indian River (down river from the CER Project's study area). The data emerging from this project will provide the most detailed account to date of human history in JNP. All the work by the field school was used to address particular needs of JNP's archaeological resource management program. It is anticipated that this model of field research will continue in the future.

Additionally, Alberto Mussachio, a doctoral student in geoarchaeology at the University of Alberta and an assistant to the field school, is undertaking further original research in the Snake Indian River drainage.

The CER Project asked Shelly Funston (staff member, 1996) to assemble archaeological data for the study area. Permission to use site reports was obtained, and these data were placed in a restricted database for potential further research. Bill Perry, an assistant archaeologist and GIS specialist at Cultural Resource Services in Parks Canada's Western Canada Service Centre, Calgary, shared the archaeological potential model he developed for Banff National Park (BNP). The CER Project ran this model, based on elevation, slope, aspect, and proximity to water, in a preliminary way with the Project's 1:10,000 digital elevation model. The fit of this model to actual sites was less significant than hoped, and certainly less tight than Perry has reported for BNP.

Realizing both that the amount of work required to integrate the archaeological data in its present state of development for the CER Project's study area, and that original archaeological research itself lay well beyond the scope of the CER Project, further analysis and research awaits future projects. The integration of existing data and the setting of strategic priorities for further

research—including site excavations—in the CER Project's study area offer a number of promising scholarly projects. This promise is especially significant given the amount of cultural and ecological data that now exists for the study area.

5.9 Palaeoecological Research

Cynthia Zutter, then a doctoral student in Anthropology at the University of Alberta and specialist in the palaeoecology of bogs (she also served in 1996 as the first manager of the CER Project), undertook sampling of several small wetlands in the CER Project's study area with the aim of learning more about changing ecological conditions. These data are still being analyzed, and she has taken a role in integrating palaeoecological data from other researchers, including David Schindler, Charles Schweger, Alwynne Beaudoin, and Brian Luckmann. The aim of this work is to integrate palaeoecological data with dendrochronology and the vegetation change information to construct a detailed composite view of ecological change in the montane ecoregion. Palaeoecology permits a much longer view of vegetation history than afforded typically by dendrochronology.

Palaeoecology is a historic science which relies on the priniciples of geological stratigraphy to reconstruct past ecosystems using all available biotic and abiotic evidence. Palaeoecological studies are limited by the preservation of fossil deposits which are often distorted by various taphonomic processes, including redeposition and diagenesis. Scales of analysis range from one to hundreds of square kilometers and one hundred to thousands of years. Palaeoecological investigations in Jasper National Park (JNP) have generally focused on the reconstruction of post-glacial ecosystems as a result of the last 10,000 years of climate change. Various methods have been used to reconstruct past ecosystems, including sedimentology, glaciology, dendrochronological data and palynology (Bear 1989; Beaudoin 1984; Beaudoin and King 1994; Kearney 1981; Kearney and Luckman 1987; Luckman 1993).

As part of palaeoecological investigations in JNP, various disturbance processes (i.e., fire) have been and currently are being investigated. Although tree ring and fire scar analysis can provide a fire record in JNP for the last few centuries (e.g., Tande 1979), a longer-term fire history, that pre-dates the arrival of Europeans in the park, can be documented through the analysis of palaeoecological deposits. Recently completed analysis of fossil pollen and charcoal fragments from lake sediments in JNP (Huvane 1998; unpublished manuscript) display variations in pollen and microscopic charcoal that reveal regional patterns of fire history and vegetation change. Although these regional scale studies are useful for reconstructing the large scale pattern of fire and vegetation change in the montane of JNP, it is often difficult to interpret the proximity, intensity and impact of individual fires. Smaller study areas (0-100m diameter) are necessary to discern more localized fire and vegetation histories (Jacobson and Bradshaw 1981).

In order to document a more localized and small scale fire history and vegetation record in JNP, a small scale investigation has been initiated within the delineated study area of the CER project. Palaeoecological samples were collected in the fall of 1997 from the Moberley Flats wetland, a small in-filling depression with a diameter of approximately 100 m2 approximately 15 km east of the Palisades Center. The site was chosen for its limited size as well as close proximity (4 km) to the historic Moberley farm site where within the last century, human ignited prescribed burns are known to have occurred (pers. comm. Dr. Hank Lewis, U. of Alberta 1996).

Studying macrofossils, fossil pollen and charcoal remains from a small wetland basin in close proximity to a historic farm allows for the documentation a long-term record of localized vegetation change and fire frequency (including historic prescribed burning). This study will provide insights

into the variability of vegetation and ecosystem change the montane in JNP and contribute to JNP ecosystem management activities.

6 Implications

6.1 Summary and Overview

From the Palisades Research Centre, the base of operations for the CER Project during the last three years, the view is of Roche Bonhomme to the east. Walking less than half a mile toward the peak, one comes to the Athabasca River, a river that flows across the province of Alberta before draining into the Slave River, and north out of the province to Great Slave Lake, the Mackenzie River and the Arctic Ocean at the Beaufort Sea. First, however, one must cross the railway tracks and railway communication lines, then an abandoned access road to the Centre and a railway service road, a transmontane gas pipeline, a T1 fibre optics cable, the Yellowhead Highway (Hwy. 16), several trails, and a roadside picnic area. These manifestly human intrusions are at the heart of the ecologically rich montane ecoregion of JNP, the largest of the Rocky Mountain national parks and one of Canada's most celebrated wilderness areas. (Thus, crossing to the river would also stand one a fair chance of encountering elk or bear at certain times of year). It was the juxtaposition of so-called wilderness and human congestion, a clash between perception and reality, which prompted us several years ago to begin research on the ecological history of human influence in JNP. No one appeared to be considering from an informed basis how, at present and in the coming decades, humans can respect this place.

