Research Links
A Forum for Natural, Cultural and Social Studies

Highway Effects on Wildlife in Banff National Park:

A Research, Monitoring and Adaptive Mitigation Program


Crossing structures, currently under construction, may facilitate wildlife passage across the TransCanada Highway.

Anthony Clevenger

The current rate of habitat fragmentation and human development along the TransCanada corridor is a threat for the long term survival of wildlife in Banff National Park (BNP) (Banff-Bow Valley Study 1996). The TransCanada Highway (TCH) has serious effects on wildlife populations in the Park, fragmenting habitat, acting as a barrier to natural movements in the Bow Valley and more importantly, it is a significant factor in wildlife mortality. Roughly half of the reported wildlife deaths in BNP can be attributed to highways (Shury 1996). Levels of highway-related mortality for some populations in Banff is equal or greater than mortality rates in hunted populations (Gibeau and Heuer 1996). Ironically, the Park is intended serve as a core refuge and a source for replenishing peripheral, unprotected populations outside its boundaries.

The TCH, the most important transporation route in Canada, brings high-speed and high-volume traffic into the Park. In the last 20 years, traffic volume has increased steadily, and the highway has been frequently upgraded to meet the demand. The first upgrade began in 1980 at the east gate. Today, twenty-seven kilometers have been twinned (expanded from 2 to 4 lanes; Phase I & II), another 18 km twinnng project is currently underway (Phase IIIA), and the remaining 30 km to the Yoho National Park boundary will likely be upgraded in the next five years (Phase IIIB).

Several measures were taken to mitigate the adverse effects of the highway upgrades on wildlife. Crossing structures (under- and overpasses) were constructed to link habitat and provide wildlife with safe routes accross the highway. Wildlife exclusion fencing keeps animals off the highway right-of-way (ROW) and directs them to the crossing structures. Studies show that when crossing structures are used in conjunction with fencing, highway-related mortality is reduced (Reed *et al*. 1975, Woods 1990, Foster and Humphrey 1995).

Two years after twinning and fencing the first 26 km of TCH in BNP, ungulate road mortality was reduced 96% (Woods 1990). Until now, mitigation on the TCH focused primarily on ungulates and the measures seem to be effective. However, the effectiveness of crossing structures for other species, particularly large carnivores is questionable (Kansas *et al.* 1989, Gibeau 1993, Paquet 1993).

In the fall of 1996, a research and monitoring plan will examine the effects of highways on the long-term persistence of viable populations in BNP. The objectives of this work are to: 1) monitor wildlife use of the mitigation measures, 2) evaluate them for their effectiveness in reducing highway-related mortality and maintaining population connectivity, 3) make recommendations for improving them if necessary, 4) identify potential problem areas and research gaps as they relate to the TCH and associated fauna, 5) initiate new studies where needed, and 6) develop a predictive model that will help identify wildlife-vehicle collision hot-spots on the TCH from historical highway mortality data. The results of this work will yield data needed to improve functional crossing structures along the TCH, advance our knowledge of highway-associated wildlife behavior, and more importantly, apply the best available technology to highway planning and design in BNP and elsewhere.

MONITORING AND ASSESSMENT OF HIGHWAY MITIGATIONS

Wildlife use of Crossing Structures

Wildlife use and the effectiveness of highway crossing structures can best be assessed when exclusion fencing is impermeable and

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Research Links

Volume 5 • Issue 1 • SPRING 1997

"SAMPA Issue"

FEATURE ARTICLES

DEPARTMENTS

FRANCOPHONES

Le texte de cette publication est offert en français. Vous pouvez l'obtenir en écrivant a l'adresse dans la p. 24.

SUBMISSIONS WELCOME FOR SUMMER ISSUE. DEADLINE IS JULY 4, 1997.

For information on the Third International Conference on Science and the Management of Protected Areas, contact the SAMPA III Conference Secretariat. Tel: (403) 292-4519 Fax: (493) 292-4404, E-mail: sampa3@pch.gc.ca

EDITORIAL

Welcome to this special issue of Research Links featuring a preview of the SAMPA III Conference to be held in Calgary at the University of Calgary this May 12-16. Elsewhere in this edition Neil Munro, Co-Chair of SAMPA III, provides some of the conference history and background on the association.

In order to involve protected areas researchers and managers from the west, I sought permission to move this year's conference from its Maritime roots to western Canada. Parks Canada West has been generous in its support, allowing Patricia Benson, Conference Secretariat, and myself to spend countless hours planning this event. We worked with a dedicated Steering Committee to bring to you a conference with a montane cordillera orientation and yes, even from our foothills location, a significant marine component.

This year's conference is an opportunity to focus on research underway in and around the protected areas in the mountain Cordillera of North America and to consider linkages amongst them. Western management issues are often large and extend far beyond the local area because of the large protected areas in the west and their high profile as visitor destinations. Much research has been done to assist managers in making decisions. This conference is an opportunity for those involved to share the results of their work and exchange ideas. Participants will also have the opportunity to discuss the results of research being done in many other areas of North America and elsewhere in the world. A field trip will be a highlight of the week, as all participants may experience the Bow Valley and examine the conference theme—Linking Protected Areas with Working Landscapes Conserving Biodiversity—with some very experienced park managers from multiple jurisdictions.

SAMPA Conferences include a marine component. The organizers of SAMPA III have planned presentations such that all participants will be exposed to some marine and some terrestrial oriented papers. Sessions are organized to encourage participants to expand their horizons across the land/air/water interfaces. International speakers will enable participants to explore new ideas by providing perspectives from abroad.

Response to calls for papers has been overwhelming. We reviewed abstracts and selected papers for presentation based on their relevance to the conference theme. Some excellent papers have been assigned to a poster session where participants can review a wide variety of information at their leisure.

We hope the conference will be attended by protected area managers who see the value of research underway beyond their areas of immediate concern. This is a conference of applied research and we encourage presenters to relate their work to managerial needs. Many attendees will be students who are often unable to attend conferences far from their places of study. This is their opportunity to gain knowledge regarding issues affecting the ecological integrity of protected areas and learn about the research taking place to assist management in addressing these issues.

I hope that all Research Links readers will enjoy this taste of SAMPA III. For those of you planning to attend the conference, warm, western hospitality awaits you. For those of your who cannot attend, enjoy this preview!

Bernie Lieff
Editorial Board Member, Chief Ecosystem Management Services and Co-Chair of SAMPA III.

SAMPA III

The West Welcomes the Third International Conference On Science and the Management of Protected Areas

Neil Munro

The Science and Management of Protected Areas Association (SAMPAA) has left the shores of Nova Scotia for the first time, to hold its third International Conference in Calgary. SAMPAA encourages people from various backgrounds to meet and discuss the use of science in the management of protected areas. SAMPA conferences are Canada's premier public venue for bringing managers and scientists together to discuss protected areas management. These forums provide an opportunity for researchers, land managers, academics and non-governmental organizations to inform each other of significant contemporary issues and to propose actions for further responsible management of protected areas. Speakers from around the world are encouraged to participate, share views and exchange experiences to ensure participants have a broad view of issues. Papers presented at the conference are refereed and published in a hard-bound proceedings for easy reference.

SAMPAA has been active sponsoring local workshops, collaborating with the George Wright Society (US) to produce an IUCN publication on Coordinating Research and Management of Protected Areas, and this past year, developing and delivering a three week Smithsonian/Man and the Biosphere course on Forest Biodiversity Monitoring.

Founded in 1990 by a group of scientists and managers, SAMPAA was in part responding to a recognized deficiency in the interaction between scientists and managers. Nonetheless, there was a strong commitment to improve communication and understanding between researchers and land managers. SAMPAA was incorporated under the Nova Scotia Societies Act and is recognized as a nonprofit organization. The objectives of the society are to promote the effective use of science and technology in the management of protected areas; support research activities and scientific scholarship which may benefit the field of protected areas management; provide a forum for consultation and education; and promote cooperation and information exchange among land use managers and specialists in the academic, public and private sectors.

The first major endeavor of the association was to organize the first International Conference on Science and the Management of Protected Areas, which became the theme for the conference. It was held in May, 1991, at Acadia University in Wolfville, NS. Two hundred and ten participants from diverse backgrounds attended. The proceedings, published by Elsevier in early 1992, contained 75 of the papers presented. Three years later, the Second International Conference was held at Dalhousie University in Halifax, NS. The theme of this conference was Ecosystem Monitoring and Protected Areas. A concurrent symposium, on Marine Protected Areas and Sustainable Fisheries, was equally successful. Over 300 people attended and two volumes of Proceedings containing 104 papers were produced and published in Canada by the Association. Copies are available, and can be ordered from the Conference Secretariat.

