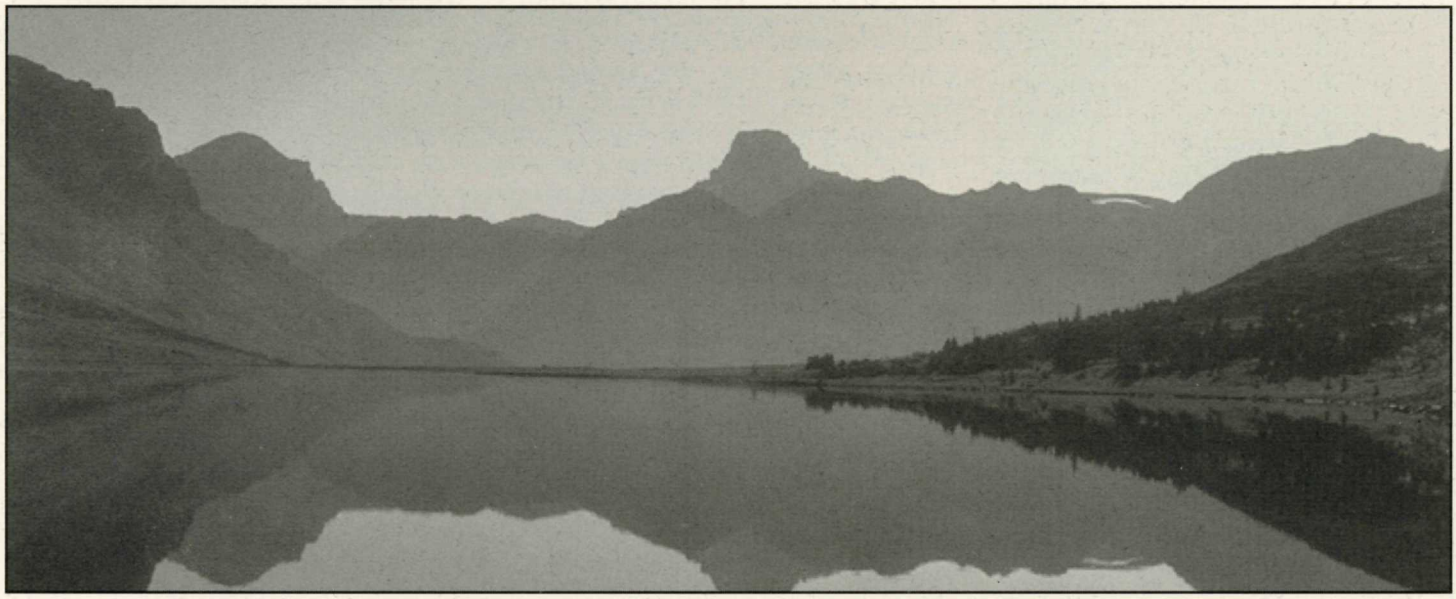
Research Links
A Forum for Natural, Cultural and Social Studies

BIOTIC IMPOVERISHMENT

The results of sport fish stocking during Banff's early years are still with us today



Fiddling with nature: Sport fish, such as trout, were stocked into many of Banff National Park's naturally fishless lakes

Brian R. Parker and David W. Schindler

INTRODUCTION

Canadian national parks, now protected and preserved in as "natural" a state as possible, were once developed to encourage recreational and tourism activities. In order to increase the appeal of mountain parks for angling, sport fish were stocked into about 20 per cent of the national park's lakes. Stocked species usually were rainbow, cutthroat, and brook trout *(Oncorhynchus mykiss, O. clarkii, and Salvelinus fontinalis)*, but the list also included Atlantic salmon *(Salmo salar)*, lake trout *(Salvelinus namaycush)*, and several hybrids. Introduced fish, particularly the trout, had an enormous impact on the naturally fishless lakes into which they were stocked. Through predation on aquatic invertebrates and release of nutrients in their waste, stocked fish fundamentally changed the character of aquatic ecosystems in the affected waterbodies. We have been studying the effects of fish stocking in several small alpine lakes in Banff National Park. In this article, we will describe some of the impacts stocked fish had, and continue to have, long after the discontinuation of stocking.

IMPACT OF FISH STOCKING

Snowflake, Pipit and Bighorn Lakes, three small alpine lakes in the front ranges of Banff National Park, were stocked with trout and/or char in the early '60s. The introduced fish quickly eliminated the natural top predator, the large calanoid copepod *Hesperodiaptomus arcticus* (see *Figure 1*), and large herbivorous cladocerans (*Daphnia* spp.) from the lakes (Anderson 1972, Anderson and Donald 1978). These invertebrates were important in structuring the aquatic communities through predation on other organisms and their loss had cascading effects on the abundance of organisms in lower trophic levels.

Daphnia exert a strong negative influence on the planktonic algal communities through their ability to filter large volumes of lakewater for algae, which they use as a food source. In combination with the addition of phosphorus to the lakes through fish waste, which fertilized algae in these phosphorus-limited lakes, the loss of *Daphnia* resulted in large increases in algal biomass. Fossil chlorophylls and other photosynthetic pigments preserved in the sediments of Snowflake and Pipit Lakes indicate that algal biomass increased eight to 23 times over pre-stocking levels (Leavitt *et al.* 1994).

Hesperodiaptomus is a predator of small copepods and rotifers (microscopic planktonic algal grazers). In lakes where it is abundant, it keeps populations of these organisms at low levels. After *H. arcticus* was eliminated by stocked fish, other smaller species of copepods, including *Diacyclops* and *Acanthocyclops*, genera too small to be attractive to fish as a food source, increased in abundance and eventually dominated all three lakes. These copepods were not effec-

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Research Links

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EDITORIAL

Have you ever driven into a winter sunrise on the prairies? The small world of the night, in which darkness hides the immensity of the sky and the rolling hills, is slowly stripped away. The stars grow paler as the horizon becomes red, then orange, then pink. The midnight-blue of the sky gradually transmutes into lighter and lighter shades of grey and blue, as the sun creeps up from its resting place at the end of the horizon. And suddenly, the morning sun, blinding in its brilliance, ascends into the sky, and lifts the curtain night dropped over the prairie. You see the pale blue morning sky that goes on forever, you see the vast fields that look up at it, and you realize that you are a little speck between earth and heaven, privileged, by some whim of the gods, to witness this beautiful sight.

Have you ever seen the sun set in the Rocky Mountains? The mountain tops light afire with the colours of the setting sun, their harsh ridges and peaks standing out against the canvas of colour. Sometimes, the sun hides behind a mountain for a while, then peeks out, teasingly, in a valley, before finally disappearing for the night, and leaving the sky to the moon and stars. The stars flicker brighter and brighter, like candles in an enormous cathedral. The mountains become bigger and more mysterious, the sky higher, and more unreachable, and there you are, again, so small, so insignificant.

One of the most profound spiritual experiences of my life took place on a clear mountain night. I lay on the ground, among heather, grass, and moss, and looked up into the starry sky. For a few seconds, I felt the earth and the sky pulsating through me, breathing with me, living as I lived. It is an anthropomorphic and romantic and often ridiculed view of the world—a "primitive" view of the world—and one that we are increasingly (re)discovering to be true.

There are warriors and heroes in our midst, and they are the scientists, academics, land managers, administrators, park wardens, wildlife specialists, cultural resource managers, fire researchers, geologists, historians, biologists, glaciologists, archaeologists, conservationists, economists, environmentalists, sociologists and others who, within and without, strive to understand the world we live in, our dependence on it, and our role in it. Our future and the wellness of our children and our planet depend on their efforts.

Over these last five issues of *Research Links*, I have been privileged to work with some of these warriors and heroes. They have widened my world, earned my respect, and impressed upon me the importance of natural, cultural, and social stewardship. They have taught me that everything is interconnected and interdependent, that one cannot have a healthy natural world if one does not work on having a healthy social world, that cultural research and advances are intricately bound up with social issues and natural effects, that diversity is beautiful and necessary in nature and society. Most importantly, they have filled me with hope and optimism for the future. In the face of academic funding cuts and government down-sizing and restructuring, these amazing people continue to do the best job they can in understanding, managing, and living in our fragile world.

You have encountered many of these people on the pages of *Research Links* over the last three years, and you will meet more of them in future issues. You have read their work, been exposed to their efforts and philosophies, and perhaps, like I, were impressed and inspired. I want to especially acknowledge and thank the committed members of the *Research Links'* editorial board—Bernie Lieff, Graham MacDonald, John McIntosh, and the University of Calgary's Dr. John Post—and *Research Links'* editor-in-chief Patricia Benson for the excellent work and life models they have given me. I leave *Research Links* and Parks Canada with more than job experience, but with a new outlook on life. I also want to thank graphic artist Margaret Zielinski for all the time and work she has put into *Research Links*, and thus into communicating the important work that is being done in our national parks.

Have you ever felt the cool Atlantic water wash over your feet? Have you seen ocean waves rise up, tall as a man or a house, rush towards you, and then crash on coast cliffs? Have you ever bowed your head before the power and immensity of nature, and thanked her for her beauty, your life, her laws, your responsibility in upholding them?

These people have. Thank you.

Marzena Czarnecki
Production Editor

HISTORY NOTES

HISTORIANS OF THE WORLD, UNITE!

For the first time since the regionalization of Parks Canada in 1973, the agency's historians met in session this November.