JNP is experiencing development by humans at a rapid pace; many say too rapid. The quiet town of Jasper, long appreciated by locals for its unassuming charms, is filling with destination retail outlets and franchise eateries. Traffic is increasing on the Yellowhead Highway, as are the number of visitors who engage in an increasingly wide array of pursuits. Development proposals abound. The town of Hinton, fewer than twenty km distant from the East Gate of JNP, is boosting tourism as an adjunct to resource extraction. Further coal-mining operations are planned for the eastern boundary. Local JNP activists commonly cry that JNP cannot be allowed to become another Banff, a Park in crisis because of too much development and visitation. How far away is JNP, realistically, from reaching this point?

In 1991, several of us, including University of Alberta researchers David Schindler, Suzanne Bayley, and Eric Higgs, predicted that JNP managers would arrive at a fork in the road. They began building a cooperative research program with JNP, and wrote several grant applications based on this prediction. From that perspective, it appeared that JNP was sufficiently far behind Banff in terms of development that good opportunities for preventive research and management still existed. It would save money and time to invest in precautionary management programs rather than either paying the costs of remediation and restoration, or, worse still, coming to grips with a place of declining ecological value. Park managers, these researchers believed, were faced with two main options. More likely was the business-as-usual approach: respond to development applications in a moderately conservative way, fight defensive battles against deleterious developments such as the Cheviot coal mine (a twenty-three km-long open-pit mine proposed for land adjacent to the eastern boundary of JNP), and avoid conflict whenever possible. This option has, for the most part, been their choice over the past eight years, although the picture deserves to be painted with fine as well as broad brush strokes. Some of the finer strokes, such as JNP's Ecosystem Secretariat, improved spatial analysis capabilities, and projects such as the environmental assessment of the Three-Valley Confluence, have been hopeful, enlightened, and valiant initiatives, but their potential benefits have been counteracted or precluded by drastic reductions in the budgetary resources available to Park managers. The best intentions are frustrated at times by flagging morale, programs left incomplete, and the lack of direction that issues out of the need constantly to extinguish administrative brush-

fires. As researchers who have undergone similar institutional trials over the last decade, we have empathy.

At the beginning of the CER Project, we saw the fork in the road in the near distance. Our concern was that the business-as-usual approach, so much a necessity in the prevailing fiscal climate, would spell grave troubles for JNP. It meant that the problems we had hoped as researchers to help prevent would in fact manifest themselves fully. Once development pressures reach a certain threshold, the capacities of Park management are overwhelmed by a sequence of crises. The Banff-Bow Valley Study did not, ironically, help the plight of JNP, although perhaps the long-term effect will be salutary. In fact, the study alerted visitors and developers alike to the determination that the "open ride" in BNP was coming to an end. People began streaming north to JNP in search of the conditions and values that they sought originally in coming to a mountain wilderness park. Another image borrowed from research discussions in the early 1990s was a development gradient extending south from Yellowstone: If one wanted to see what JNP is going to be like in a decade or two, it was suggested, just look at the conditions in Yellowstone. There had to be another path to follow.

The alternative tine in the fork is a restorative one. It compels managers, and the public of course, to be clear first about what values are important for appreciating JNP, and then about how these match up against ecological values and realities. After almost a century of management, ecosystems in the ARV are transformed by virtue of Park management practices. In other words, our choices in the past have shaped JNP, and one of the challenges is to wrestle with how our choices, based on shifting cultural values, will affect the future. There is an opportunity to restore JNP, which means not so much returning to the exact conditions that flourished before the creation of the Park, as balancing the long-term ecological and cultural history of the place with present circumstances. This pragmatic approach fuels thousands of ecological restoration projects around the world, and notably the ambitious Yellowstone-to-Yukon Wildlands project. A change in management style is needed. More intervention, not less, will be necessary to return ecological patterns and processes to historical norms. Cultural practices past and present must be accounted for in bringing people into meaningful relationship with the landscape. Clear goals are necessary, and these will require negotiation and an awareness that values shape actions.

How has the CER Project as a research program served to apply new approaches and concepts to the understanding of human influence on the montane ecoregion, and how might the insights gained from this research be applied to the ecological restoration of JNP? It has developed potential applications:

- by showing how ecological and cultural history can be intertwined,
- by creating a common language for mapping human activities,
- by using historical materials in innovative ways,
- by stretching the CER Project's initiatives from conceptual research all the way to applications, and
- by promoting interdisciplinary and intersectoral research.

These achievements have occurred during a decade when the challenges confronting research in JNP have been mind-boggling, caught, as all research about JNP is, in a web of institutional mandates, cultural values, a poverty of well-researched knowledge, and relentless development pressure. JNP has changed significantly in light of staff changes, administrative restructurings, and financial cutbacks; it is a much different institution now than it was in 1996. Personnel and/or their roles have changed to reflect Parks Canada's changing mandates and policies; this state of affairs has left researchers bemused and often frustrated. The story in JNP

rings true in many other national parks in Canada and elsewhere, and resembles problems faced by managers in all kinds of protected areas.