At the Calgary conference, discussions on the management of greater park ecosystems and how to best protect biodiversity will be key themes. Previous conferences have attracted internationally known presenters such as Reed Noss and Chris Maser. Some of this conference's presenters include Michael Soulé, Conservation Biologist, Adrian Phillips, Chair of the World Commission on Protected Areas, Gary Davis and John Reynolds of the US National Park Service.

This year's SAMPA conference challenges individuals working within and external to protected areas to explore opportunities for better management, especially as it affects biodiversity. The theme "Linking Protected Areas with Working Landscapes-Protecting Biodiversity" is one with a considerable challenge. Both leadership and cooperation are required to bring about long term protection of biodiversity. The reduction to our life-support systems through loss of biodiversity and associated habitats is an increasingly urgent issue that needs resolution. One of the prime purposes of this conference is to look at successful approaches and concepts that might help us slow the rate of biodiversity loss. Sharing these ideas beyond the scientific community, with land managers and the public is another priority of the conference.

Neil Munro is Co-Chair of SAMPA III. E-mail: neil_munro@pch.gc.ca

THE SAMPA LOGO

The concept of the SAMPA logo was developed by Martin Willison for the first SAMPA conference early in 1992. Although Willison notes that the current logo is slightly different in detail from the original used for the first and second conferences, the key concepts which represent the roles of science and management, as well as terrestrial, aerial and aquatic environments, have been retained.

"The idea (behind the logo design) was that a scientific instrument, a simple one, was both measuring and protecting a natural environment. The spruces are intended to be *Picea mariana* (black or "bog" spruce), which is typical of Nova Scotia. The birds are unidentifiable in the current logo, but I see the lower one as a black duck in the original. At the right there is water, and the wavy line at the bottom also indicates water. There used to be some wetland plants at the lake margin, but unfortunately they disappeared in the process of digitizing the image."

- Martin Willison
SAMPAA Board Member

The Legacy of George Wright

George Mendelez Wright was born into a wealthy sea captain's family in 1904. As a child, he roamed the San Francisco Bay area and came to love and to know its plants and animals. In college he studied with famous naturalists of the day, including zoologist Joseph Grinnell. In 1927, as an assistant park naturalist in Yosemite Valley, he became concerned about the disappearing Tule elk, the overabundance of tame mule deer, the scarcity of predators, marauding black bear already accustomed to feeding on garbage, and the impacts of hunting and trapping along the park's boundaries. Scientific wildlife conservation and management had not yet become an institutionalized part of park management.

In 1929, Wright did something about his concerns by initiating a wildlife survey program (which he funded himself) for the national parks then extant in the United States. In 1930, he became the first chief of the wildlife division of the US National Park Service, and under his leadership each park started to survey and evaluate the status of wildlife and to identify urgent problems. Recommendations for restoration were generated, and special attention was paid to rare and endangered species, conflicts, and sources of problems. A member of the influential Cosmos and Bohemian clubs, Wright associated with the conservation luminaries of his day, and worked with them on conservation projects beyond the national parks. He influenced nationwide planning for public parks and recreation areas and was named to a commission to work with Mexico in identifying and establishing new areas along the international boundary.

Wright's contributions are distinguished by a keen perception of problems. He recognized that, even then, protected areas are not islands that can stand aloof from the rest of the world. He was one of the first protected area professionals to argue for a holistic approach to solving research and management problems. His analyses were so far ahead of their time that they still sound modern, though they were written some sixty years ago.

George Wright's life was cut short by an automobile accident in 1936. Had he lived, in all likelihood he would be among the best known American conservationists of his generation. With its name, the George Wright Society honors his vision.

The George Wright Society

Dave Harmon

The George Wright Society (GWS) is a professional association for researchers, managers, and educators who work in or are concerned with parks and other protected areas, an organization which parallels Canada's Science and Management of Protected Areas Association (SAMPAA). Over the last century, the group of people responsible for research and management in protected areas has evolved into a specialized professional community. They are a diverse community of individuals, from such a wide spectrum of disciplines, working toward common goals. This diverse community reflects the rich variety of values associated with cultural and natural parks, public forests and rangelands, wildlife refuges, marine reserves, and other protected areas. For protected areas to be effective, historians must confer with natural resource managers, foresters with coastal biologists, archaeologists with interpreters, area managers and supervisors with data specialists—and all of these with the public. The GWS was founded in 1980 to foster this sort of communication and bolster a sense of shared purpose in what can easily seem a fragmented professional community.

The GWS pursues its goals by:

- Publishing a quarterly journal, The George Wright Forum: A Journal of Cultural and Natural Parks and Reserves. The George Wright Forum is devoted to interdisciplinary inquiry about protected areas. We seek to publish critical thinking on all aspects of research, management, and education as they relate to cultural and natural protected areas.

- Holding conferences. Every two years, The George Wright Society is the organizer and primary sponsor of a Conference on Research and Resource Management in Parks and on Public Lands. It is the USA's premier interdisciplinary conference on protected areas. By "protected areas," we mean a broad array of places, both "cultural" and "natural," managed by different entities including: parks at all levels; historic and cultural sites; and research areas and designated wilderness within publicly held forests, grasslands, wildlife refuges, and other public lands; tribal reserves; marine, estuarine, freshwater, and other aquatic sanctuaries; private land-trust reserves; and similarly designated areas. The 1997 conference, held March 17-21 in Albuquerque, New Mexico, was the ninth in a series of conferences on park research and management, dating back to 1976.

- Maintaining a Web site which includes an annotated hotlist of references to Internet resources for professionals working in cultural and natural parks and protected areas. The Web address is: http://www.portup.com/~gws/home.html

- Producing a variety of publications on park research and management issues. A complete list is available on-line through the GWS Web site.

- Serving as a clearinghouse for inquiries. We welcome questions from members and non-members alike!

The GWS is distinctive among professional organizations because it encourages dialogue and information exchange among all the people needed for protected area conservation, from historians to biologists, managers to researchers, public agencies to private organizations, academics to field personnel. Our conferences bring over 400 people together to share problems and information, hear new perspectives, and contemplate critical questions about the future of protected areas. The GWS conference is an important chance to meet people from other organizations and from other disciplines.

The GWS welcomes members from around the world. Dues for individuals are US$35 per year (US$25 for students). As a special offer to *Research Links* readers in Canada, we would be pleased to welcome you as a new member by accepting your first year's dues in CDN$ at par. This represents approximately a 25% discount!

For further information, or to become a member, please contact:

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Dave Harmon is Secretary of The George Wright Society.

Defining National Parks: J. B. Harkin and the National Parks Branch

C. J. Taylor

During the first decades of the 20th century, James Bernard Harkin (1875-1955) was one of Ottawa's more promising civil servants. A former newspaper man and political secretary to Clifford Sifton, minister of the Interior, Harkin was handed the task of forming a national parks service in 1911. At that time, national parks consisted mainly of the mountain parks now known as Banff, Jasper, Yoho, Glacier and Waterton, and were governed by unsatisfactory legislation known as the Dominion Parks and Forest Reserves Act. Harkin developed a national system of parks, a centralized agency to administer existing parks, and had a hand in drafting the National Parks Act of 1930 that enshrined principles of conservation. At the same time, he presided over a massive program of park development that transformed the nature of parks and made them accessible to the majority of Canadians.

J. B. Harkin's star began to wane after pro-development Calgary lawyer R. B. Bennett's election to Prime Minister in 1930. With the reorganization of the parks Branch as part of the new Department of Mines and Resources in 1936, Harkin, faced with either retirement or demotion, opted to retire. However, in the space of 25 years, Harkin helped to create the base for a system of national parks and define issues which are still important in national parks today.

In defining national parks, Harkin and his branch discussed conflicting points of view. On one hand, Harkin aggressively sold parks for their usefulness to the nation:

"Nothing attracts tourists like national parks," Harkin wrote in his annual report for 1913-14. Moreover, he added, ". . .the most important service which the parks render is in the matter of helping to make Canadian people physically fit, mentally efficient, and morally elevated."