The Ottawa conference, themed "History and Commemorative Integrity," focused on how historians may contribute to the conservation and commemorative mandates of Canadian Heritage programmes. The steady rate of change in the government and in Canadian Heritage provided the rationale for this conference, and the agenda reflected these forces.

The conference was also a much needed opportunity for historians from the regions, including the new region of Pacific-Yukon, to meet with their colleagues from across the country and from Ottawa. Agency historians were also joined by a select number of members of the Historic Sites and Monuments Board of Canada, including board chair Professor T.H.B. Symens, special guests from the U.S. National Park Service, the province of Alberta, and Parks Canada managers and superintendents.

Session topics, which reflected the important advances made in policy over recent years, included "Defining and Commemorating National History," "New Historical Perspectives and Commemorative Intent," History and Presentation," and "History and Cultural Resource Protection."

The sessions on the role and nature of commemorative integrity explored various aspects of the concept. Of particular interest was the relationship of commemorative intergrity statements to new trends in historical interpretation and to park planning procedures. One of the challenges identified concerns procedures for the definition of commemorative integrity statements in the context of an increasing number of partnerships and cost-sharing arrangements, in which Parks Canada may no longer be the main day-to-day land manager.

The partnership theme was emphasized in discussions with members of the Historic Sites and Monuments Board of Canada. A much-approved suggestion was that provincial members of the board and working historians seek to build informal bridges of communication.

Participants were also very interested in what Dwight Pitcaithly, head of Historical Research for the U.S. National Park Service, had to say about changes and programme initiatives taking place south of the border. The conference was overall a positive and productive experience for those involved, and Parks Canada historians hope the various discussions and suggestions encountered at the conference will bear fruit in the months to come.

For further information, please call ***Graham MacDonald*** *at (403) 292-8865.*

ORAL HISTORIES: PRESERVING STORIES OF THE PAST

Alberta Region's Historical Services staff have had a busy year. Historical research activities relating to the Bar U Ranch National Historic Site alone include photograph collection acquisitions, historic structures reports, and seven oral history interviews.

Notable among the oral histories are the *Oliver Christensen Interviews.* Conducted by Barbara Holliday over the month of September 1994, the interviews focus on the year and a half in the mid-'40s Christensen spent living and working "at the famous Bar U Ranch"—a dream come true for him. Although he loved "cowboying," he saw little future in the life:

"There was an old fellow from Saskatchewan (Old Pete), it's hard to say how old he was at the time—he could have been 50, he could have been 60 also, but during the winter all the entertainment there was at the bunkhouse was playing poker.... It was a nickel a bet and this old fellow from Saskatchewan... would gamble his money away. If he had enough for a case of beer at the end of the month, that was it.

"...nothing, no thought for tomorrow. I looked at a lot of these old fellows and during the winter, they'd ride the grub line, they didn't have a job. They knew all the cowboys up and down from Pincher Creek to Rocky Mountain House and they'd stop in for a couple days and go on to the next ranch—if they didn't have a job. Sure, maybe they got to haul hay for a couple of days, a week, maybe, or if they were short of help, they'd get a couple days work and I thought, 'Man, you know, that's one place I'm not going to end up.' I loved working with livestock and I just made up my mind I was going to do something else. Cowboying was a pretty tough life. That was nothing—you got your three meals a day and that was basically it."

Christensen, now 71, lives in Strathmore, AB.

For further information, please call ***Barbara Holliday*** *at (403) 292-5467.*

FEEDBACK...

"I just read your editorial in the spring issue and very much wish that there were a nationally focused equivalent to *Research Links.* ... Clearly, if *Research Links* were to expand its geographic coverage, it would require commitments from other regions and from Parks Headquarters for the production, the costs of distribution, and the editorial board. I think that these are all possible. By sharing the costs and working in partnership, the organization might just be able to build something that can help us all understand the differences and the similarities in the problems and approaches being taken across Canada. The national nature of our parks system demands that there be vehicles to bridge the gaps that are ever widening between those working in different parts of the country. Here is an opportunity to take something that works in the west, expand it to meet national needs, and practice what we preach about working in partnership."

– Harry Beach, Regional ConservationBiologist
Atlantic Region

"Thank you for the couple of great looking issues of *Research Links.* ... You're doing a terrific job and at a time when efforts like yours are beginning to make more of a difference than ever before. There's a real scent of transcendence in the air—a dawning global consciousness that the biosphere is beginning to shift the balance of nature, under terrible stress, into something less pleasing and more threatening than anything ever caused by humans in the past. The more solid, science-based information is available, the more effective will be the efforts to turn the environmental tide.

"I am particularly impressed with your determination to present natural, cultural, and social issues as a whole, not to compartmentalize and fragment them. A true systems approach is the only way to grasp the 'how and to what end' of the ecological processes we deal with and are part and parcel of. You are doing an excellent job not only of giving this kind of inter-related information, but in a thoroughly fascinating and enjoyable way."

– Jean Matthews, Former Editor
Park Science (U.S.)

Cultural Depressions

Aboriginal housepits in Banff National Park continue to puzzle archaeologists

E. Gwyn Langemann

In 1994, Alberta Region Archaeological Services staff identified a prehistoric housepit site at the foot of Drummond Glacier, in the heart of Banff National Park. This kind of site is common in the British Columbia Interior Plateau, but unknown elsewhere in the Rocky Mountains or the foothills beyond. The discovery of the Drummond Glacier site brought the number of such sites known in Banff to seven. Nearly all of these sites are threatened to some degree, either by development or natural erosion. Although it is possible that more of these sites will be discovered, now that we know what we are looking for, it is also likely that some have already been destroyed by construction of highways and fire roads in major valleys, and by river erosion of the terraces on which they were built.

Because of the unusual nature of these sites, and because of the threats they face, Archaeological Services staff began a programme of more complete test excavations at the Drummond Glacier and the Divide Creek housepit sites. Parks Canada archaeologists Bill Perry, Susan deCaen and I were joined by Norman Allard Jr., a Ktuna'xa student, Don Mickle, Banff National Park's Cultural Resource Management warden, and Mary Harding, a Banff resident.

DRUMMOND GLACIER SITE

A dozen circular depressions, about four metres in diameter and one and a half metres deep, can be seen in a small grassy terrace beside Drummond Creek (see *Figure 1*). The pits were known to park wardens for some time, as glaciologists had used the terrace as a base camp in the early 1960s. As so often happens in the mountains, a historic camp had been placed over top a prehistoric site and it was not until 1994 that a test pit dug in one hollow proved the site to be a prehistoric feature, with hearth remains and traces of several stratified cultural layers in the bottom of the pit. The cultural layers were dated at 1970 ± 50 and 2850 ± 60 years ago, making them somewhat older than other housepit sites in Banff.

In 1995, we excavated a trench bisecting one of the 11 housepits, and excavated two units along the terrace edge. We found a central hearth that had been cleaned out and reused at least six times over the years, as there was a series of dark charcoal stained lenses below the uppermost layer of fire broken rock (see *Figure 2*). In the rest of the pit, however, there were only one or two such occupation layers, and very few artifacts. The pithouse must have been kept very clean.

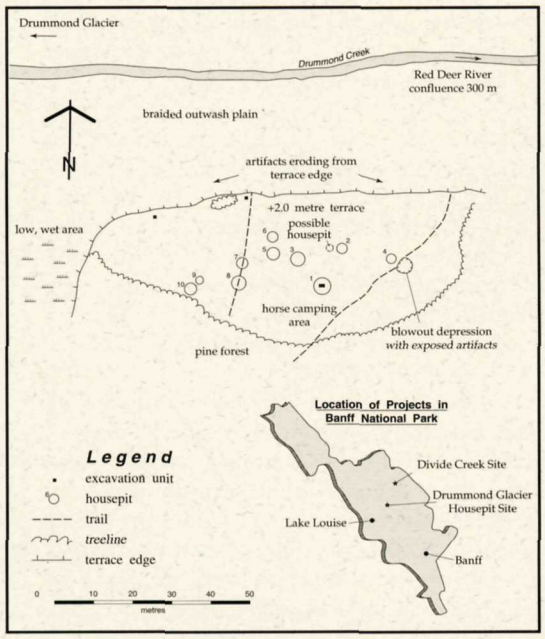

Figure 1: Drummond Glacier Housepit Site

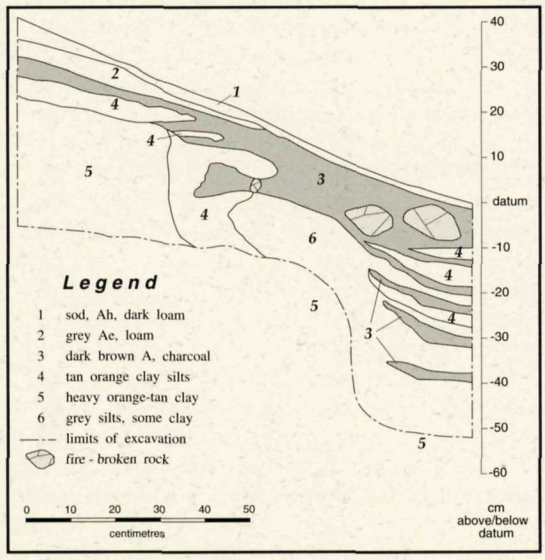

Figure 2: West Wall Profile of Drummond Glacier Housepit Sit

The excavation units along the terrace edge were another story: the units contained thousands of chert and siltstone flakes—more flakes than dirt in some levels. These units were placed along the terrace edge away from the housepits, where flakes and cores, the debris resulting from making stone tools, were eroding from the bank. In all this debris, there were only five formed tools: two side-notched atlatl points, a point midsection, and two scrapers. The terrace edge was apparently a favoured place for sitting and flintknapping, keeping an eye on the valley, and catching the breeze off the glacier.