What made JNP so attractive a site for study, apart from the growing fiduciary responsibility felt by university researchers who live nearby, was the symbolic place it occupies in the minds of so many Canadians and visitors from other countries. As an icon of Canadian wilderness, it offered a preeminent challenge for ecological restoration. Why restore wilderness? What is wilderness? Of JNP, these basic questions could be asked and investigated sincerely and promisingly. One of our earliest and central contentions in the CER Project was that this core idea of wilderness might be doing more harm than good, that perhaps we needed to re-conceive the way we look at JNP.

The shifting meaning of wilderness is the subject of the following discussion, the most theoretical and conceptual fruit of our work. We proceed from there to examine the implications of our work in four subsequent sections. These fives sections bear the following titles:

1. Challenging the Idea of Wilderness
2. Static vs Dynamic Images of the Future
3. Ecological Integrity and Culture
4. A Restorative Approach
5. The Research Environment

In each, we provide an overview followed by contributions of the CER Project, implications for Park management, and suggestions for future activity; the last category is offered with a due sense of urgency.

6.2 Challenging the Idea of Wilderness

6.2.1 Overview

JNP is considered a preeminent example of wilderness: it is forbidding, extreme, and often breathtaking. Its mountains force the gaze upwards toward sites of unimaginable isolation and exposure and away from the valleys in the foreground. The search for wilderness leads some visitors to the backcountry of JNP, struggling for a trail that crosses no other, day after day of people-less travel. For most visitors, what makes JNP a wilderness area is this knowledge of vast, largely untrammelled landscapes lying beyond the reach of the day hike, the highways, and the town. This image of JNP as wilderness persists despite the presence of a sizable permanent community, all modern amenities, a major cross-continental highway and railway, burgeoning tourism that includes large-scale developments (a golf course, downhill skiing, a tramway, hot springs, and so forth), and many other visible signs of human activities. These phenomena are examined through a cultural lens that ignores the implications of human influence. In a sense, knowledge-by-association illuminates the entire Park with the glow of wilderness. Tourists can sit in the town of Jasper taking in wilderness figuratively by osmosis.

The problem with this view of wilderness is that it contradicts reality. It embeds complicated ideas based on several hundred years of Eurocanadian cultural values that make little sense. Few areas that are now called wilderness were always free of people. In JNP, there are certainly regions of what is now known as the backcountry that had relatively little human presence. However, the ARV, with its temperate montane ecosystems, was at least a transportation corridor if not home to many First Nations peoples, and continues to serve as a magnet for people. Our culture's concept of wilderness tends to romanticize and overly simplify the challenges faced by Park managers, as though simply leaving natural processes to find their own way will sort everything out.

In contemporary life, some argue, our understanding of wild nature—wilderness—is changing. It is no longer composed of people-less places, of mountain vistas, and remote, inaccessible valleys. These caricatures are drawn from Euroamerican cultural values that have produced a view of nature-as-wilderness, an Edenic place that one finds in the receding distance (Nabhan, 1997; Cronon 1995; Blackburn and Anderson, 1993). In the contemporary world, some are suggesting, wilderness is a relative term inspiring a continuum of human activity. On one end is a human-dominated landscape and at the opposite a place without a trace of people.

Accordingly, with a growing awareness that wilderness values are indeed rooted in part in cultural projections (Lease and Soulé 1995), we see that the subject of ecological management keeps changing form. What do we aim to make of a place such as JNP? Should we allow natural and cultural processes to proceed without regulation? Should we use management practices, such as prescribed burning, to mimic, replace, or amplify natural processes? Should we be setting long-term goals based on negotiations about desired landscapes, and then design our practices to achieve these ends? At least one matter is clear: cultural beliefs, threaded through a labyrinth of institutions and shielded increasingly from direct experience, impinge on ecological management.

Despite a Parks Canada policy that lacks a clear integration of ecological and cultural requirements, many people still do not see a role for cultural resource management in a national park. This separation of the cultural and ecological management of JNP into two components can lead to the misunderstanding that ecological integrity and people do not mix. It is similar to the notion that the protection of wilderness (a corollary to ecological integrity for some) requires that people and the influences exerted by people be absent from a protected area operated under a policy aimed at ecological integrity.

What needs to be distinguished in the Eurocanadian concept of wilderness is that although it encompasses the meaning of "wild" (that is, it refers to areas that bear fewer marks of human activity than others), it also includes areas deeply impacted by human activity over millennia. This distinction has significant implications for the cultural and ecological management of JNP. Few would dispute the importance of protecting landscapes that are relatively wild. Such places are becoming rare, and national parks can be effective ways of ensuring their protection. The free flow of ecological processes and the flourishing of indigenous species are important and laudable goals. They form the basis of Parks Canada's commitment to ecological integrity. At the same time, however, it is equally important to ensure protection and respect for the places that we would associate with those areas of wilderness that are, or have been, heavily affected by human activity.

6.2.2 Challenging the Idea of Wilderness—Contributions of the CER Project

- By bringing social scientific and humanistic research into relation with natural science, the CER Project has brought together new ideas emanating from environmental history, anthropology, and cultural studies.