On the other hand, the perception of parks as recreation areas was later overshadowed by the view that national parks should preserve outstanding areas of natural landscape:

"According to the standards which we have adopted with respect to national parks," Harkin wrote Deputy Minister Cory regarding new parks in 1925, "park areas must be outstanding in their scenic and recreational values. In addition, our inclination has been towards large areas preferably in wilderness condition because one of the purposes of a national park is to preserve bits of original Canada for all time."

It followed, then, that national parks could not be justified as regional recreation areas, serving the needs of metropolitan areas across the country. As Harkin advised the Deputy Minister in 1930:

"The primary purpose of National Parks is not recreation as it is understood by the advocates of regionally distributed National Parks, but rather that they are the outdoor museums of the finest in primitive conditions."

The ecological approach to parks led Harkin and his branch to define potential new national parks in a particular way. Harkin wrote, for example, "that the area of each park must be a logical unit, embracing all territory required for effective administration and for rounding out all the life zones of its flora and fauna." This meant that national parks had to be large enough to conserve a recognizable geographical area, later defined as a minimum of 200 square miles. A related corollary was that the national park system should include a variety of geographical areas. One of the priorities of the Parks Branch therefore became acquiring an oceanside park, and Harkin was prepared to turn down proposals for new mountain parks until this end was achieved. He turned down the chance to establish Garibaldi Park in BC while anticipating the aquisition of Prince Edward Island National Park.

While increasingly conservation minded in its official policy, national parks were heavily immersed in building programs that were profoundly changing park landscape. Despite growing emphasis on parks as wilderness conservation areas, Harkin was determined to make them accessible to people. Roads and other facilities were necessary to attract tourist dollars, and visitor statistics were used to secure appropriations from parliament.

During the 1920s the Branch embarked on a massive highway building program to open up the mountain parks to international automobile tourism. The parks mountain highway building program was the largest single project undertaken by the National Parks Branch in the years before 1940. During this period, highway building consumed almost one quarter of the entire budget for national parks. Aware of the dramatic effects roads could have on the landscape of parks, Harkin made an effort to study the problem.

He concluded that the key to opening parks to automobile travel was careful planning which balanced concerns for development with those for conservation. The proper location of highways, for example, could provide scenic enjoyment without blighting the landscape. Harkin later said: "I feel that everything our engineers construct in the Parks should be dominated by the spirit of beauty." Road engineers were instructed to locate roads with an eye for the scenic rather than the strictly utilitarian. Hotels and other buildings were constructed to accommodate the increasing numbers of tourists but, as with roads, Harkin believed their presence could be mitigated by careful planning. After 1922 designs for new buildings in the parks were subject to head office review aimed at establishing a pleasing park aesthetic.

J.B. Harkin

During the Harkin years, the National Parks Branch established parks along the present lines as large multi-purpose reserves. They serve as wilderness reserves, game sanctuaries and tourist attractions. This led the Branch into that paradox of parks: in order to experience parks, they must in part be destroyed. This leaves us with the question: Was Harkin aware of this paradox? Probably not. Harkin saw some development as a good thing, introducing people to the wilderness. He seems to have been unaware of parks as managed environments, and despite speaking of ecological aims, likely did not have an "ecosystem perspective" as the term is understood today. Then again, the scale of development in national parks in the 1920s and 1930s, does not compare with the scale of park development in years since.

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Highway Effects on Wildlife

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prevents alternative means of animals accessing the highway ROW. Therefore the 27 km of exclusion fenceline was inspected for gaps, holes and other needed repairs. This work will be carried out annually and new evidence of fence intrusions by wildlife will be addressed immediately.

Twelve highway crossing structures are currently being monitored and data collected on wildlife use. Prepared track sections and infra-red operated 35mm cameras are means of detecting wildlife visits and passages at the underpasses. Monitoring also is taking place at all potential travel routes under the TCH (eg. creek undercrossings and below large span bridges).

Previous winter work showed that wolves (*Canis lupus*) approached the structures, they passed through them only 50% of the time (Paquet 1993). To investigate this behavior and widen the scope of the work, we are evaluating the response of wolves and other highway-wary species to crossing structures by routinely inspecting a semi-circular transect, 100 m in radius from the structure ends.

Work has begun examining crossing structures and their environment as factors influencing wildlife use. Variables associated with the structures and their surroundings will be used to ascertain the relationship between the variables and the frequency of wildlife crossing use. Based on the results, it may be recommended to minimize impediments to use by retrofitting existing structures and providing more favorable habitat conditions.

Performance and Effects Analyses

Invariably the following questions arise: When will we know that the highway over- or under-passes work? How will the success of the highway mitigation measures be determined? Their success cannot be measured in sheer numbers alone, as one cougar (*Felis concolor*) or wolverine (*Gulo gulo*) passage, allowing genetic interchange once per generation, may be as valuable as hundreds of elk passages per year. A functioning system of crossing structures must permit individuals to fulfill their biological needs and recolonize habitats from which they have been locally extirpated. A valid performance assessment will require data from rigorously conducted, long-term cooperative wildlife studies monitoring movements, population trends, and activity in and around the crossing structures.

The continuous monitoring of wildlife activity at the crossing structures will give us initial data to determine how and what species are affected by the TCH. Knowledge of animal distribution and their relative densities along the TCH corridor will contribute further to explanations of wildlife crossing structure use. Location data from on-going radiotelemetry studies in the Bow Valley will allow for analyses of real and hypothetical movements and determination of home ranges relative to the TCH in BNP. Comparative habitat suitability assessments of areas separated by the TCH will shed light on why some population distributions or individual ranges favor one side of the TCH versus the other.

Special Concerns

Some areas of research along the transportation corridor which merit special attention include: an analysis of the effects of road salt on aquatic systems adjacent to the TCH, in particular amphibians and their life history requirements; TCH effects on habitat connectivity of non-flying insects with specialized habitat needs; and TCH effects on micro- and meso-fauna that readily permeate exclusion fences and are unaffected by highway mitigation measures.

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Banff-Bow Valley: At The Crossroads

Charlie Pacas

Photo: Andrew Dickinson

BACKGROUND

The Banff-Bow Valley Study was a twenty-seven month initiative to ensure that sustainable management and land use strategies are developed and implemented to protect the environmental integrity, and the social and economic vitality of the Banff-Bow Valley for future generations.

The study was initiated in 1994 by the Minister of Canadian Heritage to stem the ongoing rhetorical debate among various interest groups, and had three main objectives:

- Develop a vision and goals for theBanff Bow Valley that will integrate ecological, social and economic values;
- Analyze existing information comprehensively, and provide direction for future collection and analysis of data to achieve ongoing goals and;
- Provide direction on the management of human use and development in a manner that will maintain ecological values and provide sustainable tourism.

The Study's Task Force, an independent body from the federal government, implemented an approach unprecedented in national parks. A shared decision making process incorporated public opinion to formulate recommendations through the Bow Valley Round Table. In addition to this approach, the Task Force initiated a broad range of research programs to meet the Study objectives. (Please see page 10 for details regarding these research programs and related reports.)

INTRODUCTION

Banff National Park (BNP), the birthplace of Canada's national park system, was established in 1885 to preserve a 26 km^2 area encompassing thermal springs located on Sulphur Mountain. The deputy minister of the Interior at the time stated that the Banff Hot Springs were to become "the greatest and most successful health resort on the continent" and commenced planning for the construction of roads and bridges and other operations necessary to make the Reserve a credible National Park (Lothian 1976 cited in McNamee 1993). Since then, the need to strike a balance between preservation and development has been an issue in BNP.

BNP is internationally renowned as one of Canada's best known and frequently visited national parks. Visitation has changed dramatically since park establishment. In 1887, attendance was estimated at 3,000 visitors. By 1995, more than five million people visited the park, translating to more than 20,000 vehicles entering the park's East Gate on an average summer day (Pacas 1996).

Visitor services have also changed to accommodate increasing visitation. In the early 1960's, businesses in Banff Townsite numbered approximately 200. Today, visitor service centres in the Park contain more than 850 businesses; including 125 restaurants, 220 retail outlets, and three downhill ski areas. The Town of Banff, Hamlet of Lake Louise and adjacent areas contain over 360 km of paved roads providing access to over 3,600 rooms and more than 2,800 campsites. The influx of visitors over the years has also contributed to the economic development of Canmore, a resort community located 8 km east of the Park.

If the current trend in visitation continues, the Bow Valley Study area can expect an additional 13.6 million recreation visits by the year 2020. This trend of increasing usage, and the patterns with which visitors and residents currently use the park, weighs heavily on the park's natural resources. Park managers must meet the overwhelming challenge maintaining the park's ecological integrity, while trying to accommodate increasing visitor use and demands on park infrastructure.

