Research Links

A Forum for Natural, Cultural and Social Studies

Another Look Back

Updating the Archaeological Resource Inventory of Prince Albert National Park

David Arthurs

ISSUES IN ARCHAEOLOGICAL RESOURCE MANAGEMENT

Current knowledge of archaeological heritage resources of Prince Albert National Park (PANP) is based primarily on inventories and limited test excavations conducted between 1971 and 1973 (Forsman 1972; Gryba 1974). This research revealed many sites and resources, and, supported by a few subsequent studies, has served as the basis for park interpretation and cultural resource management programs ever since (Burnip and Lee 1986).

The ensuing quarter century has brought about changing management needs. In particular, the Cultural Resource Management (CRM) Policy (Canadian Heritage 1994), requires inventory and evaluation of heritage resources, and consideration of their historic value in actions affecting them. These changes brought to light several key issues, and demonstrated the need for another look at the archaeological resources of PANP.

Sites discovered during the initial surveys received only basic documentation, and most had not been revisited since their discovery. Insufficient information on the nature and current status of many sites and their resources often precluded adequate assessment within the new policy framework.

The initial surveys focused on the major waterways of the park. There was concern that many undocumented, and therefore unmanaged, resources might be at risk, as visitation to previously underused areas of the park increased, and other factors such as shoreline erosion continued. Previously surveyed areas were of concern as well, as illustrated by a 1995 consultant's survey of the Kingsmere Lake area (Gibson & McKeand 1996). This survey added several archaeological sites to the inventory, many of which lay along the popular hiking trail to Grey Owl's Cabin. Some sites had been impacted inadvertently by visitor and trail-maintenance activities, demonstrating that even this well-traversed area could benefit from closer examination.

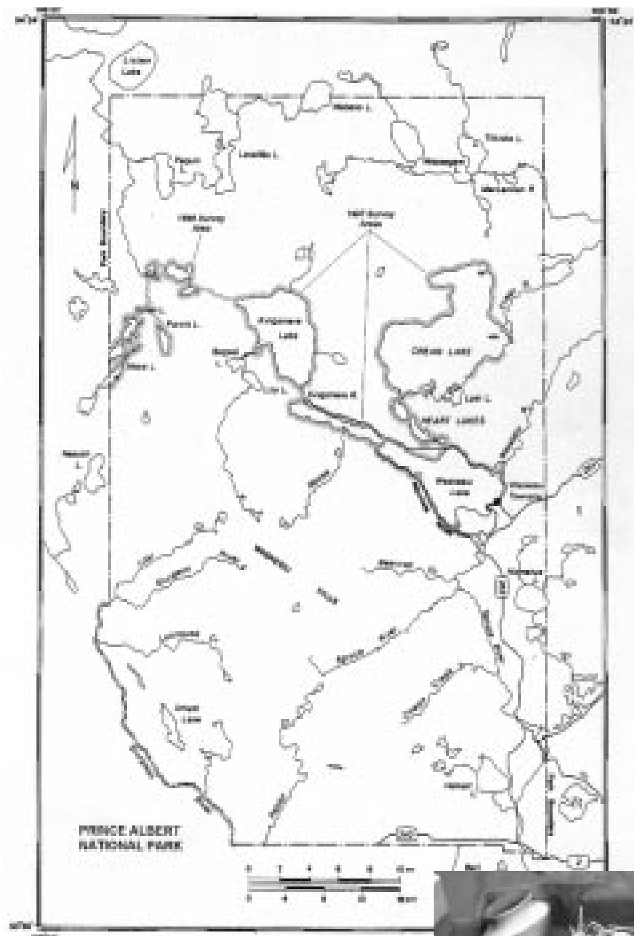

Figure 1. The 1997 and 1998 Archaeological Resource Inventory Survey Areas, Prince Albert National Park

Many sites that had been reported to the park by informants had never been verified in the field. In many cases, the nature of the resources associated with these reported sites, and even their locations, were known only vaguely; their evaluation and management required further documentation in the field.

To address these issues, and assist PANP in fulfilling its responsibilities under the CRM Policy, a four year initiative was begun in 1996, coordinated by the author, to update information and design a strategy for managing the park's archaeological resources.

IDENTIFYING DATA GAPS

During the first phase of the project in 1996, Eric Simonds compiled existing data to identify gaps and provide direction for field studies in the second phase of the project. This review

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FEATURE ARTICLES

DEPARTMENTS

FRANCOPHONES

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SUBMISSIONS WELCOME FOR THE SUMMER/AUTUMN ISSUE. DEADLINE: APRIL 9, 1999

EDITORIAL

This issue of *Research Links* is laregely devoted to research in Prince Albert National Park. However, the work presented here represents only a cross-section of the research activity in the park. The park's diverse history, aquatic habitats and terrestrial habitats provide a wealth of research opportunities.

Collectively, the authors of the following articles provide us with a glimpse of PANP's cultural history, aquatic issues, plant community structure, wildlife population challenges and management strategies. In our Podium piece (page 19) PANP Superintendent, Bill Fisher shares his thoughts on Parks Canada's efforts to achieve ecosystem-based management.

It is not often that we are able feature research from a single national park. We wish to thank Susan Carr and Bill Fisher for their assistance coordinating article submissions.

Gail Harrison
Ecosystem Services, Western Canada Service Centre and
Editor of Research Links

What's New for *Research Links*?

In this issue we introduce "Research Highlights" (pages 10-11), a feature intended to present a broad perspective of ongoing research in Western Canadian National Parks and Historic Sites. If you are interested in submission details for this section of *Research Links*, please contact us as indicated on page 20.

We are also pleased to announce that *Research Links* is once again available electronically. We can be found in PDF format on the Parks Canada main website—http://parkscanada.pch.gc.ca—under "Library" in "Download Docuuments." If you do not already have Adobe Acrobat on your computer, you can download a copy from this location. We are not yet available in HTML format, but we're working on it!

Dianne Willott
Production Editor, Research Links

An Introduction to PANP

Bill Fisher

Prince Albert National Park, 3875 square kilometres in size, was created in 1927. The park is the largest protected wilderness area in Saskatchewan, representing approximately 0.6% of the total area of the province. The park is located 65 kilometres north of the city of Prince Albert. Topography in the park is dominated by the effects of glaciation, and is a mosaic of uplands and lowlands that range in altitude from 488-732 metres above sea level.