- The HAD raises the profile of cultural practices, and exposes by implication the changing values that have governed decisions about land use in JNP.

- The publication of a number of articles about national parks and cultural values has highlighted the extent to which visitor and management values are shifting, or exhibit the potential for shifting, to a more commodity-oriented world view. In its most extreme form, we call this the Disneyfication of wilderness, or the process by which culture industries and mass media transform our understanding of wild places.

6.2.3 Challenging the Idea of Wilderness—Implications for Management Practices and Policies

- A new, more realistic portrayal of JNP as a wild place that has attracted people for millennia is required to shift public awareness away from obfuscating or isolated notions of wilderness, such as the one that identifies visitors only as consumers.

- In jettisoning conventional ideas of wilderness, Park managers will more easily be able to envision the need for respectful interventions (e.g., restoration).

- Shifting away from romantic ideas about wilderness will resist more effectively the incursion of Disneyfied values about nature.

6.2.4 Challenging the Idea of Wilderness—Recommendations for Further Activity

This first section on wilderness is clearly the most abstract of our research. It urges the following: that more attention be paid by those using, researching, and managing JNP to strengthen our appreciation of the historical roots of our understanding of wilderness; and that studies be initiated into public values about JNP, and how they are changing. The second of these comprises an area full of potential for research. Despite a recent trend towards paying greater attention to managing human activities in the montane ecoregion, little emphasis has been given to obtaining reliable information about what people do and think when they are in JNP. Research in this area is sorely needed.

6.3 Static vs Dynamic Images of the Future

6.3.1 Overview

Surveys suggest that most people strongly support the ecological protection of national parks. For many people, this support means that they want their government to "keep the parks as they are"—refuges of clean air, blue water, and green forests. Two problems attend this static approach. First, because ecological systems are dynamic, in a practical sense it would be very difficult, if not impossible, to "keep things as they are." Second, and perhaps more importantly, the assumption is deeply flawed that the "way things are" is somehow correct and deserving of preservation in perpetuity. And it is here where the historical and cultural elements at work on national parks can no longer be ignored.

There is growing evidence to show that present ecological conditions of the montane ecoregion may lie outside the long-term historical range of variability; in other words, "the way things are" is an anomaly. Some of the most dramatic evidence has emerged from the CER Project's study of vegetation change. In it, the comparison of oblique and aerial photographs reveals dramatic shifts in vegetation during the course of the twentieth century. What had been a patchy, mixed-age mosaic of forest, savanna, grasslands, and wetlands has been replaced—in less than a century—by close-canopied coniferous forest. Ecological succession has operated without the usual checks of wildfire, human fire, and other processes.

The "way things are" results from a combination of natural processes and human decisions about land use and management over the last two centuries (although the number and significance of the changes have increased substantially in the twentieth century). If you believe that wilderness is the absence of human influence on the land, then JNP is no longer "wilderness"—nor was it wilderness when the Park was established as Jasper Forest Reserve in 1907. If you believe that Parks Canada should maintain the ecological integrity of JNP, then keeping it "the way it is" would be

contrary to your views. Recognition of the dynamic character of the montane ecoregion constitutes a paramount insight required in the charting of the future of this protected area.

There is, we believe, a perspectival contradiction between Park managers and scientists, on the one hand, and the public, on the other. Most managers and scientists agree about the dynamic character of the montane ecoregion; the public, however, generally does not. Moreover, understanding that nature evolves is much easier than acting on the understanding.

6.3.2 Static vs Dynamic Images of the Future—Contributions of the CER Project

- The vegetation change project offers the means for a powerful qualitative and quantitative assessment of changing vegetation in the CER Project's study area. Jeanine Rhemtulla developed a novel and reliable method for interpreting historical survey photographs and has provided a lasting dataset for use by others in interpreting vegetation change in the ARV and other montane ecoregions of JNP.

- The CER Project, primarily through the work of Cynthia Zutter (on staff in 1996), undertook sediment core sampling of specific wetlands to answer questions about anthropogenic fire. The analysis is ongoing. Zutter has been instrumental in bringing together palaeoecologists to discuss research findings and opportunities.

- We invested considerable time and resources in the Montane Disturbance program, a joint project among CER, JNP, and Foothills Model Forest. The intensive data collection of tree core and sections will yield, it is hoped, high resolution information about historical disturbance processes in the montane. This work is ongoing.

6.3.3 Static vs Dynamic Images of the Future—Implications for Management

- Managing a dynamic landscape places greater weight on the need to set goals, goals that are clear to all stakeholders. A goal need not be a static condition, and can involve the specification of an appropriate range of variability or the return of certain processes.

- Greater, rather than less, intervention may, and will likely, be required to achieve appropriate ecological goals.

- Raising public awareness of the dynamic nature of cultural and ecological processes is crucial to the support by which protected areas such as national parks function successfully.

6.3.4 Static vs Dynamic Images of the Future—Recommendations for Further Activity

- Historical and cultural research is vital to understanding the changing character of JNP and better approaches are needed to ensure such research is integrated in decision making.

- Adaptive goal setting for future landscapes is the key in ensuring clear expression of values, integration of the most effective science, broad participation, and reliable implementation and monitoring.