Visitation numbers and use are the main pressures on the Banff Bow Valley and surrounding area (Cornwell and Costanza 1996). Over the last 45 years, many environmentally sensitive areas of high value and their fragile ecosystems have been affected by the influx of visitors, supporting infrastructure and development pressures. Sensitive, affected areas include the Vermilion wetlands, the montane ecoregion and linkage zones between BNP and adjacent regions (which are particularly important for wolves and grizzly bears). Based on evidence in the Ecological Outlook Project, town, lodge, highway, railway, trail and other facility development continues to have a detrimental effect on aquatic and terrestrial systems in the Banff-Bow Valley (Green *et al*. 1996).

Introducing non-native fish, fish stocking activities, altering wetlands, regulating water flows and water levels, and creating water impoundments have greatly altered aquatic biodiversity (Schindler and Pacas 1996). Population growth, urbanization and the development of outlying commercial accommodation have also resulted in declining water quality, increasing nutrient, chemical and pathogen concentrations in the water system.

Landscape fragmentation, wildlife mortality, loss of habitat connectivity, and the regulation of fire have seriously impacted wildlife species and vegetation communities (Achuff et al. 1996; Gibeau *et al*. 1996; Paquet *et al*. 1996; Woods et al. 1996). Changes in the distribution and abundance of elk in the valley which result from human activity lead to human-elk aggression, the loss of trembling aspen and detrimental effects on other species such as moose and beaver.

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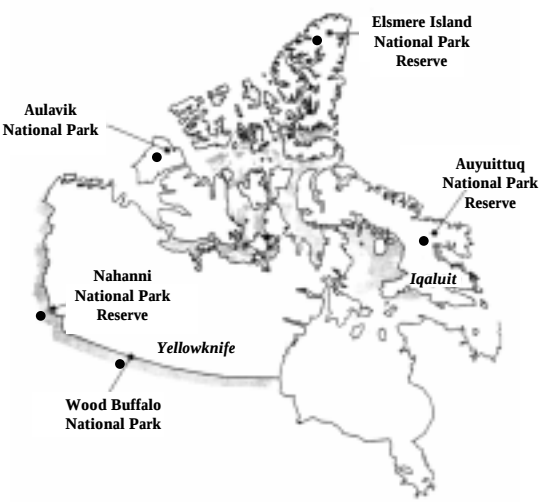
Ecological Monitoring in the National Parks of the North



Chuck Blyth

Ecological monitoring is a form of quality control, essential to assess ecological dynamics. Although closely related to in-depth ecological research, the two disciplines are not the same. Ecological monitoring is a suite of standardized procedures applied consistently at regular intervals over a long period to measure the "vital signs" of an ecosystem. An initiative to develop such a program for ecological monitoring in the National Parks of the NWT was suggested by McCanny and Henry (1995). In Winnipeg on December 12, 1995, senior management strongly supported this idea and, as a result, follow-up meetings were conducted in Ft. Smith in May, 1996 to develop a program for National Parks in the NWT. These meetings involved management, park wardens and ecologists who produced the following vision:

Vision for Ecological Integrity Monitoring

Parks Canada - NWT will show leadership in the maintenance of ecological and commemorative integrity by developing an integrated monitoring program. This program will be implemented in all its Parks by 1998. Eight baseline measures will form the core part of this monitoring program: climate, cultural resources, water quality,landscape diversity, plant phenology, disease, human use and biodiversity.

To this core program, each park will incorporate threat specific monitoring measures. Park based monitoring teams will implement this program. Trends in the eight core measures will be monitored in all parks simultaneously, thus permitting integrated monitoring across the NWT. Emerging patterns will be used to assess the types of stresses affecting Park ecosystems.

On November 17-20, 1996 at Ft. Smith, NWT management, park wardens, ecosystem specialists and guests met to complete protocol development for all eight core measures and discuss the logistics of implementing the measures as well as the interpretation of data for ecosystem management decisions. This meeting resulted in agreement on the methods for most protocols and a detailed schedule for further development of the program. Climate and water quality standatrds were easily developed from existing Environment Canada protocols. Like wise, plant phenology will be monitored using a method adapted from the International Tundra Experiment (ITEX). These standards make it possible to compare data across arctic regions. Protocols for biodiversity represented a difficult problem given the size of the task at hand. Several methods, including lemming population dynamics, large ungulate air surveys, snow track counts and Modified Whittaker vegetation plots were agreed upon as means of measuring biodiversity.

Instructions for the collection and analysis of data for each protocol are being be prepared during the winter of 1996/97. Once these instructions are in place, each protocol will be tested/ piloted in at least one NWT park in the summer of 1997. Feedback and results will be analyzed and protocol methods refined for implementation in all NWT parks in 1998. To accomplish this rather large task, teams consisting of people from the field and the service centre were assembled to complete the development of each protocol, including one for data management. Some protocols, e.g. plant phenology (ITEX plots), will be tested in all parks, whereas others, such as human use monitoring, a protocol which would require extensive modification for use in most NWT parks, will be piloted only in Ivvavik National Park.

The process of team building and consensus among management, ecosystem specialists is and field staff is achieving results and providing all involved with a common currency for discussion and consistency for purposes of training. With the success of these early planning stages, it is hoped that ecosystem management can move into a more certain future founded on knowledge-based rather than belief-based management decisions.

For further information, contact the team leader for each protocol. They are namely:

Climate	Mike Etches	Wood Buffalo at Ft Smith	(403) 872-7966
Water quality	Doug Clark	Eastern Arctic at Pangnirtung	(819) 473-8828
ITEX	Martin Raillard	Western Arctic at Inuvik	(403) 979-3248
Landscape	Stephen McCanny	Winnipeg Service Center	(204) 984-6228
Biodiversity	Martin Raillard	Western Arctic at Inuvik	(403) 979-3248
Disease	Steve McCanny	Winnipeg Service Center	(204) 984-6228
Cultural Resources	Dave Arthurs	Winnipeg Service Center	(204) 984-5822
Human Use	Maureen Peniuk	Winnipeg Service Center	(204) 984-2416
Data Management	Chuck Blyth	HRM at Ft Smith	(403) 872-7938

Chuck Blyth is the data base coordinator for the NWT field unit. He is currently producing a report on the status of data base management and will be developing a plan for NWT National Parks.

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The Status and Distribution of *Physella johnsoni*, the Rare Endemic Banff Springs Snail

Dwayne A.W. Lepitzki

In some of the hot springs on Sulphur Mountain in Banff National Park (BNP) lives an inconspicuous snail that is found nowhere else in the world. *Physella johnsoni* (originally *Physa johnsoni*), was named by Clench (1926) in honour of C.W. Johnson, an entomologist of the period. This snail was originally described and collected from only a handful of hot and cool springs in BNP (Clench 1926, Clarke 1973) in the late 1920s. Over 35 years elapsed until the next collection: in 1965 *P. johnsoni* was collected from one location only (Clarke 1973). Shortly thereafter, Clarke (1977) suggested the species was "clearly endangered and should be protected." The snail is also identified as a Special Resource of BNP (Achuff *et al*. 1986). Until now all that was known about the snail was its historic presence in some hot springs in BNP. In 1996, the Hot Springs Enterprise Unit of Parks Canada initiated a study to determine the status and distribution of the snail. What follows is a summary of that study (Lepitzki 1997a.).

Physella johnsoni is a member of the Physidae family, a group of freshwater snails with shells that coil to the left (sinistrial). This characteristic distinguishes physids from all other North American families of freshwater snail which have shells that coil to the right (dextral). *P. johnsoni* are quite small and have globe like shells (Figure 1). The maximum shell length is 8.8 mm (Clarke 1973), but most individuals are considerably smaller, around 5 mm in length. A small, black eye can be seen at the base of each slender tentacle.