DIVIDE CREEK SITE

The second pit excavated was at the base of a high terrace at the junction of Divide Creek and Red Deer River. A single small pit right on the river edge was threatened by bank erosion. The single pit proved to be an earth oven not a housepit. A pit about one metre in diameter and 50 centimetres deep had been dug into the stratified silts and sands of the river terrace. The pit was solidly filled with fire broken rock and charcoal, and it contained butchered bison bones.

Such earth ovens are typical of sites found in the interior of British Columbia, where they were used to roast or steam plant foods. It is gratifying to find one associated with a site containing so many housepits, as it means that another part of the typical Plateau lifeway is present here. These are complex house sites, where a number of activities are represented.

INTERPRETATION

Many questions remain unanswered. We still do not know who the people who made these sites were, although a good guess is that they were from the salmon-dependent cultures of the British Columbia Interior Plateau. We still do not know where they were going, although one likely explanation for the presence of such housepits so far outside their usual location is that these sites were constructed by Plateau people as they moved through the mountain valleys on

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BURNING BUSHES

Elk Island makes the most of an accidental fire

Anne Dickinson

In the spring of 1994, a fireguard-burning operation in Elk Island National Park inadvertently burned 16 of 20 one-metre square plots along the Tawayik 2 transect, providing the park with a unique opportunity to observe the effects of fire on shrubs. Four plots had not burned at all, and the remaining 16 plots had five to 100 per cent of their areas burned, with eight plots burned less than 50 per cent and eight burned more than 50 per cent. Fire severity ranged from light to moderate as a result of low fire weather indicies and the rapid rate of spread.

Elk Island National Park has been monitoring the production and use of the park's shrub component through annual browse surveys for over a decade. The information is collected from six permanent transects located throughout the park (see *Research Links* 2[2]). During the browse survey this past spring, we saw clearly that the fire had left its mark. Not only were the charred skeletons from what had once been large *Corylus* bushes, but the data recorder worked furiously filling out the front and back sides of our tally sheets due to the dramatic increase in stems.

An initial cursory look at the data has indicated some interesting, if not overly surprising, changes that occurred in 1994–1995—the first year after the burn.

The total number of live stems increased in all the plots that burned, suggesting that fire stimulated suckering. While stem numbers increased, total numbers of twigs decreased on all plots. Even the unburned plots averaged a 15 per cent decrease in total twig numbers. Interestingly, the average decline in total twig numbers was about the same for the plots burned less than 50 per cent and more than 50 per cent. Large, multi-twigged shrubs were killed by the fire and replaced by single-twigged suckers, thus reducing the total numbers of twigs. Although the plots that burned more than 50 per cent had more shrubs (and twigs) killed, they also experienced a greater amount of suckering. The net result was a similar decline in twigs for the less than and more than 50 per cent burned plots.

By killing large shrubs and stimulating the growth of new shoots, fire greatly reduced the average stem height in the burned plots (see *Figure 1*). The control plots experienced a minor decline in average stem height.

Initial results of changes in species composition indicate that all species, even the minor components of the shrub layer, were enhanced by the fire, the one exception being the low bush cranberry (*Viburnum edule*), which is a miniscule component of the transect. In particular, snowberries (*Symphoricarpos* sp.), roses (*Rosa* spp.), and beaked hazelnut (*Corylus cornuta*) experienced notable increase in numbers of stems in 1994–1995, which suggests they are stimulated by fire.

Overall, we can conclude that the fast-burning, light-intensity fire of 1994 stimulated and rejuvenated shrubs along the transect. We know from prescribed burns in other areas of the park that repeated burns eventually reduce the shrub component and favour grasses and forbs. Future fires on this transect will provide an opportunity to document this process and provide valuable information for Elk Island's prescribed burning programme.

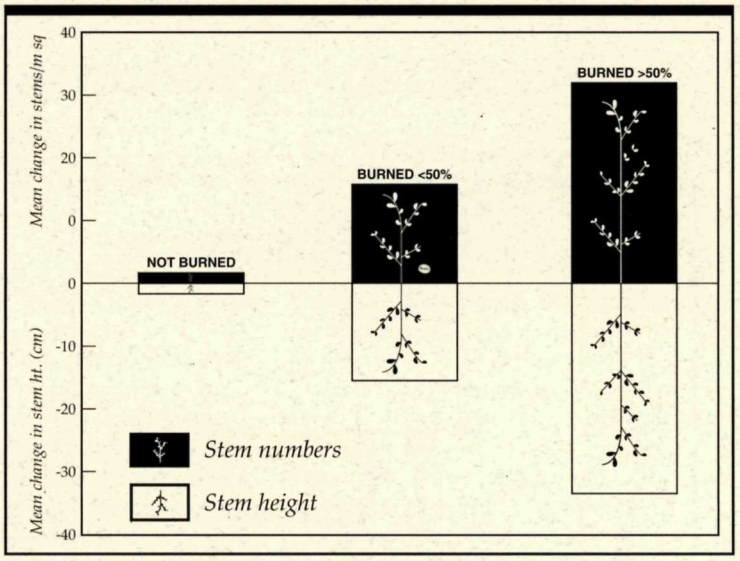

Figure 1: Mean change in stem height and quantity

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Cultural Depressions

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their way to a spring, summer, or fall buffalo hunt in the eastern slopes of the Rocky Mountains and foothills. We do have a better idea of what the inhabitants were doing while they were at the sites, how the pits were originally excavated and reused, what sort of tools were made, and how the earth ovens were used to cook bison.

These semi-subterranean pithouses were an effective strategy to deal with camping at the foot of a glacier, in an area of unpredictable and often inclement weather on a summer or fall expedition. People went to a good deal of trouble to build these sites. The Drummond Glacier pits were dug into heavy clay soil. The series of charcoal layers below the hearth in the excavated Drummond housepit prove that the hearth was used repeatedly. The three Red Deer River valley sites have about the same number of pits at each site, and are spaced at intervals of several miles, as if these were good stopping places along a well-known travel route. The sites are found in three major river corridors that pass through Banff National Park: the Red Deer, the North Saskatchewan, and the Bow river valleys. A pressing question is whether there are corresponding sites in the valleys east of the park boundaries. A logical place would be the Kootenay Plains on the North Saskatchewan River, now largely flooded by Abraham Lake reservoir, but historically a major gathering place for people traveling east across the Rocky Mountains. The grassy terraces of the Ya-Ha-Tinda ranch would be another good place to look.

By next summer, we will have completed the analysis of the artifacts and faunal remains from the tests described above. We will plan further excavation strategies in light of those results. We hope to excavate a second housepit at the Drummond Glacier site next summer, and test some of the other housepit sites. Perhaps then we will have answers for some of the many questions posed by these unusual sites.

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Biotic Impoverishment in Banff National Park

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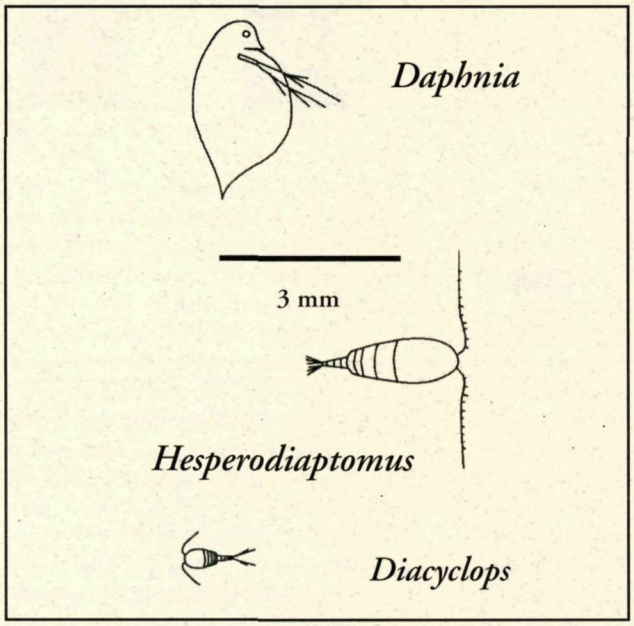

Figure 1: Common zooplankton and their relative sizes

tive predators of rotifers, and the change in copepod species dominance led to a large increase in rotifer abundance in the stocked lakes (Paul and Schindler, in press).

In general, fish stocking caused the aquatic communities to shift from dominance by large zooplankton to dominance by fish and microscopic zooplankton and algae (see *Figure 2*).

We have been studying the recovery of these lakes for the past four years. In Snowflake and Pipit Lakes, stocking failed to establish self-sustaining fish populations and the fish eventually died out, while in Bighorn Lake, brook trout have become well established. Ideally, lost zooplankton populations will recover naturally following the loss of stocked fish populations. For example, both *Daphnia* and *Hesperodiaptomus* produce resting eggs that are deposited in lake sediments where they remain viable for 50 years or more (Parker *et al.*, in prep.). This "egg bank" is a source of zooplankton from which a lake may be repopulated after stocked trout populations have been lost.

Daphnia recolonized Snowflake and Pipit Lakes quickly. Once stocked fish populations were lost, and *Daphnia* recovered, algal biomass returned to pre-stocking levels. In Bighorn Lake, where stocked fish are still present, *Daphnia* has not recovered to its former abundance. When Snowflake and Pipit Lakes were compared to Bighorn Lake in 1991, chlorophyll concentration, an indicator of algal biomass, was still three times higher in Bighorn.