Prince Albert National Park is located within the Southern Boreal Plains and Plateaux Natural Region as identified in the national parks system plan, and lies within the southern mixedwood region of the boreal forest zone. Mixedwood forests are dominant and occur throughout the park. Typical tree species include trembling aspen, jack pine, white spruce, black spruce and larch. In the southern portion of the park significant outliers of fescue grassland occur in the drier locations.

The aquatic ecosystem inside the park is extensive, with seven watersheds and over fifteen hundred lakes. Water bodies comprise approximately 10% of the area of the park. Except for the MacLennan system, watersheds originate from within and flow out of the park. The water systems drain into either the Churchill or Saskatchewan river systems and then to the Arctic Ocean.

Some components of the regional ecosystem protected in the park include: viable and naturally reproducing populations of lake trout, habitat for woodland caribou, free-ranging plains bison, and a large White Pelican colony.

Archaeological evidence and oral histories suggest that Aboriginal cultures have inhabited the region for at least 6000 years, perhaps longer. There are many sites within the park that represent habitation, fishing, hunting, tool and pottery making and burial activities. Fur-trading began in the 1700's and the Hudson Bay Company built a trading post on Waskesiu Lake in 1886. Timber harvesting in the park and surrounding area began in the late 1800's and continues today on adjacent lands. The noted conservationist, Grey Owl, lived in the park from 1931-1938.

Park development includes campgrounds, picnic areas, trails and a golf course. The townsite of Waskesiu is a major tourist focus and seasonal community. Cottages, cabins, hotels, bungalow camps, restaurants and gift shops are located in the townsite. The park attracts about 200,000 visitors annually. Popular activities include: camping, hiking, swimming, canoeing/boating, golfing and cross-country skiing.

Bill Fisher is Superintendent of Prince Albert National Park

Prince Albert National Park

Science Liaison Committee

Parks Canada is committed to supporting research which will help to sustain the integrity of ecosystems and improve the quality of ecosystem management decisions. Toward that end, Prince Albert National Park is pleased to announce the establishment of the Science Liaison Committee, an advisory group made up of members of the scientific community who can provide guidance to the park in its science and research programs.

- Bill Fisher, Superintendent, PANP

Susan Carr and Guy Melville

Members of the scientific community in Saskatchewan and Parks Canada have formed a science liaison committee for Prince Albert National Park (PANP). The decision to form the committee evolved in response to deficiencies identified in the report on Science in Decision-Making produced by the Prairie and N.W.T. Region, and the Final Report of the Ecosystem Management Task Force—Toward Sustainable Ecosystems produced by Parks Canada Alberta Region. These reports identified two specific deficiencies in relation to science and research: the lack of a clear vision of the role of parks and sites in research, and the lack of regional research policies and guidelines.

Largely as a consequence of these reviews, parks staff and researchers identified the support needed to encourage research in national parks at a University of Regina workshop entitled Science and Research in Western, Prairie and Northern Region National Parks. Participants identified the need to improve communication between parks and researchers, remove barriers to appropriate research in national parks, and provide rigorous reviews of the science program in individual national parks.

The 1995 Park Management Plan Review indicated that science and research can help the park:

- endorse the role of PANP as a site for scientific and benchmark research that will contribute to long-term protection and public understanding;
- encourage ecosystem-based science and research in the park that is compatible with the protection of the park's values;
- ensure that decision-making associated with the protection of park ecosystems will be based on science, research, integrated land management, and traditional knowledge.

The PANP Science Liaison Committee provides the park with critical comment about its research, management and communication programs and recommends ways of improving park decision-making though the application of science and research. The committee provides a forum for discussion of issues of mutual interest to park staff and researchers. It can provide the park with valuable external review of proposed research projects, emphasizing the importance of long-term protection of park values.

At the park's request, the committee has reviewed and provided valuable feedback on several major research and management proposals. These proposals include options for the Waskesiu townsite water and sewer treatment, the park's proposed fire management strategy, and the future of the Boreal Ecosystem-Atmosphere Study (BOREAS) site in the park. The BOREAS site was allowed to remain intact for use in the Boreal Ecosystem Research and Monitoring Sites (BERMS), because both the park and the Science Liaison Committee recognized that the project data would ultimately be important to PANP ecosystem management.

By continuing to enhance cooperation between PANP and the scientific community, the committee will improve understanding of regional ecosystems in the Southern Boreal Forest and adjacent parkland. Input from the committee will help to establish long-term monitoring to track the effectiveness of management approaches.

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Fescue Grasslands

in Prince Albert National Park

Mary Vetter

Visitors accustomed to the forest and rolling topography of Prince Albert National Park (PANP) might be surprised that grasslands dot well-drained glaciofluvial deposits in the Rabbit Creek area of the extreme southwestern corner of the park. As the sign at the largest area, Wasstrom Flats, states, the grasslands of PANP represent a significant portion of the remaining rough fescue (*Festuca altacia* Trin.) grasslands in the Canadian prairie provinces, and thus have Zone 1 Special Preservation Area status. Fescue grasslands were once widespread throughout the aspen parkland region, but because of the rich black soils underlying them most have been utilized for agriculture.

Grasslands occur throughout boreal forest areas, from Manitoba to Alaska; and, as in PANP, most are shrinking as a result of forest invasions during recent decades (Schwarz and Wein, 1997). Fire suppression has been suggested as a major factor in the loss of grassland area in PANP (Carbyn, 1971; Cameron, 1975; Gunn *et al.*, 1976; Trottier, 1985). In his inventory and status report on the fescue grasslands of PANP, Cameron (1975) stated that if observed rates of invasion continued the grasslands could largely disappear within a few decades, surviving on only the most well-drained areas such as the center of Wasstrom Flats. Comparison of 1949 and 1990s aerial photographs shows that many small grasslands have been fragmented by forest invasion from a larger Wasstrom Flats (approx. 100 ha in 1949 but only about 26 ha now) over the past 50 years.