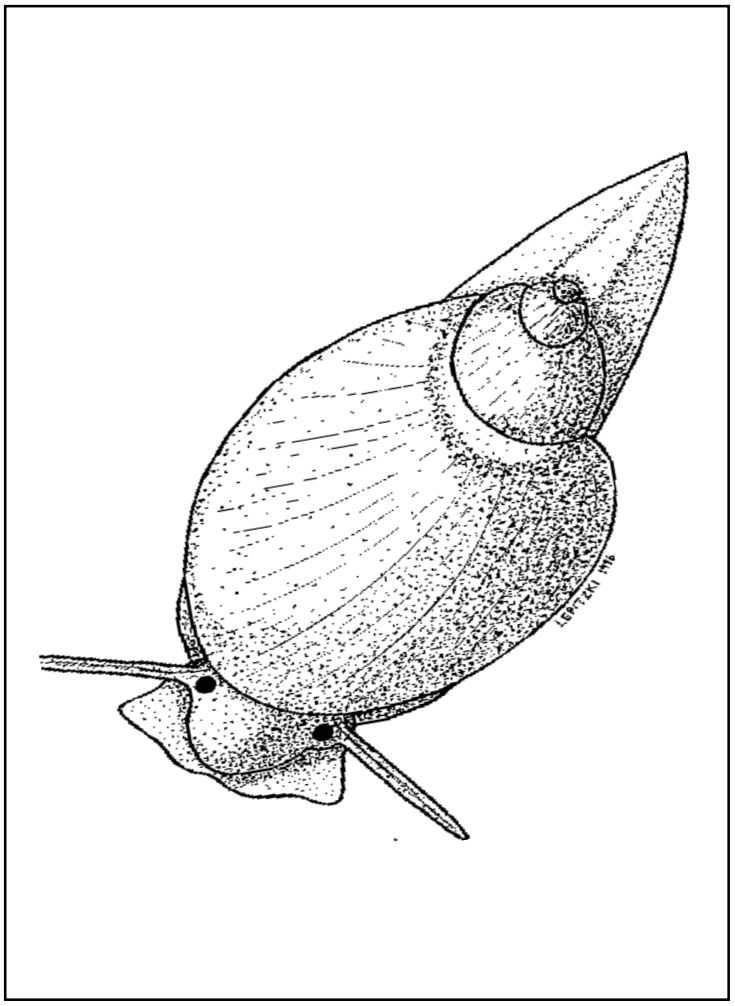

Figure 1. Physella johnsoni, actual size: approximately 5 mm.

RECENT RESEARCH

In 1966, a study began to establish the status and distribution of *P. johnsoni*. Some of the objectives were:

- to determine the presence of *P. johnsoni* at each location
- to estimate the population size of *P.johnsoni* at each location
- to determine whether population numbers fluctuate seasonally
- to determine the local distribution (on a scale of metres) of *P. johnsoni* in each hot spring and outflow stream.

Every three weeks throughout 1996, each of the known locations for *P. johnsoni* was visited. Maps of the hot springs and their outflow streams, drawn with the aid of compass and tape measure, delineated sections or sites. Site divisions were based on the contour and outline of the hot spring and outflow stream.

Each site was visually searched for snails at each visit. All snails inhabiting each site were counted with the aid of a hand tally counter. Snails were not handled; the largest and smallest individuals at each site were measured with a ruler *in situ*. Water temperature was recorded periodically along each hot spring using an electronic probe.

RESULTS

During 1996, no live freshwater snails were found at three of the historic locations. Live physids identical to the description of *P. johnsoni* were found at five others. A related physid, *Physella gyrina*, was found at the Cool Springs at Third Vermilion Lake, and is common throughout Canada (Clarke 1973, 1981).

Numerous shells of *P. johnsoni* were found in the outflow stream of one of the locations, suggesting that the species was recently present. A single shell was found at one hot spring on the last day of the survey and no shells were found at another, suggesting that the species disappeared from these two hot springs some time ago.

Trends in *P. johnsoni* population numbers have not previously been recorded. During this study, population estimates fluctuated extensively (Figure 2). Within each hot spring, snail numbers varied from 2.6 to 26.9 times. At the lowest point in the fluctuations, the observed number of snails at each of two hot springs was alarmingly low, 43 and 147 snails respectively.

Three possible patterns in snail numbers can be noted. In Hot Spring 1, numbers increased gradually in 1996. In Hot Spring 2, an exponential increase occurred during the latter part of the year. At the other three hot springs, numbers increased in January, declined

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Banff-Bow Valley: At The Crossroads

– continued from page 7 –

AT THE CROSSROADS

Today the Banff-Bow Valley is facing a paradox. Although its scenic splendour and ecosystems are environmental assets that attract and sustain tourism, these qualities are increasingly compromised through overuse. Evidence from the Ecological Outlook Project indicated the ecological integrity is compromised for various indicator species and suggests that unless a new path is chosen, Banff may not meet the criteria for a national park in the future. However, it is not too late to change direction.

To take this new path will require courage, personal sacrifices, cooperation and political will. Crafting the vision for the Banff-Bow Valley marks the beginning of this journey and demonstrates that a holistic approach, focusing on public involvement, will be required to make the vision a reality.

Current evidence demonstrates that further compromise to natural processes in the Banff-Bow Valley cannot be sustained. Growth in visitor numbers and use patterns will continue to erode cultural and ecological integrity in the Valley unless a comprehensive management program is implemented. The resident population and current infrastructure are also inconsistent with the principles of National Parks, and sustainable levels must be established. As infrastructure in the Banff-Bow Valley reaches its maximum, pressure will increase in adjacent communities to compensate. Subsequent development in these communities will also have ecological consequences for the Bow Valley.

Continued human use and regional growth represent difficult challenges for Parks Canada. A consistent application of the National Parks Act and Park's Canada Policy are fundamental elements of successful management design and implementation. It is important to strengthen the relationship between the BNP and outside entities to ensure the values which define the uniqueness of the area will not be lost. Facilities and infrastructure design must be updated to include advances in ecological and engineering principles such as wildlife overpasses and underpasses, elevated highways, unified transportation corridors and higher flow capabilities at hydroelectric dams. To ensure that ecosystems continue to function fully, natural processes such as fire and flooding must also be restored.

Better information, public awareness, environmental stewardship and a shift to greater personal responsibility are required to ensure that the area's natural capital is protected. A vital ingredient to this direction is the adoption of the Touchstone Tourism Destination Model. This model sets a clear standard, outlining ways in which tourism can support and enhance ecological integrity in an environmentally sensitive tourism destination (Banff Bow Valley Study 1996). Helping the tourism industry understand the concept of ecological integrity and how visitor activities affect ecological integrity are essential to achieving this objective.

The need to embark on a path toward sustainability in the Banff-Bow Valley is clear. Perhaps the greatest challenge will be to ensure that adequate funding is made available to implement the recommendations of the Banff-Bow Valley Study. Clearly, all who share BNP should participate financially in its restoration. If we do not, what legacy will be available to future generations?

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Research Projects in the Banff-Bow Valley Area

ECOLOGICAL OUTLOOK PROJECT

This project attempted to evaluate the cumulative environmental effects of the forces at work in the Banff-Bow Valley and to predict how current behaviour, trends and decisions will shape its future. This project included two closely related studies: the Cumulative Effects Assessment (CEA) and the Futures Outlook Project.

The Cumulative Effects Assessment Project quantitatively assessed the cumulative effects of land use development, and human presence and activities on aquatic and terrestrial ecosystems, the physical environment and socio-economic systems by evaluating the changes to key representative species or indicators in the past, the present and the reasonably foreseeable future.

The Futures Outlook Project analyzed potential interactions among environmental, economic and social-cultural variables in response to different land use and management decisions for the Banff-Bow Valley.

Green, J., C. Pacas, S. Bayley and L. Cornwell (eds). 1996.
Ecological Outlooks Project. A cumulative effects assessment and futures outlook of the Banff-Bow Valley. Prepared for the Banff-Bow Valley Study. Department of Canadian Heritage, Ottawa, ON. In progress.

RELATED RESEARCH PROJECTS

TOURISM OUTLOOK PROJECT

This project looked at the factors that influence the type and number of visitors who come to the Banff-Bow Valley, historical developments and current global, regional and local trends. The study also identified indicators commonly used to measure development and the well-being of the tourist sector.

Coopers and Lybrand Consulting. 1995a. Tourism Outlook Project. Prepared for the Banff-Bow Valley Task Force, Banff, AB. 19pp + Appendix.

VISITOR BEHAVIOUR RESEARCH PROJECT

Visitor expectations, activities in which visitors participate and the types of activities and services available to them were looked at in the Visitor Behaviour Research Project. This research resulted in a framework to measure the nature and extent of the ecological, economic and social impact of visitors on the Banff-Bow Valley.