Unfortunately, unlike *Daphnia, Hesperodiaptomus* seems susceptible to local extinction. Although Pipit Lake had a large *Hesperodiaptomus* egg bank in the sediments and recolonization from this source occurred quickly following loss of the stocked fish population, our studies indicate the egg bank in Bighorn and Snowflake Lakes was exhausted before recovery could occur. In Snowflake Lake, the species was still absent 10 years after the last trout were lost. We believe recovery of this species would be impossible without reintroduction from outside sources. In Bighorn Lake, removal of the stocked fish population is required before reintroduced *Hesperodiaptomus* can survive.

Reintroduction of copepods can occur naturally through the transfer from lake to lake of resting eggs trapped in feathers or intestinal tracts of waterbirds. However, there are significant barriers to transfers mediated by waterbirds in the front ranges because of the long distances between lakes and the small number of birds that visit them. Indeed, transfers between arctic ponds separated by only a few metres seem to be infrequent (Boileau and Hebert 1988), although presumed continent-wide transfers are reported on rare occasions. Even if inter-lake transfer occurred, some of the small copepods that replaced *H. arcticus* may be able to prevent its recolonization through predation on the small number of immigrants and their subsequent offspring (Anderson 1970).

In order to attempt to restore Snowflake Lake closer to its pristine condition, and to answer a number of scientifically interesting questions, we reintroduced 660 000 *Hesperodiaptomus* into that lake in 1992, with permission from Parks Canada. *Hesperodiaptomus*

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Micro-hydro system at Mount Fidelity creates economically and environmentally

Responsible Power Source

Pat Inglis and Alvin Sippola

Not all of Parks Canada's research operation activities take place in convenient urban areas serviced by utilities most people take for granted. More often than not, water must be treated locally and power must be produced on-site by large diesel generators that run continuously.

In Glacier National Park's Columbia Mountains, some of the most demanding terrain on the continent, Parks Canada operates a snow and avalanche research facility. The Mount Fidelity Research Centre is located about 350 km from Calgary at 3 500 metres above sea level. In this sensitive alpine environment, the Architecture and Engineering Unit from Calgary, with staff from Mount Revelstoke and Glacier National Parks, designed and constructed a micro-hydro station to remove the need for continuous diesel power generation.

The small hydro system consists of a rock-filled wood dam connected by a 260-metre long, 150 millimetre diameter penstock to a pelton wheel turbine, which drives a three kilowatt generator. The generators supplies 600 volts of power through an 850-metre long buried transmission line. The new micro-hydro system is connected to the original diesel system and a battery bank that stores power for use at the station. The diesel system now only operates at peak power demands and when stream flow is reduced (and the micro-hydro system cannot function adequately).

A gasoline-powered water supply pump from the station was replaced with an electricity-powered pump that uses the new micro-hydro plant as a power source.

Construction of the system and energy conservation measures at the site have reduced the diesel generator run time from 5 500 hours per year (a six-year average) to about 500. Diesel fuel consumption similarly has been reduced by 90 per cent.

The total cost of the micro-hydro project, including transmission lines, batteries, and systems, was $55 000. The installation is expected to have a pay-back period of about 7.5 years. Diesel fuel savings alone will be about $6 000 per year.

***Pat Inglis** was an environmental stewardship manager at Alberta Regional Office. He is now with Calgary Cooperative Association Limited. **Alvin Sippola** is a structural engineer with the Architecture and Engineering Unit at Alberta Regional Office. For further information, please call (403) 292-4714.*

Biotic Impoverishment

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abundance has increased each year, and the restoration appears to have been successful. We will continue to monitor this lake until the aquatic community stabilizes.

CONCLUSION

The stocking of trout and other sport fish into previously fishless lakes earlier this century has significantly altered many aquatic ecosystems. Entire populations of organisms were extirpated and their loss affected other levels of the aquatic community. The nutrients excreted in trout waste exacerbated the changes that occurred. In some cases, the affected lakes did not recover to their pristine state, even when stocked fish populations did not persist. Some species were perhaps permanently eradicated from the lakes because the stocked fish outlived the supply of resting eggs held in the lake sediments. Fortunately, it appears that restocking some lakes with the missing species will restore extirpated species to parts of their former habitat.

Not all lakes in the mountain parks have data that describe the invertebrate community before fish stocking took place, so we have attempted to determine the effects of fish-stocking in some systems using paleoecology, the study of fossil organisms in lake sediments. These, too, show that stocking changed the original communities of crustaceans, insects, and other invertebrates, as well as algal abundance. However, not all native species leave fossils that can be used to study past abundance. This makes the question of possible restoration of some lakes more difficult. If we do not know the original fauna, we cannot judge if we are making appropriate management decisions when we introduce species into lakes where they are only presumed to have been extirpated. Also, in some cases, stocked or introduced organisms may themselves be threatened or endangered elsewhere and their removal may be unwise. Park managers and the public must accept that some lakes of the mountain parks may remain in an unnatural condition as a legacy of our past management activities.

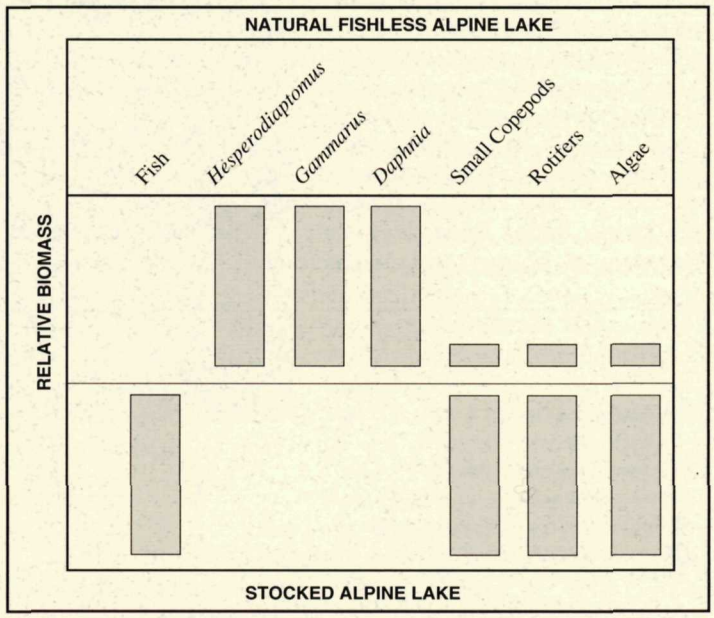


Figure 2: Generalized pattern of biomass of different taxa and trophic levels within natural fishless and stocked alpine lakes in the front ranges of Banff National Park

***Brian Parker** is Killam technologist in the Department of Biological Sciences at the University of Alberta. **David Schindler**, renowned aquatic ecologist and winner of the 1991 Stockholm Water Prize, is Killam Memorial Professor of Ecology in the Department of Biological Sciences at the University of Alberta.*

NATURAL REGION

Links with Post-secondary Institutions

PACIFIC COAST MOUNTAINS (I)

Pacific Rim National Park Reserve

Pacific Rim National Park Reserve is involved in three projects through the Department of Geography at the University of Victoria. This summer, MSc candidate Rosaline Canessa and Pacific Rim Co-op student Jody Riley worked on consolidating all of the information available to the Barkley Sound Sustainable Development Strategy in digital format as a basis for Canessa's study of Geographic Information Systems as a tool for community-based decision-making. MSc candidate Karen Wipond is completing a study of Pacific Rim's move into ecosystem-based decision-making. Dr. Philip Dearden and his former MSc student Barb McNicol (now a PhD candidate at the University of Calgary) have recently published a study of the German visitor group to the West Coast Trail Unit of Pacific Rim.

Our long-time cooperator, the Bamfield Marine Station (see *Research Links* 2[1]) is jointly funded and administered by five Western Canadian Universities: the University of British Columbia, the University of Victoria, Simon Fraser University, the University of Calgary, and the University of Alberta. In addition to its on-going study of the distribution of benthic macrophytes in Barkely sound by Dr. Louis Druehl, the station is cooperating with the Department of Fisheries and Oceans on a number of projects that contribute to the larger, long-term study by the department of the whole La Peyrouse Bank ecosystem.

Dr. Michael Pendleton of the University of Washington recently completed a study of the nature of forest crime, offences, and enforcement in British Columbia, which included Pacific Rim as part of the study area.

Through the Long Beach Model Forest, we are involved with the Centre for Conservation Biology at the University of British Columbia in developing community-based hydroriparian research in Clayoquot Sound.