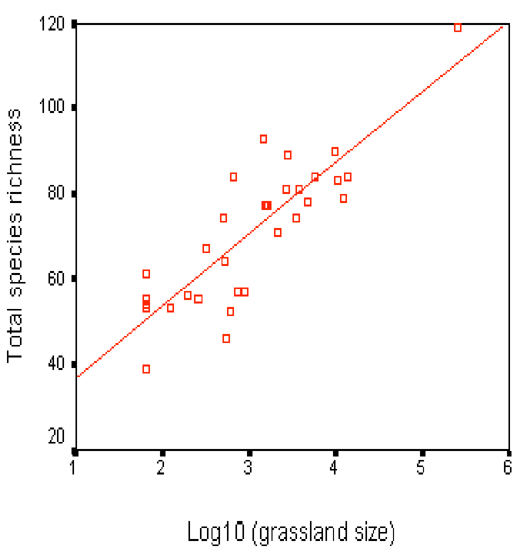

Figure 1. Total floristic richness (TFR) in individual grasslands versus log_{10} (grassland size). (R^2=0.73, F-82.3. $p <0.01$. df=32)

Intuitively, this fragmentation and decline in grassland area should threaten the remaining fescue grassland ecosystem. Island biogeography theory (MacArthur and Wilson, 1967; Connor and McCoy, 1979) suggests that species richness (number of species) should vary positively with island size and negatively with isolation due to their effects on extinction and immigration rates. Habitat diversity theory states that species richness increases with the number of habitats (Westman, 1983), whereas the intermediate disturbance hypothesis proposes that intermediate levels of disturbance produce the highest species richness (Grime, 1973), perhaps by increasing the number of habitats. On the basis of these theories, Elchuk (1998) hypothesized that the floristic richness of grasslands in the Wasstrom Flats area would vary positively with grassland size and disturbance (as defined below), and negatively with distance from Wasstrom Flats (as a measure of isolation). If richness decreases substantially as fragmentation and forest invasion produce smaller grasslands, prescribed burning or some other management to maintain larger grassland areas actively would be indicated.

In 1997 the floristic richnesses of 32 small grasslands ranging in size from several m^2 to a few thousand m^2 were compared to that of Wasstrom Flats (Elchuk, 1998). Floristic richness in the grasslands was recorded in two ways: total number of plant species found in the grassland (Total Floristic Richness or TFR; determined by at least three visits to each grassland during the growing season) and the number of plant species in 8m x 8m quadrats randomly located in the grassland pockets (Quadrat Floristic Richness or QFR). Disturbance was assessed with an index compiled by ranking various kinds of animal activity (pocket gopher mounds, ant hills, ungulate bedding spots, grazing and browsing), and with a comparative measure of the amount of thatch accumulation. Grassland size was determined by counting pixels in digitized aerial photographs. Elchuk also measured isolation (distance) from the Wasstrom Flats core area.

RESULTS

Linear regression analyses (Elchuk, 1998) indicated that TFR depended on grassland size (Figure 1), but not on isolation, animal activity, or thatch accumulation. This result indicates that as grassland sizes decrease, individual grasslands become floristically impoverished. However, the collective species richness of all the small grassland fragments exceeded that of Wasstrom Flats alone. In fact, more than 25% (46) of the total plant species (169) occurred only in the smaller fragments and not in Wasstrom Flats. Although habitat types were not classified, these results suggest that a mosaic of grasslands, which presumably represents a variety of habitats, produces greater diversity than a single larger grassland. However, many of the 46 species not found in Wasstrom Flats are characteristically ecotone or forest species, rather than typical grassland species. Three species were found exclusively in Wasstrom Flats. Two of these might easily have been missed elsewhere: *Anemone patens* because of its spring-ephemeral habit and *Draba nemorosa* because of its small size. The other species, *Artemisia frigida*, was found in the driest habitats.

Quadrat floristic richness (QFR) indicates plant diversity per unit area, and thus is a better test of the island biogeography

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Figure 2. A McKean Projectile Point from Site 12N22, Prince Albert National Park (length 3.1 cm)

Another Look Back

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supplemented Kevin Lunn's 1989 research by synthesizing in-house and published archaeological and historical reports, examining park files for site leads and other information, and searching for artifact collections or documentation held by outside institutions. This information was entered into the computerized archaeological site database administered by the Cultural Resource Services Unit of the Western Canada Service Centre in Winnipeg.

THE 1997 LAKE SURVEYS

In consultation with park staff, the three large lakes in the park, Kingsmere, Crean, and Waskesiu, were selected for the first season of fieldwork. These three lakes are the most heavily used areas in the park and have the largest concentration of documented archaeological sites. Assisted by Eric Simonds, the author conducted a 17-day survey of these lakes in the autumn of 1997. During the course of the survey more than 70 known or reported site locations and numerous previously unsurveyed locations were inspected (Figure 1). The survey added 30 sites of archaeological interest to the existing inventory, and provided updated information on many previously recorded sites.

One of the major deficiencies of previous surveys had been the inadequate mapping of individual sites and their resources, which complicated relocation and monitoring. To address this problem, the 1997 survey crew prepared compass and tape or compass and pace maps for each site visited.

The sites recorded dated from early park-related installations back to ancient First Nations occupations. One of several precontact sites examined, on Waskesiu Lake, produced a lanceolate (leaf-shaped) projectile point with a deeply concave base that may be attributed to the Middle Precontact McKean Complex (Figure 2). There are now seven sites in the park known to have McKean Complex occupations, supporting the hypothesis that these Plains bison hunters used the park area some 4000 years ago, perhaps when the prairie-forest border lay north of its current position (Arthurs 1994).

Several other sites attest to the potential of the archaeological record to augment the interpretation of the cultural and ecological history of Prince Albert National Park and the surrounding area. Two Late Precontact sites yielded Native ceramics, which, for reasons not yet understood, appear to be relatively rare in the park. Another site, on a ridge several metres back from the present shoreline of Waskesiu Lake, appears to represent an Early Precontact Palaeo-Indian occupation, which may be more than 7500 years old. Its ridge-top location and distance from the present shore may reflect a lakeside occupation at a time when water levels were much higher than today.

One of the more intriguing sites documented during the 1997 survey consisted of several linear trenches, circular pits and oblong cellars (at least one cribbed with small saplings), dug into a hillside overlooking the Waskesiu River (Figure 3). Though rumoured to relate to fur trade activities, this late historic site resembles sites related to early 20th century commercial fishing operations in the park. It is hoped that local knowledge can shed some light on the nature and significance of this site.

THE 1998 BLADEBONE CANOE ROUTE SURVEY

Popular with canoeists, especially large school expeditions, the Bladebone canoe route was identified by park staff as the priority for examination during 1998. This area, which encompasses a series of smaller lakes west of Kingsmere Lake (Figure 1), had not previously been surveyed archaeologically. The only cultural resource known was the ruin of a cabin on an island in Purvis Lake, reported to the survey crew by warden Gregg Walker the year before. The 1998 survey was conducted by Project Archaeologist Sharon Thomson and Patrick Carroll.