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Ritchie, J.R.B., E. Katic and B. Darbyshire. 1995a. National Tour Association Survey. Prepared for the Banff-Bow Valley Task Force. Banff, AB. In progress.

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Ritchie, J.R.B., E. Katic and B. Darbyshire. 1995b. Banff Tourism Industry Survey. Prepared for the Banff-Bow Valley Task Force. Banff, AB. In progress.

IDENTIFYING APPROPRIATE ACTIVITIES FOR BANFF NATIONAL PARK.

The objective of this research was to obtain the views of Calgarians on the types of activities, facilities and services that should be allowed or encouraged in Banff National Park.

Angus Reid Group. 1996. Identifying Appropriate Activities for Banff National Park: Views of Calgary Residents. Prepared for the Banff-Bow Valley Study Task Force. Banff, Alberta. 23pp + Appendices.

MANAGEMENT FRAMEWORK REVIEW

The objectives of this study were to examine the existing management model, and future trends, for governing the Banff-Bow Valley; to determine its strengths and weaknesses, and to make recommendations on how it could be improved. This study also examined selected management models for similar protected areas to determine their applicability to the Banff-Bow Valley situation.

Coopers and Lybrand Consulting. 1995b. A review of the Governance Model of the Banff-Bow Valley. 2 Volumes. Prepared for the Banff-Bow Valley Task Force, Banff, AB. 46pp.

STATE OF THE BANFF-BOW VALLEY: A COMPENDIUM OF INFORMATION

This research provided background material essential to other research projects and identified areas where data are either nonexistent or insufficient to support decisions about the future of the Banff-Bow Valley.

Pacas, C., D. Bernard, N. Marshall and J. Green. 1996. State of the Banff-Bow Valley: Acompendium ofinformation.Prepared for the Banff-Bow Valley Study. Department of Canadian Heritage, Ottawa, ON. 291pp. And appendices.

HISTORICAL ANALYSIS

The Historical Analysis looks at the key developments in the Banff-Bow Valley from 1968-1994.

Hilderbrandt, W. 1995. Historical analysis of Parks Canada and Banff National Park 1968-1995. Prepared for theBanff-Bow Valley Task Force. Banff, AB. 200pp.

The Rare Endemic Banff Springs Snail

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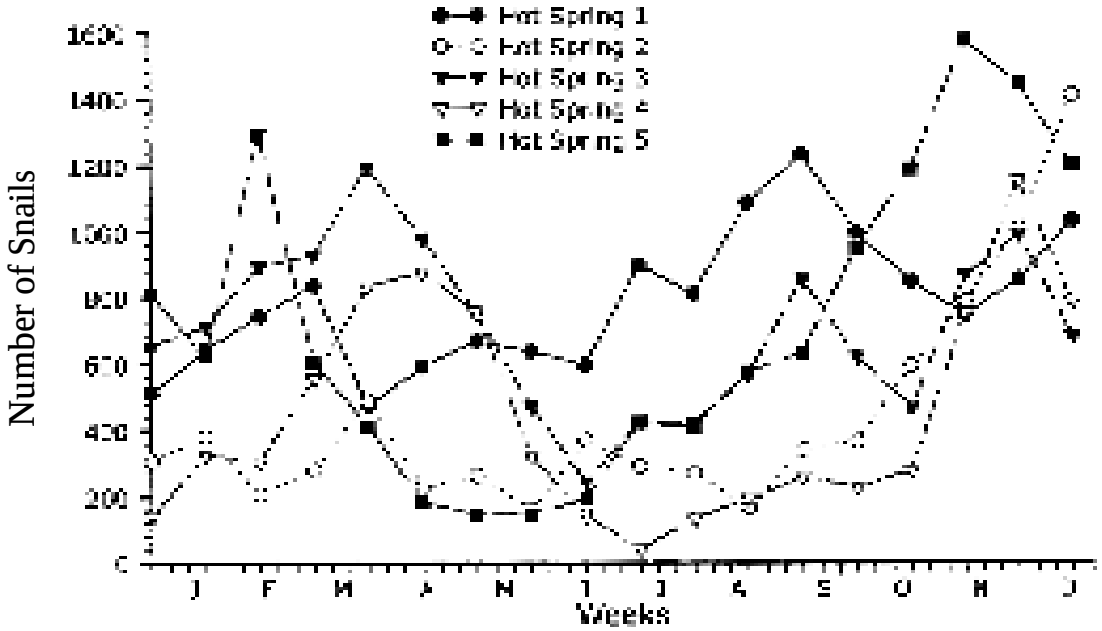

Figure 2. Total number P.johnsoni in each of the hot springs on Sulphur Mountain

from February to June, and recovered to peak or near-peak levels by November or December. If the five separate populations are combined (Figure 3), adult snail numbers declined in April and May and increased starting in July. The fewest snails were found in early June, with peak abundance during early December.

The seasonal decline in total numbers (Figure 3) occurred at or slightly before a seasonal decline in water temperature and increase in flow rate. This trend in water conditions begins in May, and is common among the hot springs of BNP (Van Evergingen 1972). The decline in snail numbers may be related to seasonal patterns in water temperature and flow regime.

Physella johnsoni appear to have an extremely limited local distribution. At most hot springs, the vast majority of snails were found in the pool where the spring originates. Even within 15 m of the hot springs' origin numbers decreased dramatically. Limited distribution is also a characteristic of Canada's only other known hot springs snail, *Physella wrighti*, which is only found along a 34 m section of an outflow stream at Laird Hot Springs in northern BC (Te and Clarke 1985).

Data from the year-long survey were also used to produce a Status Report for COSEWIC (the Committee on the Status of Endangered Wildlife in Canada (Lepitzki 1997b). The Status Report is the first step in officially listing a wildlife species in Canada. By March 1997, when the entire COSEWIC committee reviews all Status Reports, the official designation for *P. johnsoni* should be known. My recommendation for the status of "endangered" in a draft Status Report was accepted by the Lepidoptera and Mollusca Subcommittee. The status "endangered" has been recommended based on low snail numbers, extreme seasonal population fluctuations, the species' disappearance from its former range and limited distribution and local distribution.

The biology of *P. johnsoni* remains virtually unknown. We do not know

THE NEXT STEPS

whether the seasonal fluctuations and limited local distribution are indicative of a yearly cycle, part of a long-term trend, or unique events. We know nothing of the snail's reproductive biology apart from noting the presence of very small individuals at some hot springs throughout the year. Although we do know that fluctuations in water temperature and flow rate in hot springs are normal, the cessation of water flow at one of the Middle Springs

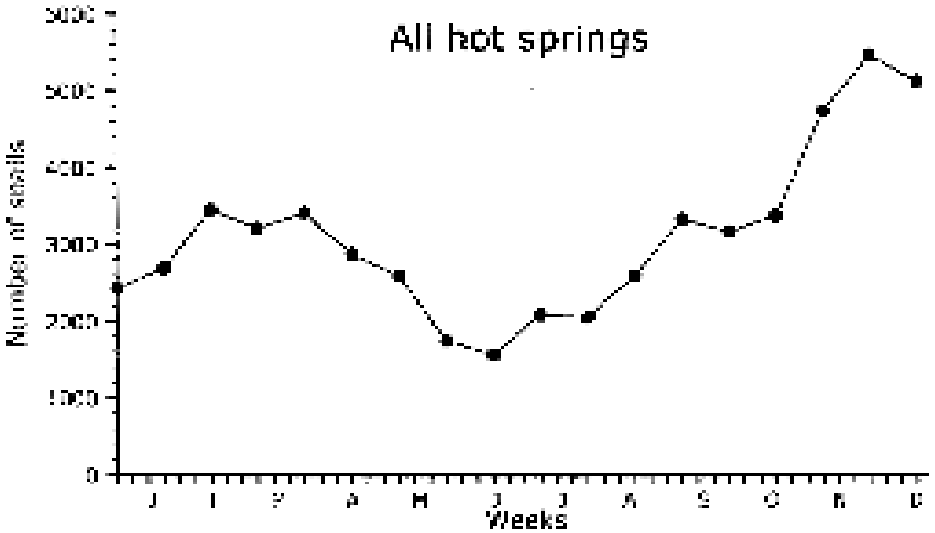

Figure 3. Total number P.johnsoni in all hot springs on Sulphur Mountain

in 1996 may be the first reported instance of this Sulphur Mountain Spring drying during the winter. It is documented that the Upper Hot Spring ceased to flow from March 12 to May 11, 1923 (Elworthy 1926, Van Everdingen 1970). The effect of flow cessation on the snail is unknown, and since *P. johnsoni* were collected at the Upper Hot Spring four years later in 1927 (Clarke 1973), the species may be able to survive these periodic events.