For further information, please call ***John McIntosh*** *at (604) 726-7721.*

COLUMBIA MOUNTAINS (IV)

Mount Revelstoke and Glacier National Parks

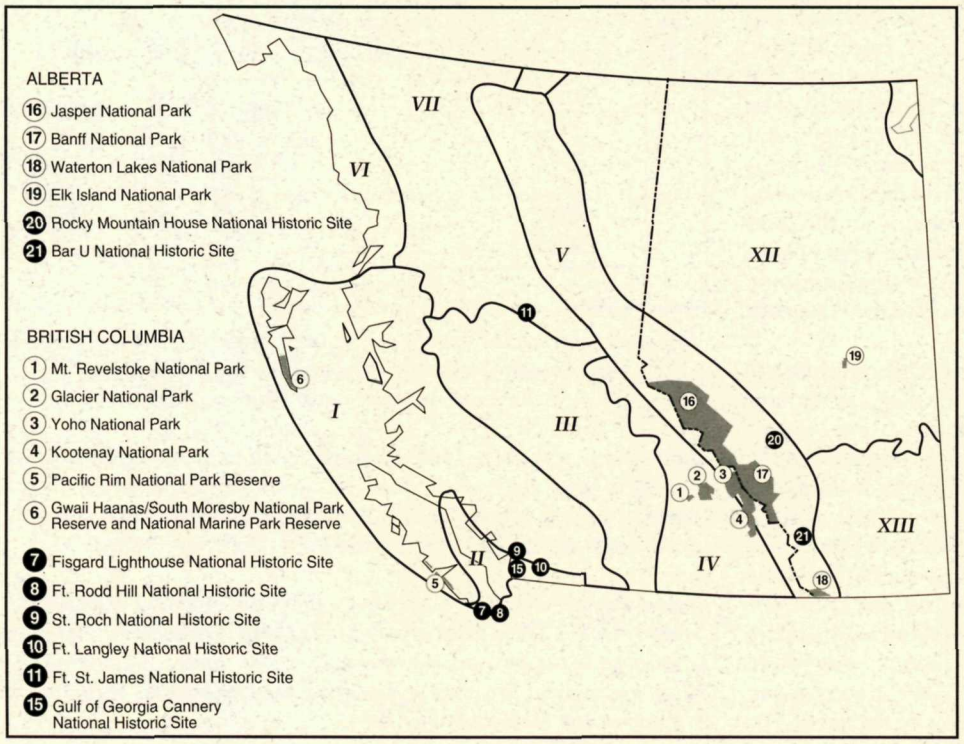
Mount Revelstoke and Glacier National Parks are involved in a number of ecological research projects with university partners right now. Robin Monroe from the University of British Columbia is studying impacts of the national transportation corridor on bear populations in the Beaver Valley. With highway twinning projects under discussion throughout British Columbia, the results of this project will help mitigate the greatest threat to ecological integrity in the parks.

As part of the West Slope Bear Research Project, University of Alberta's David Paetkau is producing DNA fingerprints from bears' hair and tissue samples. Paetkau's work is a major breakthrough in how wildlife monitoring can be carried out in the future.

University of British Columbia's Brad White is studying wolf movements and their role in predation of ungulates in the northern Selkirk Range. White's work ties into the Revelstoke Caribou Project (see *Research Links* 3[1]).

Another UBC researcher, Chris Steeger, is working on a study of snags and other forest charactersitics of biodiversity as part of an assessment of the ecological integrity of the Interior Wetbelt Forest relative to harvested areas.

For further information, please call ***Susan Hall*** *at (604) 837-5155.*



ROCKY MOUNTAINS (V)

Kootenay National Park

In addition to the two University of Calgary projects profiled in this issue (see p. 12 and 13), Kootenay National Park is also supporting several undergraduate research projects. COSEP and Co-op students have recently been hired to conduct backcountry visitor surveys and oral history interviews, to collect historic photos, and to provide general support to the park's science programme. The park frequently hosts classes and practicum students in biology, resource management, and outdoor recreation.

The park has a number of other formal and informal relationships with post- secondary institutions. Larry Halverson, chief of Heritage Communications, is on the Board of Governors for the College of the Rockies, and is on the Advisory Board for Selkirk College's Wildland Recreation Pro-

gramme. Halverson, Danny Catt (communications specialist), and Alan Dibb (ecosystem management specialist) all make frequent visits to various colleges and universities to give presentations and workshops on ecosystem management, research in national parks, and related topics.

For further information, please call ***Alan Dibb*** *at (604) 347-9361.*

Waterton Lakes National Park

Lethbridge Community College students Paula Rodriguez de la Vega and Todd Cashin conducted two directed studies projects in Waterton Lakes National Park, evaluating the potential for a variety of techniques for monitoring carnivore populations. They determined that the recurring thaws and intense winds that characterize the climate of this area rendered track count transects and scent posts only moderately effective, while the nighttime use of spotlights is only effective for relatively abundant species in open habitats. The park and the college have developed a number of initiatives to link training on wildlife and vegetation survey techniques to on-going monitoring of the bison paddock and other areas in the park.

In another initiative, the Blood Tribe Outreach programme teamed up with Canada Immigration and Employment, Alberta's Fisheries Enhancement Programme, and Parks Canada to hire two fisheries technicians who worked under the supervision of senior fisheries technician Elliot Fox to inventory bull trout populations in the park. The project was a success, with 80 bull trout caught and tagged. In spite of this spring's 100-year flood, which scoured fine sediment from many stream reaches, spawning redd counts were higher then in 1994 in the two major spawning streams inventoried.

For further information, please call ***Kevin Van Tighem*** *at (403) 859-2224.*

Yoho National Park

A major project at Yoho National Park right now is the Lake O'Hara bear/human use project. We are attempting to understand the interactions and relationships between the species and then develop a decision-supported model that will objectively assess and manage the interactions. Faculty from the University of Calgary (Dr. Stephen Herrero) and Simon Fraser University (Dr. Pam Wright) are part of the Technical Steering Committee, which has the role of formulating the research and monitoring objectives. The role of Simon Fraser University has been expanded to include the full responsibility for the completion of the socio-economic portion of the study, which has involved the preparation and implementation of research tasks through the use of a graduate student in the field.

For further information, please call ***Derek Petersen*** *at (604) 343-6424.*

Canis lupus*: Wolves are among the fauna researchers from Alberta and B.C. universities are studying in Banff*

Banff National Park

University researchers have been very busy in Banff National Park this year: so busy, park wardens joke, you can hardly take a stroll through Banff without bumping into one. Geologists make up most of the crowd. The most unusual project among them is with Gerard Bond of Columbia University. They are using Banff rocks to evaluate climatic cycles in Cambrian times. Also active are the Glaciologists at the Peyto Glacier Research Camp, led by Scott Munroe from the University of Toronto and Gordon Young from Wilfred Laurier University.

Fauna research is in full swing as well. Carolyn Callaghan from the University of Guelph continues her wolf project, Michael Gibeau and Jen Theberge from the University of Calgary keep the airplanes busy looking for their 15 collared grizzlies, and Tom Hurd from the University of British Columbia is scanning the airwaves for his missing moose.

Banff's flora has no reason to feel neglected either: U of A's Brendon Wilson is exploring the exotic life history of Lyall's larch (*Larix lyallii*), and Utah State University's Charles Kay continues his quest for the true story on the rise and fall of aspen forests.

For further information, please call ***Cliff White*** *at (403) 762-1422.*

BOREAL PLAINS AND PLATEAUX (XII)

Elk Island National Park

Elk Island National Park has taken a lead role in research partnerships by establishing a Heritage Research Office at the University of Alberta. The office, run in conjunction with the newly established U of A Department of Renewable Resources, is meant to serve as a physical centre for interactions with potential researchers.

The University of Alberta and Elk Island have a long history of cooperative research endeavours. Among the many important collaborative works that have affected the direction of modern ecosystem management at the park are the ungulate habitat interaction research by A. Cairns in the 1970s and the population dynamics and ungulate physiology research conducted by park staff in conjunction with Dr. R. Hudson in the 1980s. Hudson and others, such as the noted parasitologist Dr. Bill Samuel and ichthyologist Dr. J. Nelson, have been conducting research in Elk Island for more than 15 years. The long-term nature of their studies continues to provide invaluable understanding of ecosystem processes.

Elk Island and the U of A plan to continue cooperative research in the future. This research will be guided by the parks' Ecosystem Conservation Plan, strategic research framework, and the U of A's various departmental agendas.

For further information, please call ***Charles Blyth*** *at (403) 992-6380.*

Revelstoke reflects on its vision

Sustainability or Status Quo?

Jenny L. Feick

BACKGROUND

The Revelstoke *Mountain Town with a Vision* research project focused on a resource-based community with a long-standing relationship with two neighbouring national parks, Mount Revelstoke and Glacier, in British Columbia's rugged North Columbia Mountains (see *Research Links* 1[1], 2[1]). For three years (1992–95), the project monitored Revelstoke's stated vision of wanting to become a "sustainable community by balancing environmental, social, and economic values." Through personal interviews, telephone polls, household questionnaires, focus groups, participant observations, and newspaper and document analysis, social scientists and volunteers attempted to evaluate the utility of the vision-setting process in achieving sustainable development at a community level.

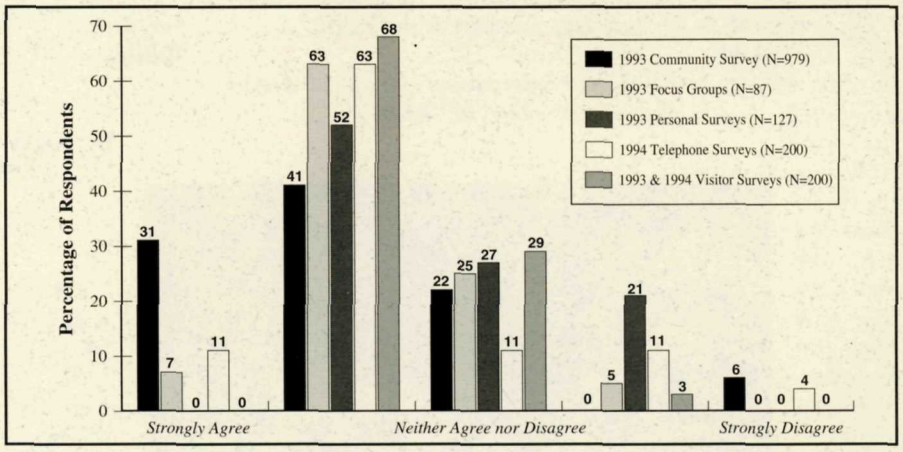


Figure 1: Perceptions of the achievability of Revelstoke's Vision Statement (N=1,593)

The "vision-setting process" was a conscious attempt by Revelstoke residents to govern the town with a vision statement that balanced environmental, social, and economic values.