Whereas the 1997 survey relied almost exclusively on surface exposures of cultural material on the worn surfaces of designated campsites, in trailbeds, and in erosion cutbanks along the lakeshore, the 1998 Bladebone investigations included extensive sub-surface testing. This sampling discovered 13 previously unrecorded sites. Perhaps most important was the discovery of three fragments of Laurel pottery at a site on Bladebone Lake—only the third site in Prince Albert to yield Laurel artifacts. This discovery suggests that the park lies on the far western limits of the known distribution of this 2000 year old Boreal Forest culture (see Arthurs 1994).

The results of the Bladebone survey contrasted markedly with those of the previous year. Site density along the shores of the large lakes seems considerably higher than on this interior route. Although sites on the major lakes may represent a history of occupation from approximately 7500 years ago to historic times, those examined during the 1998 survey encompass only the late precontact through recent historic periods. Further research into the nature and function of the sites, and of their ecological context, may help explain these apparent differences.

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Another Look Back

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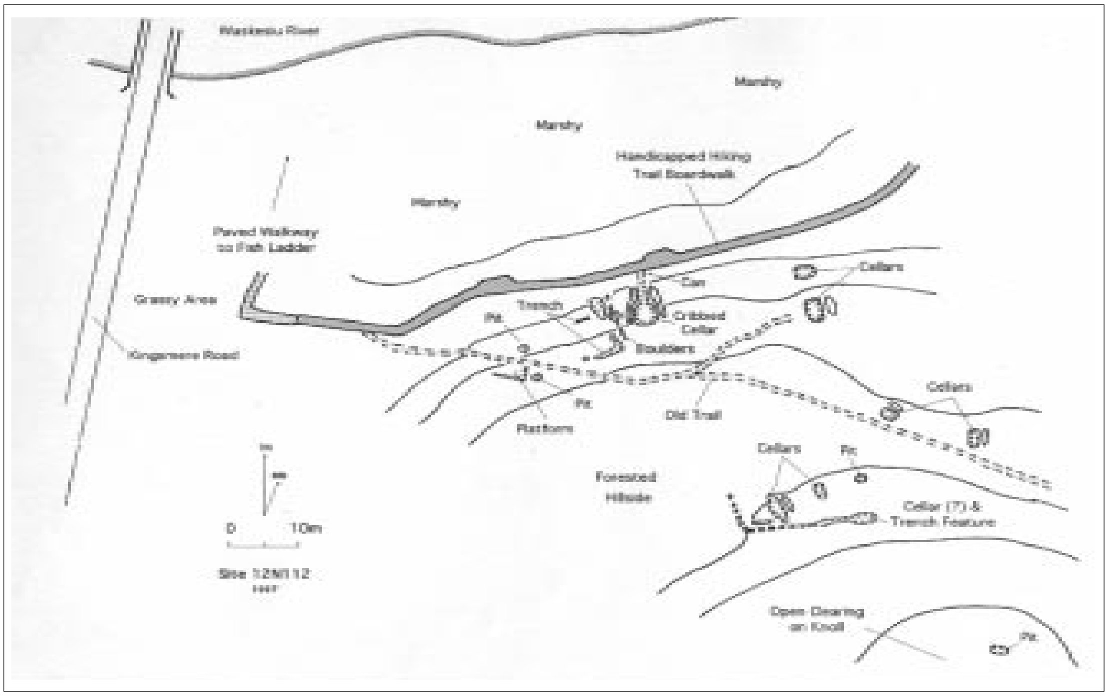

Figure 3. Compass and Pace Map of Historic Features at Site 12N112 Overlooking Waskesiu River, Prince Albert National Park

SUMMARY

In addition to confirming unverified sites and updating information on the location, nature and condition of previously recorded sites in the park, the surveys have identified several management concerns. As is so frequently the case in the Boreal Forest, many archaeological sites coincide with present-day campsites and other high-use recreational areas, and either have already suffered damage, or are threatened by modern usage. Other sites are at risk from natural processes such as forest fire or bank erosion, the latter aggravated by fluctuating water levels in the dam-controlled lakes of the park. Strategies for evaluating, monitoring and managing these fragile, non-renewable resources will be developed in consultation with park staff during the final year of the project.

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Restoration Studies in Waskesiu and Crean Lakes

Marlene Evans and Michael Fitzsimmons

Prince Albert National Park extends over 3,900 km^2 of the Boreal Plains Ecozone of central Saskatchewan. More than 10% of the Park area is open water, with Crean, Waskesiu and Kingsmere being the three largest lakes. Prior to the creation of the Park in 1927, humans had minor impacts on aquatic ecosystems, although there were commercial fisheries operations on the larger lakes. These operations were limited or closed with Park creation, but they were replaced by new activities, particularly around Waskesiu Lake. The Waskesiu Lake townsite expanded and treated sewage was released into the lake. A golf course, two marinas and two breakwaters were also constructed. During the 1930's, dams were placed on the outflow of Waskesiu Lake, the Kingsmere River (which flows into Waskesiu Lake inflow) and the Crean Lake outflow to facilitate recreational experiences.

The Aquatic Resource Management Plan for the Park (Environment Canada, Parks 1989) identified eleven specific objectives to improve management of lake ecosystems. Of these, five are particularly relevant to the restoration of Waskesiu and Crean Lakes: reestablish a naturally reproducing lake trout population on Crean Lake; restore the natural water-level regime on Waskesiu Lake; restore the natural water regime, aquatic habitat, and walleye spawning population in the Kingsmere River; ensure that water quality on all park systems remains pristine and continues to meet national and international standards for drinking water, fish consumption, and contact recreation; and collect ecological data to monitor and evaluate the aquatic systems in ecological terms such as energy flow, biogeochemical cycling, genetic integrity, and system stability.

Since 1990, the Park has addressed these objectives through a long-term research partnership with the National Water Research Institute (NWRI), Environment Canada. During this period, several specially-designed studies investigated the issues described above. Highlights of these studies to date are summarized below.