- Continued data collection and refinement of techniques for oblique photographic interpretation, specifically the Bridgland photographic survey, should be encouraged. This will yield a remarkable record of early twentieth-century ecological conditions and human activity.

- Due to the considerable efforts placed on paleaecology by the work of David Schindler, Alwynne Beaudoin, Charles Schweger, Brian Luckmann, and Cynthia Zutter, opportunities exist for further cooperative research and analysis.

- Results from the montane disturbance project can be fruitfully combined with the vegetation change project data to build a composite view of historical vegetation. In light of this potential, the vegetation change and montane disturbance datasets, combined with other research projects (e.g., Corina Brdar's butterfly movement project), render the CER Project a promising long-term, meso-scale study site for research.

- There is need to produce a comprehensive portrait of landscape change in JNP by means of the integration of a broad array of data about climate history, fire history, historical vegetation types, vegetation change, human activities, and so on.

- Public education and the training of Park staff are urgently required if a breakthrough is to occur in the prevailing simplistic reiteration and application of the "keep things as they are" perspective. Such a breakthrough requires a portrayal of landscape, not as static scenery, but as the setting for change over time. As part of this visual approach we must share the existing knowledge of how human influence has contributed to that change.

6.4 Ecological Integrity and Cultural Considerations

6.4.1 Overview

In 1988, Parliament enacted amendments to the National Parks Act. An important direction captured in this amendment is 5(1)(1.2) which states: "Maintenance of ecological integrity through the protection of natural resources shall be the first priority when considering park zoning and visitor use in a management plan" (Canada 1988). Since that time, the idea of ecological integrity's taking precedence in the management of a national park has been the battle-cry of many environmental non-governmental organizations, and it has been heard and accepted by much of the Canadian public (although views of what it means vary). The challenge in putting all your eggs in the ecological integrity basket is that you had better be sure you know what ecological integrity is and when it is (or is not) being maintained.

In an update of its policy six years later, Parks Canada provided a definition for both ecological integrity—"a condition where the structure and function of an ecosystem are unimpaired by stresses induced by human activity and are likely to persist"—and the maintenance of ecological integrity—"[m]anaging ecosystems in such a way that ecological processes are maintained and genetic species and ecosystem diversity are assured for the future" (Canada 1994).

The purpose of the policy document is to explain "how the federal government, within the context of Parliamentary approvals, carries out its national programs ...." By its very nature, the policy document is much more comprehensive than the legislation. In this expanded description of Parks Canada's responsibilities, some interesting points emerge, and the apparent singular focus on "ecological integrity" is blurred. A good example is the incorporation of cultural elements. The Act alludes to "culture" only twice. The first instance, occurring in section 7(1) (b), enables the Governor in Council to make regulations for the protection of "cultural, historical and archaeological resources"; the second, coming in section 8.5(4), permits the creation of regulations "respecting the continuance of Haida cultural activities." While these are important statements, they in no way are given the same weight as ecological integrity; they merely hint that other

considerations must be made in the management of any national park. The policy, on the other hand, goes far towards raising the profile of Parks Canada's responsibilities in considering historical and cultural elements.

Nowhere are these responsibilities clearer than in the number of formerly disparate elements that are brought together under one policy document. In addition to National Park Policy, there are policies for Canadian Heritage Rivers, National Historic Sites, Federal Heritage Buildings and Heritage Railway Stations, and Cultural Resource Management.

But it is Guiding Principle #1 of the policy document that reveals a broader thinking. This guiding principle takes the keystone statement about ecological integrity from section 5(1) (1.2) of the National Parks Act and weaves in the cultural element. Entitled "Ecological and Commemorative Integrity" it states that

> [p]rotecting ecological integrity and ensuring commemorative integrity take precedence in acquiring, managing, and administering heritage places and programs. In every application of policy, this guiding principle is paramount. The integrity of natural and cultural heritage is maintained by striving to ensure that management decisions affecting these special places are made on sound cultural resource management and ecosystem-based management practices. It is recognized that these places are not islands, but are part of larger ecosystems and cultural landscapes. Therefore, decision-making must be based on an understanding of surrounding environments and their management.

Thus, no question remains that JNP, like other national parks, is to be managed by policies that pay due attention to both human and non-human life, to both culture and ecology.

The last two decades have brought about an increasing awareness of the role of human influence on the landscapes in the Rocky Mountains and how "natural" processes have been altered. The best example is an increasing understanding of the role of fire suppression in altering vegetation communities. As work continues on better understanding other human influences on the land, Park managers, researchers, and others are talking about parks not just as ecological reserves but also as cultural landscapes.

This orientation emphasizes the complexity of the debate regarding the criteria used to manage the nation's protected areas. Legislation and policy clearly make ecological integrity paramount in park management, but, as has been seen, they also now insist that the human dimension be factored in, and for several reasons:

- to better understand past human influences on the land in order to know about ecosystem processes,
- to clarify the need for people to visit protected areas in order to gain an appreciation and understanding of nature, and
- to acknowledge, protect, and interpret certain historical works and activities.

National parks are defined by public policy, and as our understanding increases we need people to continue to help define what these places should be. We need to foster ways of being in JNP that are respectful and moderate. Many challenges confront those attempting to better incorporate the human dimension into research, planning, and management of protected areas such as JNP, but there is one particularly strong barrier to overcome—the perception that the human dimension has no place at all in a national park. This barrier exists not only in the minds of some members of the public but also in the minds of some Park managers. The current policy provides

ample direction to managers for the preservation and protection of cultural resources. The task now is to truly integrate—not simply to manage—ecological and cultural elements.