Most residents felt positive about the vision statement (see *Figure 1*). They saw its value and relevance, and liked its positive content. Residents saw two main purposes for the community vision statement: to provide direction and goals, and to help make decisions. They thought the vision statement should be used to guide *all* decisions, and to focus community action.

Most citizens (92 per cent of those interviewed) expressed some degree of commitment to the vision statement. Most people switched from being "committed" to the draft to being "very committed" to the final version. The degree of commitment among the Vision Committee exceeded that of other citizens interviewed—those who participated in setting the vision had greater commitment.

CONCLUSIONS AND GENERALIZATIONS

Revelstoke's vision-setting process had both its successes and its drawbacks. On the positive side, proponents of the vision statement tried to involve the general public and various sectors of the community in the process through invitations to the committee, public meetings, and a community survey, and they incorporated feedback. Vision Committee members benefited from exposure to different viewpoints of other committee members, the discussion of concepts such as sustainability and study of future trends, and the consensus-based process used to formulate the vision. They later applied new knowledge, skills, and attitudes in processes like community planning. The vision statement's ideals inspired people. Its values and priorities seemed viable to most respondents.

The vision-setting process would have been more effective had it involved broader community participation. The Vision Committee lacked members from youth, unemployed, and poverty groups, and was perceived to be dominated by civil servants. In addition, plans for promotional campaigns never transpired, and the new city council appeared uncommitted to the vision in 1994.

The vision statement itself would have been more effective had the Vision Committee developed community-supported definitions of key concepts. Differences in opinion on the definitions of sustainable community, balancing environmental, social, and economic values, and environmental citizenship are now proving problematic. The idea of "economic growth and stability" seems contradictory to many of those interviewed.

The concept of sustainable community development involves creating communities in which ecological principles serve as the basis for decision-making, and whose people value and protect parks, wildlife, and local heritage. It promotes the kind of balance referred to in Revelstoke's vision statement. In Revelstoke, community vision-setting shows potential as one of several effective tools in sustainable community development. Research results demonstrate:

- The vision process educates citizens and provokes critical thought on sustainability.
- Citizens can translate the vision into personal and community action. They can articulate what they can do as individuals and assess the actions of their elected officials.
- Involvement in the vision-setting process increases optimism about the vision statement's achievability and commitment to it.
- Citizens use the vision statement in on-going processes that affect the future sustainability of the community.

It is too early to conclude that Revelstoke is a "sustainable community" as a result of its vision statement and application of it to municipal and personal decisions. The very nature of sustainability is long-term. However, Revelstoke is not a ghost town. It shows signs of strength as a community, but also faces significant challenges in realizing its vision.

***Jenny L. Feick**, a Parks Canada employee currently on leave, is enrolled in a PhD programme at the University of Calgary's Department of Geography. For further information, please call or fax (403) 249-8226.*

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Feick, Jenny L. 1995.
Mountain Town with a Vision: A Case Study in Sustainable Community Development in Revelstoke, BC. Master of Science/Environmental Design Thesis, University of Calgary.

Copies of this thesis are available at libraries at the University of Calgary (McKimmie Library), Mount Revelstoke and Glacier National Parks, and the Town of Revelstoke.

One Bear's Story

Using aversive conditioning, Banff wardens protect a habituated bear and park visitors

Carey Elverum

Among all animals that make their home in Banff National Park there is none more impressive than the grizzly bear (*Ursus arctos*), for it is what makes the wilderness truly wild. Although the grizzly usually (and under natural conditions) avoids humans, on occasion, some bears come into frequent, non-threatening contact with people and gradually lose their fear of human presence. This condition, known as habituation, is a tourist's dream and a park warden's nightmare. The habituated bear provides many hours of viewing enjoyment for park visitors, but it also poses a great threat to public safety. Habituation is not very healthy for the bear, either—it becomes highly susceptible to unnatural causes of mortality.

A habituated bear is a risk to itself and the public

In order to protect both the bears and the public, park wardens spend hundreds of hours every year breaking up bear jams along highways, investigating and monitoring bear problems, posting bear warnings and area closures, and informing the public of bear activity.

During the first week of August 1995, a deluge of bear-related incidents—all the work of one adult male grizzly—occurred on the Icefields Parkway (Hwy 93N) near the Saskatchewan River Crossing in Banff National Park. The bear was frequenting the roadside, chasing cyclists, bluff-charging several photographers, and creating numerous traffic congestion problems.

The extent of the problem bear's habituation was now obvious having progressed slowly over time. In the spring, the grizzly was observed feeding on green grass along the roadside and on the fertilized lawns of the Crossing Resort. Later in the season, it moved closer to the roadside and public facilities to feed on buffalo berries.

Park wardens hazed the bear away from the Crossing Resort and from the Icefields Parkway in order to alleviate traffic jams and to protect visitors. Cracker shells and screamers (noise devices) were used to scare the bear into the bush. After a while, their effectiveness became limited–the bear was no longer responding to scare tactics and its toleration of people was diminishing.

As the bear's behaviour became a very real threat to public safety, wardens decided to step up management actions. They looked at barring people from the area, relocating the bear, and changing the bear's behaviour: management options to guarantee the bear's survival and the safety of park visitors.

Barring public access by closing the main travel corridors (the Icefields Parkway) between Jasper and Banff National Parks and central Alberta was neither practical nor possible. Wardens also considered trapping and relocating the bear; unfortunately, bear relocations are generally regarded as temporary solutions at best, with limited success. Not only do relocated bears often return to the area from which they were trapped to become repeat offenders, they also have unusually high mortality rates. The best option was to spend some time and labour putting the fear of humans back into the grizzly through aversive conditioning.

The goal of an aversive conditioning programme is to prevent bear/human conflicts by modifying the bear's behaviour so that it avoids people, transportation corridors, and public facilities. These changes in behaviour should, in turn, decrease the likelihood of someone being mauled by a bear, prevent bear/motor-vehicle collisions, reduce traffic congestion problems associated with roadside feeding, and keep the grizzly alive, well, and in its own home range.

In order for the aversive conditioning programme to be effective, the warden service needs to monitor the bear 24 hours a day. To that end, after capture near Mount Coleman on August 11, 1995, the grizzly was radio-collared and ear-tagged, before release near the Saskatchewan Crossing Warden Station, well within its home range.

For the following two weeks, wardens tracked the grizzly continuously. Each time it appeared along the roadside, the bear was subjected to a pain stimulant fired from a police riot gun, locally known as the thumper gun. The thumper gun fires a rubber impact baton, and when it hits, it hurts. Wardens aimed at the bear's rump; a well-placed shot to the meaty tissue on the hind quarters would not cause injury, but would pack enough punch to persuade a bear to avoid highways and high visitor use areas.

The grizzly was hit four times with the thumper gun between August 12 and 15. Each time it was hit, the bear would run into a cover of trees, but return to feed on the berries along the roadside. It had already become more evasive and spent a lot of time out of range.

The habituated grizzly bear was hit for the fourth and final time on August 15 when it returned once more to the road to feed on buffalo berries. That time, it stayed away. Subsequent telemetry locations indicated that the bear remained in the area for sometime afterwards, but avoided areas frequented by people.

For the time being, the bear's behavioural modifications seem promising and the goals of the aversive conditioning programme have been achieved. The warden service has prevented the premature death of a park grizzly while at the same time increasing the safety of park visitors. It is possible, of course, that the bear may revert to old habits and park wardens may have to remind it again that high visitor-use areas are not all that desirable, and that it is in the wilderness.

***Carey Elverum** is a problem wildlife warden at Banff National Park. For further information, please call (403) 522-3866.*

Lakes Reveal Their Secrets

Sediment coring reconstructs vegetation dynamics in the Kootenay Valley

Douglas Hallet

INTRODUCTION

As part of the larger Ecological History Project in Kootenay National Park, University of Calgary researchers extracted two lake sediment cores in the deepest sections from each of Dog and Cobb Lakes. The cores of these two lakes, extracted with a Reasoner (1993) percussion corer, contain 8–10 000 years of sediment history in the Kootenay Valley. The purpose of this paleoecological project is to reconstruct postglacial (Holocene) vegetation dynamics in the montane ecoregion of the Kootenay Valley related to climate change and disturbance events such as fire. The information from the project will also be used to make recommendations, based on sound paleoecological research, for ecosystem management in Kootenay National Park.

DOG LAKE

Dog Lake's relatively large size (15.1 ha) makes it useful for investigating regional vegetation changes in the montane ecoregion. Thus far, researchers completed a pollen analysis for the Dog Lake core in 10 centimetre intervals to look for broad-scale, climate-related vegetation changes in the montane ecoregion.

Most fossil pollen studies in the Canadian Rocky Mountains have sampled cores in five to 10 centimetre intervals to look at vegetation changes mainly associated with climatic change. In the Kootenay Valley study, a high resolution one-to-two centimetre pollen sampling technique was considered best in order to take advantage of the core's good chronological control and to investigate pollen responses to various disturbance events.