Photo: Marlene Evans

Core sampling in Waskesiu Lake: Eric Marles, National Water Research Institute and Richard Cherpak, PANP

Photo: Darryl Arsenault

A beach seine being pulled along the Waskesiu Lake shoreline

THE CREAN LAKE DAM AND DECLINING LAKE TROUT POPULATIONS

Crean Lake historically supported a commercially harvested lake trout population. The decline in lake trout angling success, which began during the 1930s, was originally attributed to insufficiencies in angler skill and low water levels over the spawning reefs during several drought periods. More recently, these declines were associated with impaired reproductive success of lake trout. Specifically, rising water levels during the later 1950s caused by the reconstruction of the Crean River dam increased shoreline erosion which may have adversely affected lake trout spawning beds (Evans and Beaven 1993). This hypothesis was investigated by assessing overwintering hatching success of lake trout eggs incubated on the historic spawning reefs (Evans et al. 1994, 1995). Hatching success (corrected for unfertilized eggs) averaged 54.6% for the two studies. Because success correlated poorly with sedimentation over the reefs, Evans *et al.* (1995) hypothesized that shoreline erosion was not the primary factor limiting lake trout population recovery. Rather, over-fishing during the 1920s and the mid-1940s severely reduced lake trout populations and the physical/limnological characteristics of Crean Lake limit lake trout recruitment. Crean Lake presents special ecological challenges to lake trout populations because it is a moderately productive, moderately deep lake. In warm summers, there is limited cold, well-oxygenated, deep-water habitat. Spawning reefs are generally covered with algae, even in autumn. Although the lake has been closed to lake trout fishing since 1989, lake trout continue to be caught incidentally. A long-term fish monitoring program would help assess the lake trout population and identify further management options to accelerate the population's recovery.

REMOVAL OF WASKESIU RIVER DAM

A lowering of water level with removal of the Waskesiu River dam would primarily affect nearshore aquatic communities in Waskesiu Lake. Evans and Beaven (1993) determined that the Waskesiu River dam was designed to increase the low-water level of the Waskesiu Lake by only 0.5 m and mean lake level by ca. 0.3 m. These small increments in water levels are less than naturally-occurring long-term fluctuations in water levels (Evans et al. 1993b). Thus, dam removal should not adversely affect nearshore communities. Furthermore, environmental impacts can be minimized by gradually removing the stop-logs that form the dam.

Aquatic communities were investigated in the nearshore regions during 1992-1995 (Evans *et al*. 1993a; Evans 1996; Evans et al. 1996; Arsenault 1998). Together, these studies demonstrate that plant, bottom

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Bugged about Dams

Kingsmere Aquatic Ecosystem Restoration

Guy Melville, Dave Wieder and Michael Fitzsimmons

The Kingsmere River in Prince Albert National Park (PANP) has been impounded, diverted and cleared of large woody debris for more than 50 years to improve passage for recreational motor boats. Prior to 1993, largely isolated observations of Kingsmere suggested the human alterations adversely affected the ecology of the system. For example, walleye (*Stizostedion vitreum*) spawning has almost ceased since the park began alterations to the stream (Melville 1995). The Park Management Plan commits Parks Canada to restoring the Kingsmere River, in keeping with legislation that national park ecosystems be unimpaired for future generations.

In 1993, PANP and the Saskatchewan Research Council began a multiyear ecosystem-based project to: systematically document ecological conditions along the Kingsmere River, forecast the changes possible with restoration, develop long-term monitoring approaches, and recommend restoration actions. Melville (1995) identified the ecological components to be investigated in the Kingsmere project, including the effects of impoundment and the other alterations on fish and stream-edge plant communities. Study components compare the Kingsmere River to the MacLennan River, a natural reference ecosystem located in the northeast corner of the park (Melville 1997).

The objectives of this component of the study are to identify the composition of the benthic macroinvertebrate communities by feeding groups, and associated habitat characteristics, particularly current velocity and surficial substrate particle sizes, in the two streams. Invertebrate-habitat associations can provide quantitative benchmarks of ecological conditions, which can be used to help monitor restoration actions on the Kingsmere River. The study investigates the hypothesis that restoration would increase the relative abundance of invertebrates dependent on currents carrying food particles, and decrease the proportion of those feeding on particles that have settled out of the water column.

BACKGROUND

The general effects of impoundments on aquatic habitats are well understood (Hynes 1970, Vörösmarty et al. 1997). Upstream, reservoirs store water, increasing residence times, evaporative losses, siltation, nutrient concentrations, and anoxia. The downstream effects include reduced, more even flows, reduced renewal of materials in water courses, floodplains and deltas, and reductions in biological productivity. Changes in flow regimes alter the composition of benthic macroinvertebrate communities (Ward 1976), because many invertebrates have specific environmental requirements (Hynes 1960). Despite this general knowledge, it is still not possible to predict specific effects of impoundment on habitats for many types of systems.

The study streams (they are rivers in name only) have similar landscape features. In each case, water flows from a cold, nutrient-poor headwater lake, through a stretch of rapids into a series of low-gradient meanders. However, the Kingsmere rapids are ten times longer than the MacLennan rapids. The park first impounded the Kingsmere River in 1936, but about 1947 a new dam (30m long x 1.5m high) was constructed of wood and rock on the Kingsmere two-thirds of the way upstream, at the head of the rapids (Figure 1). Also about 1947, a diversion canal cut at the downstream end of the Kingsmere River eliminated about one-third of the original channel, including meanders and the delta at the outflow into Waskesiu Lake (Figure 1). Another dam isolated the original channel segment from the new route at the