This may strike to the quick those who see ecological integrity as pure, as being parallel with the notion of no human impact, as being "the" purpose of national parks. Despite appearances to the contrary, ecological integrity can in theory and practice support some levels of human impact. Pushing still further: because some ecosystems have developed in concert with certain cultural practices, maintaining the integrity of such ecosystems depends as well on maintaining cultural practices. The formidable challenge comes in determining what is acceptable practice: how much activity is too much? This determination must be based on a host of considerations, including ecological goals, visitor experience goals, cultural resource management goals, and economic and fiscal realities.

Some dwell on the negative aspect of human use of a national park, and for good reason: much damage has been done through heedless activity. A mistake like none other would be to infer that the CER Project advocates an intimate embrace of cultural practices. Rather, the CER Project concludes by promoting carefully formed, well informed understandings of historical and contemporary human practices as the indispensable way by which to understand the character of the landscape. We need to celebrate the past connections people have had with the land and the experiences people can have when connecting with nature today, and capture the enthusiasm that goes with this to engage in whole-scale restoration to meet a contemporary vision for JNP.

6.4.2 Ecological Integrity and Cultural Considerations—Contributions of the CER Project

- The Human Activity Mapping project presents an innovative method for recording and representing historical cultural practices. The relative absence of professional and comprehensive historical research means that oral and anecdotal evidence is especially important. The database that underlies the mapping project marks an apposite, perhaps even an elegant, way of recording historical information for posterity.

- The development of a database of research materials germane to the montane ecoregion will reduce the amount of backtracking facing future researchers wishing to locate important sources; moreover, it will assist in locating and centralizing information resources in JNP.

- The Fur Trade history project conducted by Ian MacLaren offers a detailed study of conditions in the ARV well back into the nineteenth century. His innovative use of repeat photographs of Paul Kane sketches offers a compelling, qualitative appreciation of landscape change.

- The CER Project worked closely with the JNP Library and the J-YM&A to improve and coordinate information resources.

- The CER Project applied archaeology, oral history, and history, not simply to tell a story, which is in itself important, but also to understand landscape change.

6.4.3 Ecological Integrity and Cultural Considerations—Implications for Management

- An intimate connection must be established between ecological and commemorative cultural integrity that is recognized and upheld by all stakeholders. Instead of viewing cultural resource management as involving solely the protection of cultural artifacts and events, direct links should be made between ecological and cultural processes on the landscape. The HAD represents an excellent means for accomplishing this.

- The number of personnel needed to support the work of learning about and commemorating cultural integrity cannot be underestimated.

6.4.4 Ecological Integrity and Cultural Considerations—Recommendations for Further Activity

- The Human Activity Mapping project warrants further research and development. This would involve:

  - improving the content of the database for the CER Project's study area,
  - conducting extensive analysis in conjunction with ecological datasets,
  - determining effective modes of presentation of data and analyses,
  - developing a user-friendly front-end means of access to facilitate use by other groups (especially local historians),
  - integrating with JNP's GIS system, and
  - expanding the database to incorporate first the entire montane ecoregion, and eventually the entire JNP landbase.

- Professional historical research needs encouragement. It may be stated without risk of exaggeration that dozens of potential research projects await inspired graduate students and supervisors. A comprehensive, exhaustive historical study of JNP is essential to the furthering of the database.

- The research collections database needs expansion and regular updates. This ongoing work could be undertaken as a joint project of the University of Alberta Library, the JNP Library, and the J-YM&A. A meeting should be held to discuss possibilities.

- Working from its commemoration of Jasper House II as a national historic site, JNP should undertake a comprehensive interpretive history of the uses made by the nineteenth-century transcontinental fur trade of the upper Athabasca, Whirlpool, and Miette river valleys, with a view to heightening public awareness, not only of the historic cultural significance of these montane regions, but also of the longevity of the influence of human activity on the ecological profiles of these apparently "wilderness" valleys. The ARV, including the routes to both Athabasca and Yellowhead (or Leather) passes, constitute rich natural archives for both the study and the appreciation of the transcontinental fur trade in the second to sixth decades (1811-1854) of the nineteenth century. Indeed, falling within the bounds of a national park, the portion of the routes in JNP just east of the continental divide may be said to remain unaltered in comparison to all other stretches of the nearly transcontinental route: the rivers have not undergone hydroelectric development, and no extensive built environment has occurred in the valleys during the past century and a half.

- During the three years' course of the CER Project, Parks Canada and JNP have been quite evidently unable and, it is feared, unwilling to devote scant resources to the development of historic interpretation of the fur trade period in the valleys of the upper Athabasca, Whirlpool, and Miette rivers. The JNP warden charged with historical interpretation, it might be justifiably stated, has been all but discouraged by budgetary and policy uncertainties from initiating any substantial work. Yet, given the relatively low impact that programs of historical interpretation of the fur trade would have on the montane and, towards the height

of land at Athabasca Pass, the sub-alpine ecoregions, and given that the fur trade period is unique to JNP among the four mountain parks, CER strongly encourages JNP and Parks Canada to establish a substantial if not ongoing working relationship with historians of the fur trade, with a view to making JNP a locus of fur trade tourism and open-air study, unique in Canada—unique because, so far, terminal points (i.e. Fort Langley, Lower Fort Garry), rather than routes, have been the focus of Parks Canada programs of commemorating and interpreting fur trade cultural history.