Researchers will use this high resolution pollen record to assess the natural variability of montane vegetation. They will also be able to compare the results with more recent (*c.* past 500 years) fire history studies based on tree-ring data. A long-term look at the vegetation history in the Kootenay Valley is considered vital in order to determine the best ecosystem management options, which both recognize and allow for natural processes and natural variability in park vegetation.

To further support the fossil pollen analysis, researchers will carry out floral and faunal macrofossil work on the core, using both microscopic and macrofossil charcoal analysis. Both charcoal signals will give a long-term look at fire activity within the Kootenay Valley and they will be compared with the high-resolution pollen record.

Additionally, a continuous record of gastropod (mollusc) shells throughout the core will allow the execution of oxygen isotope (O^{18}/O^{16} ratios) analysis, which is important in determining paleo-water temperature fluctuations. This data should add much to the paleoclimatic Holocene record in the Canadian Rocky Mountains.

COBB LAKE

Sediment cores from the smaller Cobb Lake (2.5 ha) will not be used for continuous high resolution pollen analysis as in Dog Lake. Researchers will focus instead on selected areas of the core. The sediment record from this lake represents a more local signal of vegetation change. The most intriguing intervals in the Cobb core appear in the oldest sediments where large pieces of charred wood sit at the top of five sediment influx events (similar intervals exist in Dog Lake, in the same layers). This unique event has been interpreted as a large fire from the Cobb Lake watershed. Coring Kootenay Pond (further north up the Kootenay Valley) this winter may reveal smaller charcoal fragments embedded within the pond's core, thereby allowing a model of charcoal particle source area and fallout distance to be made from this large singular prehistoric fire event.

Researchers interpreted Cobb Lake's five major sediment influx events as slope-wash erosion after large fire events have denuded local vegetation. Grain size analysis of these five events shows a definite fining up sequence in the core. Larger grain sizes dominate the bottom of the intervals and become progressively finer towards the top of each event, proving that the events are indeed separated chronologically. Each influx represents a large fire event based on the large amount of charred wood fragments embedded in each event. As these events represent the effects of post-disturbance slope wash into the lake basin, they may be a reliable way of detecting large stand-replacing fires in mountain lakes adjacent to steep forested slopes. Pollen analysis around each of the influx events will take place in the coming months to investigate vegetation changes that may have accompanied the fires.

FUTURE ENDEAVOURS

Later this winter, a frozen finger corer will be used to sample the softer, more recent sediments in Dog Lake and possibly Cobb Lake and the Kootenay Pond. This

— continued on page 13 —

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Ground-breaking study will help assess aquatic health in Kootenay National Park

Insects Hold Secret to Health

Garland Jonker and Joseph Culp

BACKGROUND

Aquatic insects are abundant in stream ecosystems and serve as a food source for many fish species. The larval forms of many terrestrial species, such as mayflies, stoneflies and caddisflies, eke out an existence on and within the rocky environment on the bottom of flowing water systems. Here, they exist for a time ranging from days to years, feeding on detrital material, fine particles, and each other, until the reproductive adult stage finally emerges onto land and renews the cycle. The relatively short life cycle of many of these insects, combined with their complex role in aquatic ecosystems, makes them an important focus for research.

The purpose of our study is to examine the changing patterns of structure in benthic (bottom) insect communities throughout the Kootenay-Vermilion river system, and to determine how these patterns are connected to the physical and biological gradients that define the aquatic environment. As no work of this nature has previously been performed in Kootenay National Park, this baseline of information will assist in the development of strategic plans for assessing aquatic ecosystem health in the park. Also, because many of the ecological concepts can be applied generally, this plan could potentially be modified for use in other mountain parks. The project is a joint research initiative among the National Hydrology Research Institute (Dr. Joseph Culp), the University of Calgary (Garland Jonker and Dr. E.A. Johnson), and Kootenay National Park.

PROGRESS TO DATE

In September and October 1994, we sampled 20 stream sites in Kootenay for benthic insects, benthic organic material, benthic algae, water chemistry, stream geometry, substrate composition, water temperature, and stream hydrology. Insect, algae and organic samples were taken to the National Hydrology Research Institute in Saskatoon, SK, for sorting and identification. Preliminary data seem to indicate a predominance of mayfly taxa, specifically flatheaded grazers (*Rithrogena* spp. and *Epeorus* spp.), suggesting that stream hydraulics may play an important role in determining community composition in the park by affecting aquatic insect respiration, feeding biology, and ability to maintain position. Both terrestrially derived leaf and organic material and instream primary productivity will likely play an important part in structuring insect communities. Because sampling at different times of the year will help to establish some of the seasonal trends in aquatic insect community dynamics, we undertook a second sampling programme in late winter 1995, and plan a third sampling programme for next fall.

Results of the multivariate analysis will help determine which environmental gradients are of primary importance in structuring benthic invertebrate communities in the Kootenay-Vermilion river system, and will establish which areas of the system are most similar in terms of benthic macroinvertebrate community structure and composition. This knowledge, along with the usefulness of aquatic insects as indicators of environmental impact, will be used to assess the health of the aquatic ecosystem in the park. Regular monitoring at specified sites and comparison to the data base from the present research can, for example, be used to assess the impacts of logging outside the park, road construction, and other anthropogenic disturbances on the quality of the Kootenay-Vermilion river and assist in establishing management policy.

***Garland Jonker** is a biology graduate student at the University of Calgary. **Joseph Culp** is a researcher with the National Hydrology Institute in Saskatoon. For further information, please call (306) 975-5742 or e-mail: gpjonker@acs.ucalgary.ca.*

Lakes Reveal Their Secrets

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coring technique will allow a more detailed look at the last thousand years of sediment history because the percussion corer has a tendency to disturb the most recent unconsolidated sediments. A Reasoner core will also be taken of Kootenay Pond to compare sediment stratigraphies with the cores of Dog and Cobb Lakes, and to provide data that will help in making recommendations for future research on this small, closed-basin lake. Results from this project will be used to determine long-term ecosystem processes (*e.g.* climatic change, disturbance events) in the Kootenay Valley and to make recommendations for ecosystem management in Kootenay National Park.

***Douglas Hallet** is a graduate student in the Faculty of Environmental Design at the University of Calgary. This research is funded by Kootenay National Park and an NSERC grant to Dr. L.V. Hills from the University of Calgary's Department of Geology and Geophysics. For further information, please call (403) 220-9444 or e-mail: djhallet@acs.ucalgary.ca.*

Stand-alone text provides everything you need to know to conduct an amphibian study

Amphibian researchers rejoice!

Measuring and Monitoring Biological Diversity:
Standard Methods for Amphibians
edited by W. Ronald Heyer et al.
reviewed by Suzanne Barnes

Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians addresses the need for consistent data collection in studying amphibians. It sets out a variety of standards to measure and monitor amphibian populations so that studies throughout the world can be compared.

Chapters include an overview of amphibian diversity and natural history, essentials of standardization and quantification, research design for quantitative amphibian studies, keys to a successful project, associated data and planning, standard techniques for inventory and monitoring, supplemental approaches to studying amphibian biodiversity, estimating population size, analysis of amphibian biodiversity data, and recommendations. Appendices cover ways of handling live amphibians, techniques for marking amphibians, recording frog calls, preparing amphibians as scientific specimens, and collecting tissue for biochemical analysis. Also included are a glossary, random number table, literature cited, index, and list of authors and contributors' addresses (little extras that make it that much less frustrating to use).

Each chapter is written by experts in the field for use in the field by people in conservation, environmental, government, wildlife, and science organizations. The book is written so that someone with an undergraduate degree in science or an equivalent can use it successfully. It is meant to stand alone and not serve as a reference or overview; as a result, it is thorough in its explanations and analysis of techniques and problems.

It covers everything from initial study design—how to ask a research question and formulate the research hypothesis through to field observations and that all important statistical design—to techniques for studying amphibians. All topics are discussed clearly, with required equipment, personal requirements, and diagrams provided where necessary. Diagrams are clear, concise, and well-explained. Studies that use the discussed techniques are referenced.

Measuring and Monitoring Biological Diversity Standard Methods for Amphibians has everything that you would need to design and carry out a biodiversity monitoring strategy for amphibians. It walks you through the entire research process (except for writing the report). This makes developing a monitoring scheme a lot easier because all the information you need on techniques and analysis is at your finger tips. It makes me wish that a similar volume was available when I was doing my MSc research on garter snakes. It is well-worth the investment if you are planning any amphibian work in your park.

Suzanne Barnes *is a warden at Prince Edward Island National Park. She spent several months in 1994 at Elk Island National Park. For further information, please call (403) 992-6380.*

Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians is edited by ***W. Ronald Heyer, Maureen A. Donnelly, Roy W. McDiarmid, Lee-Ann C. Hayek, and Mercedes S. Foster.*** *Published by Smithsonian Institution Press, Washington (1994).*

PODIUM

— continued from page 15 —

cies on federal lands: national parks, Department of National Defence establishments, Department of Transport lands, and so forth.

Applications of CEAA will require that First Nations be directly involved in managing archaeological resources that are related to them. Recent environmental cases in Alberta have witnessed significant interventions by aboriginal peoples with respect to potential impacts to archaeological and spiritual sites. As a result of an Alberta–Canada harmonization agreement for environmental assessment, the Pine Coulee Reservoir project in southern Alberta required a joint provincial-federal panel to investigate environmental effects of the proposed reservoir. Among its observations and recommendations were several pointed at the demand for greater involvement of Native peoples at an earlier stage in project planning. In British Columbia, the Archaeology Branch requires as part of its regulated permit process that archaeologists consult with appropriate First Nations prior to and during archaeological impact assessment studies.