Figure 2. Surber sampling for invertebrates

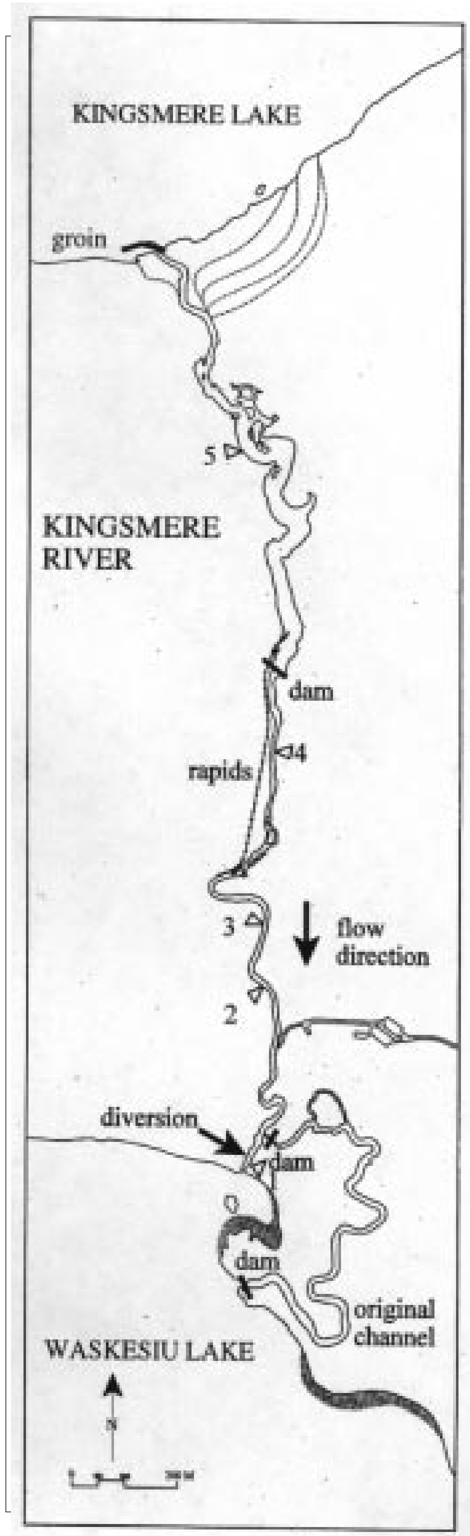

Figure 1. Kingsmere River dam locations

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RESEARCH HIGH

REVELSTOKE CARIBOU PROJECT

The BC Ministry of Forests and Mount Revelstoke and Glacier National Parks have been conducting research on the ecology of mountain caribou in the North Columbia Mountains since 1992. The primary focus of the project has been to determine habitat requirements of caribou and develop silvicultural practices which retain those attributes required by caribou. To meet this objective, 62 caribou have been radio-collared with about 5000 locations recorded. Information from this "macro habitat analysis" includes elevation, slope, aspect and forest cover. During winter, when caribou use high value old growth forests, radio location sites are visited and caribou trails followed to collect data for "micro habitat analysis." This trailing information is helping to develop prescriptions for logging in caribou habitat. Population characteristics are also being monitored. Pregnancy rate at capture, censuses and mortality rates together indicate that over the past few years the population trend of the "Revelstoke Caribou Herd" is stable. Field work is being slowly and reluctantly reduced over the next year with increased energy spent on analysis and write up of collected data.

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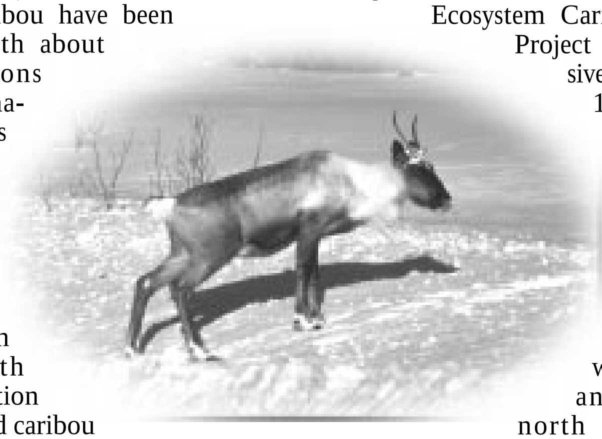

MOUNTAIN CARIBOU IN JASPER

Park wardens and a provincial biologist recently surveyed the caribou rut in south Jasper National Park and Whitegoat Wilderness to assess calf production as part of the monitoring of the park population of mountain or woodland caribou. Calf to cow ratios of 38:100 were up from the past survey conducted in 1996, and well within the range recorded since the Greater Jasper Ecosystem Caribou Research Project began intensive monitoring in 1988. Calf numbers are also up this year in the A La Peche population of West Central Alberta, which summers and calves in north Jasper and Willmore Wilderness and winters in the foothills. The increased ratio is likely indicative of an easier winter in 1997 which saw some of the lowest snowfalls recorded for this area. Total number of animals observed on south Jasper was 121. A reconnaissance and rut survey were also flown through north Banff and Siffleur Wilderness, however, only 7 animals were located.

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CARAGANA ERADICATION EXPERIMENT

Caragana *(Caragana arborescens)* is a woody bush that originated in Europe/Asia and is often used as a domestic hedge on the Canadian prairies. In conjunction with the University of Alberta, researchers in Elk Island National Park tested various methods to remove five hectares of caragana. The caragana had spread from the staff housing complex into the adjacent forest, and several hundred metres from the park golf course into adjoining aspen dominated forest. Three methods were tested: cutting and removal by hand, rototilling with a tractor mounted unit normally employed on seismic lines, and spot spraying with approved herbicide (garlone 4) and government certified weed applicators. Cutting and removal was not successful and resulted in significant regrowth the following year. The rototiller method removed all vegetation in its path including desirable native plants and understory on flat ground, and could not be used on steep banks. Directly applying herbicide on the base of the caragana plants proved to be the most successful, with a stem/root kill rate of 99% over a two year period.

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PRAIRIE DOGS IN GRASSLANDS NP

The black-tailed prairie dogs of Grasslands National Park recently became subjects of intense ecological study. As the northern-most population of the species, the prairie dogs' activities , survival and reproduction are probably constrained by harsh winter

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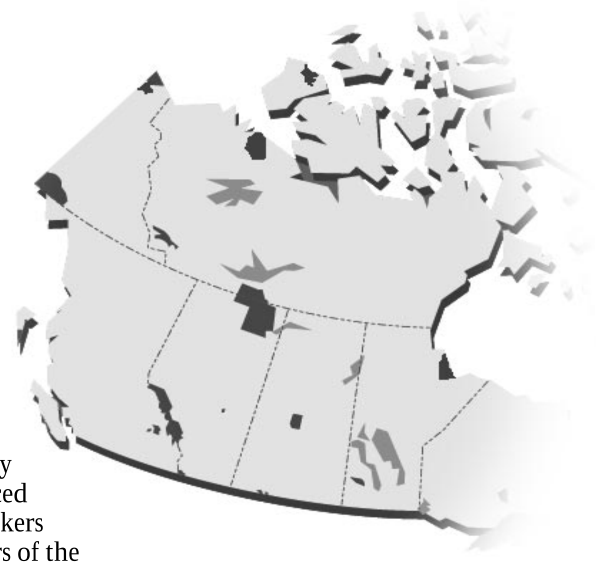
HLIGHTS



climate. To date there are almost no ecological data describing the northern prairie dogs. Researchers D. Gummer and M. Ramsay began studying the species during the autumn of 1997. Automatic weather stations were established at the peripheries of two prairie dog colonies to measure the animals' microclimate. Prairie dog activities were documented in various weather conditions. Live trapping of the prairie dogs began in April 1998. To date, prairie dogs have been caught and measured on 271 occasions, and 116 individuals have been identified. Each prairie dog is permanently marked using a uniquely encoded microchip that is implanted subcutaneously and selected individuals are radio-collared to allow measurements of their activities, body temperatures and dispersal. Researchers hypothesize that northern prairie dogs are unique in their need to hibernate to survive harsh winter conditions, unlike southern conspecifics. A comprehensive understanding of northern prairie dog ecology should improve management oriented models and decision-making regarding prairie dogs and the grassland ecosystem.