- Archaeological research will fill significant gaps in our understanding of past cultural activities, especially those before the nineteenth century. The CER Project made gestures at synthesizing archaeological research, but this is a much larger challenge. A good overview of current archaeological resources and results is needed.

6.5 A Restorative Approach

6.5.1 Overview

Ecological restoration offers a distinctive new model for managing JNP's montane ecoregion. Some regard restoration as a set of techniques used to return an ecosystem to exact conditions at a specific historical point. While this can be effected, it constitutes only one branch from the entire tree of ecological restoration. Internationally, and particularly in North America, ecological restoration has emerged as not only a practice but also an orienting framework for ecosystem management. It has the following chief benefits:

- it extends sensibly the practice and theory of ecosystem management by giving ecological integrity an historical anchor point, thereby allaying anxieties over the idea that maintaining integrity does not necessarily include respect for the continuity of earlier ecosystem functions;
- it depends on clear goal-setting and planning, so that to know what to restore means having a good understanding of historical patterns and processes, and an informed anticipation of appropriate future conditions;
- as distinguished from *restoration ecology*, it implies broader commitments to environmental awareness, community participation, and social responsibility; and
- because it seldom means restoring to a static prior condition, it builds in and on an understanding of ecological change.

If done well, research about the past, in conjunction with effective processes for participation, negotiation, and communications with all those with a stake in the outcome, will raise such poignant questions about the future as this: "If things have changed this much over the past xx years, what will it look like in another xx years?" We need to be ready not only to prompt but also to respond to those questions, spur and engage public dialogue, and perhaps in the future move again toward cooperative or collaborative projects (i.e., involving members of the community, scientists, and others directly in planning and implementation). Information and communication tools are needed to help devise scenarios depending on the choices we make about the future management of JNP. These tools must be able to incorporate information from the natural and social sciences, including creative ways of learning from qualitative data such as historical photographs and paintings.

Increased awareness, more involvement, better education, improved prediction tools, and integrated research represent important foundations for the final challenge: consciously setting a path for the future landscape. To meet that challenge, we must first embrace people and their contribution to the past, present, and future landscapes of JNP. We can no longer separate people from wilderness; we must begin to define their place in the land. We must bring together the hitherto discrete paradigms of ecological reserves and cultural landscapes.

Negative views of human intervention on the landscape tend to distract us from the capabilities we have in working creatively, respectfully, and responsibly with ecosystems. What is admittedly a terrifying thought to many environmentalists and Park managers, ecological restoration will likely mean greater rather than less intervention in natural processes. It will, at the very least, mean greater conscious intention. We have a spotty—some would say grim—track record of human involvement in protected areas. Rapid development and commercialization are only the most recent manifestations of that involvement. We need only to turn back to the work of Aldo Leopold, Ted Sperry, and John Curtis at the University of Wisconsin Arboretum at Madison in the 1930s to provide us with an alternative view. Under dire financial and institutional conditions, they pushed forward a vision of a renewed landscape, converting derelict farm fields into native prairies. Their work endures, along with thousands of similar successes, as testaments to what is possible. When we talk about designing the future, or intervening in natural processes, theirs can and should serve as a hopeful sign.

6.5.2 A Restorative Approach—Contributions of the CER Project

- The very design of the CER Project, and Higgs's role as secretary of the international Society for Ecological Restoration have served to highlight conceptual foundations and practical opportunities for restoration in JNP.

- In the summer of 1997, we experimented with a restoration pilot project in the Henry House flats area (on both sides of the Yellowhead Highway). This was intended to test procedures for planning and moving toward broader participation. Our goal was to arrive at a plan for a site of several hundred hectares that could be used as the basis for implementation. Although not launched, this project offers much potential.

6.5.3 A Restorative Approach—Implications for Management

- Ecological restoration could be incorporated as a new model for ecosystem management in JNP. This would position JNP at the lead of national parks in North America. There is much opportunity for strengthening JNP's commitment to ecological restoration. For implementation to reflect the full potential of ecological restoration, new programs for involvement of community members, scientists and other appropriate personnel are indispensable.

6.5.4 A Restorative Approach—Recommendations for Further Activity

- An ecological restoration program should be implemented in measured stages. Successful implementation of restoration projects depends on having adequate on-the-ground demonstrations of specific treatments. A series of experimental research plots should be developed to test prescribed fire, mechanical removal, and other site treatments on different ecosystems. The goal would be to develop effective and efficient techniques for managing larger areas of the ecoregion. Such an initiative is vital to the ensuring of success of long-term restoration, including the return of fire to JNP. It is similar in scope to the exclosure project (establishing permanent plots of vegetation, which enable studies of the extent and

variety of changes in vegetation cover inside and outside the exclosures), and could generate excellent long-term scientific data.

- A site-specific restoration project, such as the one proposed by the Restoration Pilot Project for the Henry House flats, should be undertaken. This project should be larger than a single contiguous site (e.g., a dump site) but small enough to make it institutionally feasible and attractive in the short run.