Parks Canada would like to continue a long-term monitoring and research program aimed at better understanding the biology and ecology of *P. johnsoni*. The species is known to exist only in the five hot springs on Sulphur Mountain in Banff National Park. It is a valuable biogeographic marker and a unique element of regional biodiversity. The hot springs it now inhabits may have acted as refuges during the last glaciation (Mayhood 1992). As *P. johnsoni* may have been reproductively isolated from all other aquatic snails for over 11 000 years, it could be used as a model in evolutionary studies. If modern sub-populations in separate hot springs are derived from a few individuals, the genetic consequences are fascinating.

P. johnsoni and *P. wrighti* are presently the only snail species known to inhabit hot springs. Of the 20 physids that once inhabited hot springs in Europe and North America since 1839 (Lepitzki 1997b), only these two survive. The uniqueness of the habitat (hot water, little or no dissolved oxygen, high levels of dissolved materials, and unique bacteria and algae), attests to the uniqueness of the species.

ACKNOWLEDGMENTS

Funding for this research was provided by the Hot Springs Enterprise Unit of Parks Canada. The Coin Drop Fund of the Cave and Basin National Historic Site purchased some equipment. The Canadian Wildlife Federation, through COSEWIC, funded the COSEWIC Status Report. Research Permits and Restricted Activity Permits were provided by Parks Canada. Dave Hunter and Joanne Cairns (BNP Wardens) helped start the study. Dave Dalman (Chief Operating Officer, Hot Springs Enterprise Unit) was key to initiating the study, and along with Charlie Pacas (Aquatic Specialist, BNP), edited a draft of this report. Brenda Lepitzki (Heritage Communicator, Historic Sites, BNP) assisted with all aspects of this study.

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ECOLOGICAL INTEGRITY AND DECISION MAKING

Some examples from the Rocky Mountain National Parks

Bruce Leeson

In recent years, the subject of ecological integrity commonly appears in literature and discussions involving Canada's national parks. The scientific definition of ecological integrity has been settled; now the challenge is, how do you maintain it, how do you get it back if you think it's lost? Perhaps even more basic in some cases, can a lost paradise be retrieved at all?

Parks Canada has a formidable task to manage for ecological integrity amidst scientific debate and skeptical stakeholders in the Rocky Mountains National Parks. However, it is clear Parks Canada has the authority and responsibility to work towards ecological and commemorative integrity, as these goals are clearly stated to be priorities in both the 1988 National Parks Act and the 1994 Guiding Principles and Operational Policies. To uphold this obligation, Parks Canada recently participated in or initiated several projects involving ecological integrity and difficult, unpopular decisions.

BACKGROUND

Canada's Rocky Mountain Parks now have more than a century of historic occupation resulting in a significant residential, social, transportation and economic infrastucture. In the case of Banff and Yoho National Parks, the TransCanada Highway (TCH) and Canadian Pacific's main rail line, both transportation routes vital to Canada's economy, run parallel through the largest valleys. Banff and Yoho, along with Jasper and Kootenay became the Canadian Rocky Mountains World Heritage Site in 1984. At that time Canadian authorities were invited to "ensure that urbanization and heavy tourism did not jeopardize the integrity of the site".

Through research projects and project planning a substantial inventory of environmental conflict has been recorded throughout these Rocky Mountain parks. Parks Canada is currently dealing with these issues using various approaches.

TRANSPORTATION CORRIDORS

Twinning of the TCH is one of the most prominent cases of development threat to ecological integrity. In 1979, a Federal Environmental Assessment and Review Panel determined that twinning was the best alternative to upgrade the highway. The panel directed that exceptional efforts must be applied to reduce environmental impact.

Wildlife conflict through roadkill, habitat fragmentation, barriers to migration and genetic exchange is the main issue. The mitigative efforts in Phases I and II have been highly successful for most ungulates. In Phase IIIA, currently under construction, unprecedented measures such as overpasses, are being installed to facilitate movement of wary species such as bears over the TCH. (The monitoring and research program for this project is described by Clevenger on page 1 of this issue of *Research Links*.)

At each of the subsequent phases of the project, the environmental protection component of the budget has increased: from 16% in Phase I, to 20% in Phase II, and 30%—about nine million dollars—in Phase IIIA. Parks Canada does not propose that constructing a four lane highway through any national park is a desirable initiative, nor that it can be done without any loss of ecological integrity. What has been learned is that the situation is not as untenable as originally forecast, and the environment has an impressive ability to accommodate most stresses if care is taken to understand ecological integrity and minimize disturbance.

WILDLIFE HABITAT

Recent research says much about the critical importance of wildlife habitat connectivity and fragmentation. Parks Canada places a high priority on wildlife and extends efforts to ensure their health and endurance. The importance of Canada's Rocky Mountain Parks in the Yellowstone to Yukon concept of preserving critical habitat for wary, dispersing species such as grizzly bears is obvious. Parks Canada recognizes its role for ecoregion and continental stewardship, and is embarking on bold measures to improve diminished wildlife habitat.

At Banff, an important wildlife corridor at the base of Cascade Mountain will be restored by removing several facilities. The buffalo paddock, horse corrals, airstrip and cadet camp will be removed to facilitate wildlife passage in the Bow River Valley at a location crowded with highways, railways, urban and recreational development. The ecological integrity benefits of this controversial action, which is criticized by some stakeholders who will be directly affected, will be immediate.

At Field, BC in Yoho National Park, increasing conflict has been noted where a spur of residential trailer court development juts from the town into a narrow wildlife corridor. Animals seldom face mortal threats at the site, but with every human encounter, they become more habituated. Habituation eventually leads to premature death or removal of the animal; this has serious cumulative results. For example, in Banff, 73 grizzly bear mortalities were recorded for 1971 to 1995. Ninety percent of these bears died within 500 m of a roadway or site of human activity, 71% of the deaths resulted from Parks Canada actions to resolve a bear/human conflict, and most alarming, 88% of the removals/ mortalities since 1983 have been female bears. In Yoho, which has about 13 grizzlies, research between 1988 and 1990 revealed the mortality situation to be worse than in Banff.

Research recently conducted in Canada's Rocky Mountain Parks reveals that maintaining habitat security for grizzly bears, wolves and Canada lynx will coincidentally protect 98% of the other terrestrial animals which occupy the same ranges. Parks Canada, with this in mind, announced their decision to remove the Field, BC trailer court in order to reduce the stress on grizzly bears and other wary animals.

CONTAMINATED SITES

A hundred plus years of transportation, tourism, and commercial recreation services has left many contaminated sites in the parks. Petroleum products are the most common contaminants. Some contaminated sites are the ongoing responsibility of operators who are still in business, such as the CP Rail yard at Field which has a large plume of heavy petroleum product under the tracks and adjacent terrain. CP Rail is completing research and preparing to initiate a reclamation action plan. Even so, it could take up to ten years to reclaim the area. Most situations are smaller than this one at Field, and are cleaned up with far less effort. However, the coal tar contamination at Bankhead near Banff is potentially more complicated. As the original operators are gone, Parks Canada becomes responsible for this orphan site. Complete cleanup would seriously impact an important historic site. Consequently, some form of risk assessment management scheme is being investigated at this time.

Accidents will probably continue to result in new contaminated sites. It is anticipated that new federal regulations concerning fluids storage tanks will reduce uncontrolled spills which lead to contamination and diminished ecological integrity. Parks Canada expects to be demanding in the application of these regulations which apply to all private and government tanks.

The are many examples of contemporary situations which have negatively affected, or threaten to reduce ecological integrity in national parks. Often, the solution to such problems involves modifying or ceasing human activity which may have proceeded for decades, and precipitates expense, anger and resentment. Scientific uncertainty sometimes exists, and unpopular decisions are resisted and challenged. A determined effort will be mandatory to ensure ecological integrity is not lost.

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PODIUM
Do Protected Areas Work?

David Mayhood

INTRODUCTION

The English writer George Orwell explored the power of language to control thought in his novel Nineteen Eighty-four. Politically-incorrect thoughts were rendered impossible by eliminating or distorting the words needed to think them. In Orwell's disutopia, one could not even conceive of "justice" or "freedom" because these words had been forceably removed from the vocabulary. Other words were used to mean their exact opposite. The Ministry of Love (Miniluv in Newspeak), the agency of law and order, routinely used torture to extract false confessions from the citizenry. In this way the word love came to connote fear, pain and loathing. The things "justice", "freedom" and "love", as we know them, could not exist because the language needed to think of them had been debased.