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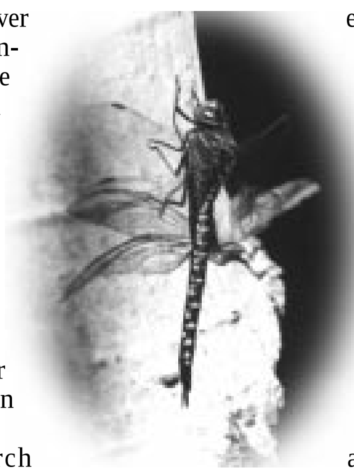
BANFF NATIONAL PARK'S RESEARCH UPDATES

For the past three springs, Banff National Park has hosted a Research Updates Speakers Series to highlight research projects conducted in the park. This year's series was cosponsored by Parks Canada, the Whyte Museum of the Canadian Rockies and the Friends of Banff. The four evenings of presentations were held in the large gallery of the Whyte Museum.Gigantic chalk paintings by Joseph Plaskett graced the walls while speakers discussed the wonders of the park—from rare plants to dynamic natural processes to communicating about ecosystems. The final night of the series was especially interesting as we turned the podium over to several of the academic advisers of our major park projects. In total, over 500 people took in the series.

In conjunction with this year's series, Banff launched its first issue of the Research Updates Newsletter (to replace abstracts that were provided at previous sessions). We expect to produce this newsletter twice per year to cover the variety of projects conducted in the park. The newsletter will be used for a number of purposes: to accompany the Research Updates Series, for staff and local guide training, student information requests, media background information, stakeholder meetings and open houses.



The next Research Updates Speakers Series will be held in late May-June, 1999. The second issue of the Banff Research Updates Newsletter is available from:

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THE DRAGONFLIES OF THE COLUMBIA BASIN

This project is a two-year effort to determine the present status, precise location of occurrences and associations of the dragonflies of selected areas of the Columbia Basin. Although we have a species list for the region, no comprehensive survey for dragonflies has ever been conducted. Several threatened species are known or expected in the region. For many reasons, they are of ecological importance. Dragonflies inhabit mainly the edge of water bodies. Many species are habitat-specific and their presence can be used to characterize wetlands of all sorts. Finally, because they are large, colorful, diurnal creatures, they are excellent subjects for nature interpretation programs and public education about aquatic ecosystems in general. Several Basin residents have expressed interest in the study and will be trained and organized to help gather specimens and data during the spring.

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invertebrate, and fish assemblages comprise taxa with broad ecological tolerances and rapid reproductive rates. These taxa appear well-adapted to varying water levels and should not suffer from gradual restoration of the natural hydrologic regime following the removal of the Waskesiu River dam.

REMOVAL OF THE KINGSMERE RIVER DAM

Removal of the Kingsmere River dam could release stored sediments downstream, into Waskesiu Lake, the outlet of the river. Removal of the dam should not affect water level in Waskesiu lake because water normally flows over the dam. The potential impact of sediment release was investigated near the Kingsmere River mouth. Fifteen centimeters of sand were added to experimental plots, resulting in an immediate and massive decrease in bottom invertebrate abundance. Most components of this community recovered within a year, suggesting that bottom invertebrates should recover relatively rapidly if dam removal releases significant amounts of sediments (Mydynski 1998). Recently, high-water flows carried large amounts of sediments down the river, likely reducing stored sediment above the dam.

Waskesiu Lake is receiving nutrient inputs from various sources, including the town's sewage lagoon. The lake was relatively well studied by Rawson (1929, 1936). We studied the limnology of the offshore region during 1992-1994, and determined that nutrient levels and plankton community structure are characteristic of mesotrophic lakes. Moreover, oxygen depletion in the hypolimnion during the summer appears to have increased slightly since the late 1920s and early 1930s. This decrease in oxygen suggests that the lake has become more productive because of increased nutrient inputs. Similarly, bottom invertebrates appears to have become more abundant. Analysis of a sediment core collected in the lake near the town site revealed a small increase in nutrient deposition rates since the late 1950's. This increase could be due to localized inputs (town site, sewage releases) or long-range, atmospheric sources. Additional studies are required to quantify phosphorus inputs and outputs to the lake and, in particular, the effects of increased nutrient releases from the sewage lagoon on the future trophic status of the lake.

Organic contaminant concentrations were measured in fish and in the sediments. The highest concentration was observed in fish. Persistent organic contaminant (POC) concentrations generally were low. However, total-DDT concentrations were elevated in a single sediment sample collected near the townsite breakwater. Although DDT is no longer used in the Park, it has a long half-life and trace amounts may enter the lake with townsite drainage. More modern pesticides continue to be used, although this usage is regulated. This study did not specifically investigate concentrations of these compounds.

Lake sediments contain low concentrations of polynuclear aromatic hydrocarbons (PAH), except in the main marina boat slips. Elevated PAHs may be due to leaching from creosote pilings, although combustion sources from motor boats may also be important. Additional studies are required to assess the ecological impact of these elevated DDT and PAH concentrations on the biota and to develop recommendations for reducing these levels. Such studies could include bioassays to quantify sediment toxicity and more detailed mapping of the spatial extent of elevated contaminant concentrations in lake sediments.

CONCLUDING REMARKS

Baseline limnological studies have investigated many aspects of energy flow, biogeochemical cycling, and ecosystem stability in Waskesiu Lake. Further research is required to better understand these dynamics and the implications of increased human activity on the state of the Waskesiu Lake ecosystem. Priority issues relate to nutrient inputs and factors affecting the reproductive success of sports fish. Furthermore, cost-effective, long-term monitoring programs are required for long-term protection of the Waskesiu Lake and other lake ecosystems.