- The CER Project's study area, which was carefully designed to represent a wide array of ecological and cultural processes, would make an excellent meso-scale restoration region. Further, the CER Project study area would make a good long term ecological study area for future research. This would serve as a logical prelude to a site-level project, although ideally the two would be undertaken in conjunction with one another. Site-level plans depend on the conditions and decisions in the surrounding environment.

- The next level, and the broadest conceptual plan within JNP itself, would be a restoration plan for the entire montane ecoregion. This would provide a clear, visual representation of what is possible in the future, and would serve as an excellent communications tool.

- Strong cooperation is needed with partners such as Foothills Model Forest and the Yellowstone-to-Yukon Wildlands project. The latter group especially has a strong commitment to ecological restoration.

- Despite the disappointments of the Maligne Valley Collaborative Process and the conservative approach taken in resolving land use disputes in the Tonquin Valley, collaborative and cooperative projects are recognized as an effective means for achieving durable decisions. Restoration projects, because they are regarded by so many as positive initiatives, could provide a solid foundation on which to build collaborative initiatives.

- Park staff should become involved more directly in activities of the Society for Ecological Restoration, including attendance at annual conferences and regional gatherings. These are crucial venues for the exchange of information about the management of protected areas.

6.6 The Research Environment

6.6.1 Overview

Effective management depends on reliable information. JNP has taken important strides in the last three years with the development of a comprehensive GIS program, the creation of a library/resource centre, and the establishment of the Ecosystem Secretariat. Most researchers and many Park staff comment that conditions for research have opened up since the early 1990's. Prior to that time, it seems, internal research was spotty and external research was largely discouraged. The result is that JNP is a kind of "black hole" for research data. Our maxim in the first year of the CER Project was, "if you think that a set of data ought to exist, then assume it doesn't." Conditions are improving, but significant changes are still required.

We need vital research programs adding to our knowledge about JNP, but these programs should combine traditional and innovative approaches. In the spirit of integration, research programs must be founded on an interdisciplinary approach similar to that taken by the CER

Project. Current policy provides some hope. The most recent federal ministerial direction for managing the mountain national parks comes from BNP's Management Plan. It directs Parks Canada to "develop a long-term, interdisciplinary research strategy to address the historical role of people in the mountain ecosystem" (31).

The development of such tools often requires investment in research methodologies that do not bear immediate fruit for management decisions. Increasingly, however, with tighter budgets for science and research, Parks Canada is focusing its allocations on research that has clear relevance to decision-making. Solid, long-lasting partnerships are needed between Parks Canada and research organizations that:

- enable Parks Canada to incorporate science in its decision-making framework,
- enable research organizations to advance scientific as well as social scientific methods, and
- create an environment in which the investments, expertise, and support of both organizations interweave to leverage better returns and mutual benefit.

The CER Project, like many other externally-funded and cooperative projects, has depended on informal arrangements. Formal agreements and clear commitments would render such projects easier to initiate and likelier to succeed.

6.6.2 The Research Environment—Contributions of the CER Project

Members of the CER team have:

- sponsored summer research seminars that highlighted the research of Park staff and outside researchers;
- organized several workshops that focused attention on the montane ecoregion;
- established, initially paid for, and provisioned the Research Centre, a former Warden residence, at the Palisades Centre;
- established and continue to be involved in developing a formal agreement with the University of Alberta;
- inaugurated the formation of a non-profit Foundation to promote and fund research in JNP;
- lobbied for stronger commitments to and awareness of social scientific research;
- developed several new research programs and encouraged others to form; and
- served in a number of formal and informal advisory capacities on research-related issues.

6.6.3 The Research Environment—Implications for Management

- JNP needs to stake a strong, formal commitment to research.
- Greater resources are required to encourage external research.
- In increasing the amount of cooperative research, Park staff will need to loosen the reins of control slightly to allow for meaningful participation by outside researchers.

6.6.4 The Research Environment—Recommendations for Further Activity

Many possibilities abound in enhancing the research environment, but the following require the initiative of Parks Canada and JNP:

- create a joint citizen-university-JNP research advisory committee to advise on research policy and support;
- support in whatever ways are possible the creation of a permanent research presence at the Palisades Centre;
- establish a research staff position in JNP, possibly funded jointly with the University of Alberta, which would be responsible for encouraging research projects, making appropriate connections with staff in JNP, lobbying within the organization for improved resources, encouraging effective use of the Palisades Centre, assisting with arrangements for the accommodation of researchers as well as their labs and field stations, maintaining a database of active and past research, and ensuring the accessible dissemination and archiving of research results;
- encourage and support the signing of the formal memorandum of understanding between JNP and the University of Alberta;
- lend support to the creation of a non-profit foundation for research;
- given a traditional and ongoing overwhelming bias in the Parks Canada system toward natural science, encourage vigorously and solicit actively the research of social scientists in what needs to amount to a kind of affirmative action program;
- encourage new external research projects by allocating a pool of funds from JNP's research budget;
- on the understanding that the failure to support basic research in the short term will yield long-term problems, recognize the importance and value of all types of research—basic, applied and mandated; and
- establish a formal system of staff support for external research projects, complete with a written agreement that states the mutual expectations of researchers and JNP, with each external project having assigned to it a member of the Park staff whose best interest is served by expediting the successful completion of the project.

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