Though far less ominously, the language of the upcoming SAMPA III conference theme poses something of the same problem for me as Newspeak did for the denizens of Orwell's Oceania. I fear that the theme, "Linking Protected Areas with Working Landscapes [and] Conserving Biodiversity," in a subtle way makes it difficult for us to think about parks and other protected areas as the critical landscapes we know them to be.

WHAT ARE PROTECTED AREAS FOR?

Do protected areas have a purpose? Are they useful for something? Few readers of Research Links would answer anything but affirmatively. Yet the dichotomy between working landscapes and protected areas in the SAMPA III theme clearly implies that protected areas do no work. The impression almost is left that protected areas are indolent, lethargic, wasted lands—capable but irresponsible landscapes on perennial pogey, as it were. The danger in the theme is, frankly, that it will be inadvertently accepted as meaning just what it says.

For as we know, protected areas really do work. Human societies have given them many important things to do, but most park scientists and managers see that the greatest worth of protected areas is in protecting ecological function.

Eugene Odum (1993), among others, has popularized the view of natural ecosystems as the life-support systems of Earth. Natural areas (oceans, grasslands and forests), and to some extent seminatural landscapes (farms, grazing lands and managed woodlands), provide the food and most of the other physiological necessities of life (air purification, water recycling and soil enrichment) supporting the artificial environments of cities, transportation corridors and industrialized areas. Viewing natural areas in this way, we see plainly that we cannot even exist, much less thrive, without them.

Given the life-and-death importance of natural areas to humanity, the most valuable use of protected areas is to help protect the life-supporting functions of the natural environment. Protected areas can protect natural landscapes directly of course, but direct protection of all ecologically-necessary natural lands is clearly impossible. Furthermore, few if any existing protected areas on their own are likely to maintain their full biodiversity and ecological function over the long term—they are too small and isolated from each other. Finally, all nominally protected areas in fact are subject to the general deterioration of the global environment. In the end, they themselves are unprotected.

From this we recognize that protected areas must be part of a much larger strategy to restore and maintain healthy natural ecosystems beyond park boundaries. In this role they can serve as representative models of natural-area structure and function, as refuges and as sources of organisms for reintroduction into restored natural areas. We view protected areas in this way to focus critical attention where it belongs: on the unprotected natural landscapes that must remain whole, and dysfunctional landscapes that must be restored, to sustain human life on the planet.

THE TRUE "WORKING LANDSCAPES?"

This raises another sense for the phrase "working landscapes". We could think of them as landscapes that function properly. In this sense, protected areas and the larger natural landscapes they represent are the only landscapes that do truly work. All others are dysfunctional, at least to some degree. This sense of "working landscapes" I suggest is as useful and relevant as the first.

At SAMPA III, it is crucial that we recognize protected areas as working landscapes in both senses: as lands with an important function, and as lands that function properly. Doing so helps to focus our attention on their critical role in restoring and maintaining regional, and ultimately global, ecological health. It also will encourage others not to dismiss protected areas in general and national parks in specific as mere wasteful frivolities.

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REFERENCES CITED

Odum, E. P. 1993.
Ecology and our endangered life-support systems, 2nd edition. Sinauer Associates, Inc., Sunderland MA. xiv + 301 p.

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MEETINGS OF INTEREST

April 30 to May 3, 1997 — Global Change and the Biological Carbon Cycle.Victoria, BC. The conference will focus on environmental degradation related to ozone depletion, increased UV radiation, climate change, water and air pollution, urbanization and desertification of the biological carbon cycle. Many federal, provincial and non-government organizations will be represented. For information, contact The Skies Above Foundation. Tel: (250) 477-0555, fax: (250) 472-0700, e-mail: skies@islandnet.com

June 6 - 12, 1997 — Symposium on Marine Conservation Biology. University of Victoria, Victoria, BC. The Marine Conservation Biology Institute (MCBI), based in Redmond, Washington, is organizing the first Symposium on Marine Conservation Biology, an integral component of the Society for Conservation Biology (SCB) Annual Meeting, June 6-9, 1997 (field trips: June 10-12, 1997). The Symposium will be an historic meeting of marine and nonmarine, natural and social, pure and applied, young and established scientists from around the world. One crucial objective is comparing phenomena between nonmarine and marine realms, to find emergent principles and establish a conceptual foundation for conserving life in the world's estuaries, coastal waters, enclosed seas and oceans. For information, contact Elliott Norse (MCBI) Tel: (206) 883-8914, e-mail: enorse@u.washington.edu or Pat McGuire Tel: (250) 721-7344, e-mail: SCB97@uvcs.uvic.ca

June 25-28, 1997 — Third Interdisciplinary Conference on the Environment. Sheraton Commander Hotel. Boston, MS USA. The interdisciplinary Environmental Association (IEA), in conjunction with Assumption College, Worcester, MS, welcomes environmental practitioners, academics, students and all interested persons to take part in seminar sessions, poster sessions, round-table thematic discussions, workshops and panel discussions. Contact: Demitri Kantarelis or Kevin Hickey Tel: (508) 767-7557, Fax: (508) 799-4502, e-mail: dkantar@eve.assumption.edu

July 20-27, 1997 — International Coastal Zone Management Conference. Boston MS. Contact : Martin C. Miller, USAE Waterways Experiment Station, CEWES-CR-O, 3909 Halls Ferry Road, Vicksburg, MS 39180. USA. Tel: (468) 736-2021, Fax (412) 279-9031, e-mail: m.miller@cerc.wes.army.mil

August 3-8, 1997 — With Rivers to the Sea: Interaction of Land Activities Fresh Water and Enclosed Coastal Seas. Stockholm, Sweden. Contact: Stockholm Water Company S-106 36 Stockholm, Sweden. Tel: (468) 736-2021, Fax: (468) 736-2022, e-mail: sympos@sthwat.se

September 12-14, 1997 — Biotic Recoveries from Mass Extinctions, the final meeting of the UNESCO IGCP Project 335. Prague, Czech Republic. This project aims to be a platform for the study of survival and recovery of the biosphere and restructuring of global environments following mass extinctions. This meeting should bring together palaeobiologists, palaeontologists, biologists, systems theorists and other persons interested in the topic. This international project is headed by Douglas H. Erwin, Smithsonian Institution, Washington, DC, and Erle G. Kauffman, University of Colorado, Boulder. Over 60 countries are involved in this project. For conference details, contact Petra Hovorkova, Recoveries '97, Eurocongress Centre, Budejovicka 15, CZ 140 00 Praha 4. e-mail: recovery@gli.cas.cz, http://www.gli.cas.cz/conf/recovery/recovery.html

September 28-30, 1997 — People and Place: The Human Experience in Greater Yellowstone. Mammoth Hot Springs Hotel, Yellowstone National Park. The purpose of biennial greater Yellowstone conference series is to encourage wide-ranging, high calibre research on the region's cultural and natural resources by providing a forum for scholars from all disciplines to present and discuss research findings. The fourth biennial conference will focus on the human experience in the greater Yellowstone, with particular emphasis on the changing relationships between cultures and on the challenges of preserving and interpreting the region's cultural heritage. Contact Joy Perius Tel: (307)344-2209 or http://www.nps.gov.yell/ycr.html

October 18-25, 1997 — 6th World Wilderness Congress. Bangalore, India. The Aldo Leopold Wilderness Research Institute and the Wilderness Society will co-chair an extended symposium entitled, "Wilderness Designation, Management and Research." There will be a wide array of sessions available covering such topics as threats and management of invasive species, wilderness site restoration methods and successes, restoration and management of fire, the use of historical and ecological information in wilderness management, issues related to protecting cultural and ancestral values, and management of human uses including recreation. Contact Alan Watson, Research Special Scientist, PO Box 8089, Missoula, MT 59807 USA. Tel: (406) 542-4197, Fax: (406) 543-2663, e-mail: /s=a.watson/oul=s22L01a@mhs-fswa.attmail.com, or Greg Aplet, ecologist, The Wilderness Society, Suite 410, 7475 Dakin Street, Denver, CO 80221 USA. Tel: (303) 650-5818, Fax: (303) 650-5942, e-mail: greg_aplet@tws.org