There are many complicating factors in developing mutually agreed upon policies and practices for protecting and understanding Native cultures of the past and present, and for promoting democratic and humanitarian solutions. To date, all efforts have been a rewarding learning experience for all parties. Archaeological initiatives have both profited from joint efforts and assisted with developing innovative solutions. Future challenges face us indeed. Parks Canada can, with its experience, profile, and its mandates of conservation and public appreciation, assist the nation with developing a fully cooperative place for First Nations' cultures.

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FOOTNOTE † I use the terms "First Nations," "Aboriginal," and "Native" almost entirely interchangeably. The Assembly of First Nations is the proper term for the largest political group representing most Native people in Canada (although the Inuit don't consider themselves First Nations). Some groups prefer the term "Native," others are more comfortable with "Aboriginal." To most (but not all), the term "Indian" is offensive.

PODIUM

Protecting the Past

Archaeology looks to future cooperative management of aboriginal resources

Martin Magne

One of the burning issues in Canadian archaeology is the multifaceted relationship that exists among First Nations, archaeological resource management, and environmental assessment. Until passage of the Canadian Environmental Assessment Act (CEAA) in 1994, Canada did not have legislation protecting archaeological resources on federal lands other than mention of four specific kinds of sites in the Indian Act and general regulations under the National Parks Act. Even now, Canada still does not have protective legislation in the strict sense. CEAA legislation can call for assessment of potential impacts to archaeological, palaeontological, and traditional sites, but in absence of a CEAA application, intentional damage to an archaeological site on federal land is not a recognized offence.

Six years ago, an "Archaeological Heritage Protection Act" was drafted by the Department of Communications. The draft bill was circulated across the country, and while it had some flaws, it was widely and strongly supported by the professional community. Many archaeologists had lobbied for over two decades to obtain such legislation. The Minister of Communications met with members of the Canadian Archaeological Association, sent a delegate to national archaeological meetings, and distributed literature nationally announcing the impending completion of the Act.

Notions of a celebration were short-lived when it became clear the proposed Act was not in step with contemporary views concerning First Nations† heritage, specifically, ownership of their heritage. At the same time that the United States was preparing and passing the Native American Grave Protection and Repatriation Act (NAGPRA), Canada was apparently not ceding ownership of artifacts to Canadian aboriginal peoples, or at least wanted to consider the broader public benefits and public trust before conceding. The Assembly of First Nations reacted strongly, commissioning studies and circulating a discussion paper entitled "My Grandfather is Not an Artifact." The Canadian act was never brought before the House of Commons.

To a few archaeologists, the consideration of Native cultural perspectives was seen as an infringement of their intellectual freedom to practice a science. Most archaeologists, however, embraced this change in perspective, as many had been working closely with First Nations for their entire careers. Some Native peoples developed awareness of the kinds of arguments that archaeologists put forward in developing knowledge of "prehistory," and became aware that the scientific world did not always jive with their practical or spiritual worlds. Many were concerned that the dynamic nature of their culture was not appreciated—Native cultures are not frozen in ethnographic time.

Although turmoil remains today, there are signs of resolution. The proceedings and results from the on-going application of NAGPRA in the US have spilled over the border to Canada. Some First Nations believe mutually acceptable solutions are best negotiated on a case-by-case basis, rather than in the polarized atmosphere that can result from national legislation such as NAGPRA. In Canada, resolution of ownership issues is dealt with productively despite the lack of legislation. There are many examples of this: scientists and First Nations are resolving human remains and burial goods issues (in most cases bones and grave goods are re-buried on request, as took place recently at Sgan Gwaii in Gwaii Haanas National Park Reserve); good quality medical history information is being obtained from skeletal material that has benefits for modern populations (a 2 000-year-old site at Pender Canal revealed some serious malnutrition traits); spiritual awareness is being fostered in laboratories and field camps (field crews are often cleansed spiritually before commencing excavations); commercial developers recognize gains in developing trust (traditional environmental knowledge is gaining respectability in helping to assess project impacts).

"Native peoples developed awareness of the kinds of arguments that archaeologists put forward in developing knowledge of 'prehistory,' and became aware that the scientific world did not always jive with their practical or spiritual worlds."

The national scene overall in Canada is encouraging. We have no NAGPRA and some professionals think that may be a good thing, since polarized political stances can be de-emphasized. The Canadian Museums Association has recognized the need for better communication and established very successful working groups and conferences, culminating in the Task Force on Museums and First Nations. Now, all major museums, and a number of smaller ones, have established Native advisory groups that not only consult on collections of sacred objects, but are also involved in basic museum management and profoundly influence research directions. In effect, as far as museums are concerned, Canada is acting in the spirit of NAGPRA.

Parks Canada has been a leader in establishing cooperative management agreements with First Nations, in each of which archaeological knowledge, collections, and training have played an important role. Archaeology provides a strong link to traditional cultures. I believe there are good reasons for this: Native peoples relate immediately to their past and retain a great deal of knowledge about it. Archaeology provides a direct linkage. Its multi-disciplinary nature involves other sciences and humanities. Archaeology is labour-intensive and encourages team work. It can serve as a training ground for youth and help grant an extended voice to Elders. Archaeology can provide scientific support for traditional knowledge. A Haida legend concerning a migration across grassy plains, for example, is supported by palaeoenvironmental evidence of environments 11 000 years ago on lands now 150 metres under Hecate Strait.

CEAA explicitly recognizes the need to have impact assessments undertaken when archaeological sites or aboriginal traditional use areas are at risk from development. Canadian Heritage is uniquely placed in government to lend its experience to assisting with appropriate liaisons between First Nations and government agen-

Research Links

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MEETINGS OF INTEREST

DECEMBER 1–2, 1995

3rd ACM International Workshop on Advances in Geographic Information Systems. Baltimore, MA. Contact Dr. Patrick Bergougnoux, tel: (33) 61-57-47-89, e-mail: bergougn@irit.fr.

FEBRUARY 20–24, 1996

Ecosystem Management: Tools for Practitioners. Edmonton, AB. This national training course is intended to provide individuals involved in the design and implementation of ecosystem management with the ability to evaluate and advance their park programme in relation to the regional ecological and land use context. Participants from across the country will be exposed to key social, economic, and ecological tools to enhance their ecosystem management skills. The course will be video-taped and distributed as a training package to regional offices of Canadian Heritage. Contact Gavin More, Parks Canada, Alberta Region, Professional and Technical Services, P.O. Box 2989, Station M, Calgary, AB, T2P 3H8. Tel: (403) 292-4496, fax: (403) 292-4404, e-mail: moreg@pkswro.dots.doe.ca.

MARCH 29–31, 1996

Western Canada Wildlife Society Conference/Annual Meeting. Banff, AB. Contact Ron Bjorge, F&W Services, 404, 4911 – 51st Street, Red Deer, AB.

APRIL 15–17, 1996

Acidifying Emissions in Alberta: Applying National and International Expertise to the Alberta Situation. Red Deer, AB. This symposium will bring scientists, managers, and other stakeholders together to explore and discuss the health and environmental effects of acidifying and related air emissions. The goal of the symposium is to place the Alberta situation in context with research and management experiences in other regions and countries. Contact the Clean Air Strategic Alliances, 6th Floor, Standard Life Centre, 10405 Jasper Avenue, Edmonton, AB, T5J 3N4. Tel: (403) 427-9793, fax: (403) 422-3127, e-mail: casa@ccinet.ab.ca.

MAY 11–16, 1996

The Changing Human Landscape During the Holocene on the Canadian Prairies. Saskatoon, SK. Sponsored by the Canadian Quaternary Association, this special session will focus on human-landscape interactions in the Canadian prairies during the Holocene and especially prior to Euro-Canadian settlement. Contact Alwynne B. Beaudoin, Archaeological Survey, Provincial Museum of Alberta, 12845–102nd Avenue, Edmonton, AB, T5N 0M6. Tel: (403) 453-9192, fax: (403) 454-6629, e-mail: abeaudoi@ gpu.srv.ualberta.ca.

MAY 18–23, 1996

The 6th International Symposium on Society and Resource Management. University Park, PA. The 1996 conference will focus on a better integration of social and natural sciences in addressing resource and environmental issues. Contact A.E. Luloff, 11 Armsby Building, University Park, PA, 16802. Tel: (814) 863-0401.

AUGUST 20–24, 1996

Second World Congress on Natural History Collections. San Diego, CA. The Congress, structured around discussion sessions and workshops, will focus on providing practical solutions for the continued development and support of natural science collections throughout the world. Contact the Administrator, World Congress, Department of Earth Sciences, University of Cambridge, Downing Street, Cambridge, CB2 3EQ, UK. Tel: (44) 1223-33-34-21, fax: (44) 123-33-3450.

SEPTEMBER 9–13, 1996

Sustaining Ecosystems and People in Temperate and Boreal Forests. Victoria, BC. This international conference, focused on integrating conservation of biological diversity with social and economic goals, intends to promote understanding of sustainability issues and to emphasize constructive, long-term solutions needed to sustain biological diversity of native forests and the human communities they support. Contact Connections Victoria Ltd., P.O. Box 40046, Victoria, BC, V8W 3N3.