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Some Preliminary Results on the Ecological Hierarchy of Foraging Activities in Bison

Prince Albert National Park

Daniel Fortin and Dan Frandsen

During the last century, bison (*Bison bison*) almost disappeared from North America. Although bison are no longer endangered, the reduction in available habitat coupled with conflicts with private landowners have restricted most bison populations to ranches and confined conservation areas.

During 1969, 50 plains bison were released about 60 km north of Prince Albert National Park (PANP). Of these individuals, about six moved into the protected area of the pPark, founding the PANP bison population (cf. Bergeson 1992). This population, currently estimated at about 220 individuals, has national significance because it represents the only free-ranging population of plains bison in a Canadian national park. Although most of the population remains predominantly within the park boundaries, the impacts of cross-boundary movements into agricultural areas are of particular concern. In the past, bison have damaged some fences and crops, and disturbed livestock in the nearby farmlands. So far, adjacent landowners and stakeholders have been very tolerant of these impacts and very supportive of the bison herd. However, as the herd grows these impacts may escalate, perhaps endangering the good relations with the park's neighbours and ultimately the viability of a free-ranging bison herd in the greater park ecosystem. Therefore, detailed knowledge of bison movements on a daily and seasonal basis in relation to resource requirements and preferences are important to the successful long-term management of the population. Long-term management may include ecologically sound and unobtrusive management interventions to limit the negative impacts of bison on agricultural areas adjacent to the bison range. If such management interventions are required, they will be developed with the benefit of current and future research on this population.

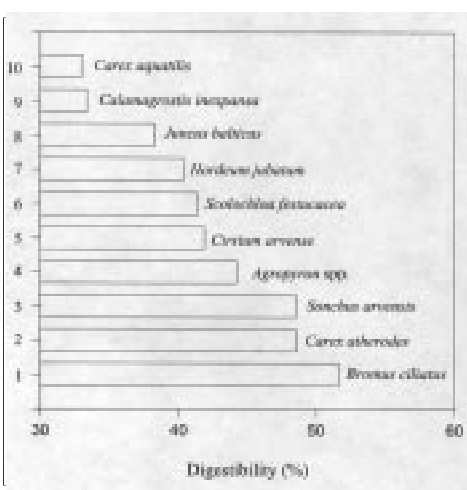

Figure 1. Average in vitro digestibility of 10 of the most common plant species in the bison range of Prince Albert National Park. For each plant species, only averages of the tissues generally used by bison are displayed.

In 1996, a research program involving the University of Guelph (John Fryxell, Associate Professor and Daniel Fortin, Ph.D. candidate) and Prince Albert National Park (Dan Frandsen, PANP Conservation Biologist) was established which aims to determine the spatio-temporal factors affecting bison movement patterns and habitat selection. The research investigates many aspects of bison ecology including habitat selection and use, movement patterns among these habitat patches, bison distribution in relation to abiotic factors and human disturbance, and intra-specific competition. Mathematical models based on various constraints faced by bison will be developed to predict optimal habitat and diet selection as well as optimal meadow residence time. These models will then be tested against the patterns observed in the field. Altogether, this information will be used to construct an individually-based model of movements by herds, which can be used to assess the potential for future resource conflict and give insights into how to modify movements if necessary.

METHODS

The year-round research considers a large portion of the current bison range, including approximately 400 km^2 in the southwest corner of the park. Bison spend most of their time foraging in dry and wet meadows, composed of various shrub, grass and sedge communities, within a generally forested landscape. The availability and abundance of forage species were estimated from transects in 25 randomly selected meadows within the bison range. During these plant surveys, bison diet was evaluated by recording the difference in grazing intensity among various plant communities. The *in vitro* digestibility of ten of the most abundant forage species was determined using cattle rumen fluid. Bison herd movements were monitored with Global Positioning System (GPS) collars (Lotek Engineering Inc.) on four female bison. Depending on the distribution of the collared individuals among the herds and the size of these herds, approximately 30% to 60% of the bison were followed with the four collars. Location information was supplemented with data from ground surveys of herd size and composition, together with activity budgets and grazing behaviour. The information gathered from GPS-collars and ground surveys will be considered with other information such as weather, snow conditions, and various layers of biophysical data in the park geographic information system (GIS).

SOME PRELIMINARY RESULTS

Although research and analysis are still in progress, a few early results identify factors influencing habitat selection and forage use by bison. These will be discussed briefly as an example of findings that will be generated by this research project.

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Foraging Activities in Bison

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ECOLOGICAL HIERARCHY OF FORAGING ACTIVITIES

As generalist herbivores, bison feed on a wide array of plant species. Nonetheless, animals rarely forage randomly (Schaefer and Messier 1995a), and selectivity has been reported during previous foraging studies of bison (Melton et al. 1989, Komers et al. 1993). Forage selectivity involves different spatial scales (Bailey et al. 1996, Schaefer and Messier 1995b). For instance, at the landscape scale animals have to decide in which meadow to forage. At an intermediate scale, they have to select foraging areas within the meadow, such as a particular plant community. Finally, at a fine scale, animals have to select which part of the plant to consume. Using preliminary results collected during winter 1998, we illustrate how foraging decisions at different spatial scales influence bison distribution and resource use within the Park.

PRELIMINARY RESULTS AND DISCUSSION

Meadows in the PANP bison range differ in their forage composition and abundance. These meadows also contrast in resource quality because plant species differ in digestibility (Figure 1). For example, Sturgeon Crossing Meadow is dominated by the northern reed-grass (*Calamagrostis inexpensa*)—water sedge (*Carex aquatilis*) community, whereas Lower Panter Meadow is dominated by the slough sedge (*C. atherodes*)—common river grass (*Scholochloa festucacea*) community (Figure 2). Compared to Sturgeon Crossing Meadow, Lower Panter Meadow provides more digestible plant species. Bison seldom grazed in Sturgeon Crossing Meadow, whereas they used most of Lower Panter Meadow repeatedly during the winter of 1998 (Figure 3). Thus, at the landscape scale bison appear to forage more in meadows with overall higher plant quality.

At an intermediate scale, we examined whether the relative use of ten forage species included in the two meadows reflected their digestibility. In Sturgeon Crossing Meadow, bison ate plant species of poor quality proportionally less often than expected from their availability, whereas the reverse pattern was observed for species of high quality (Figure 4). In Lower Panter Meadow, the forage was of overall higher quality and little selectivity was observed (Figure 4). At this intermediate scale, results suggest that, once in a meadow, bison seek plant species of relatively high quality. This strategy would lead them to feed selectively while in meadows composed largely of poor quality forage.

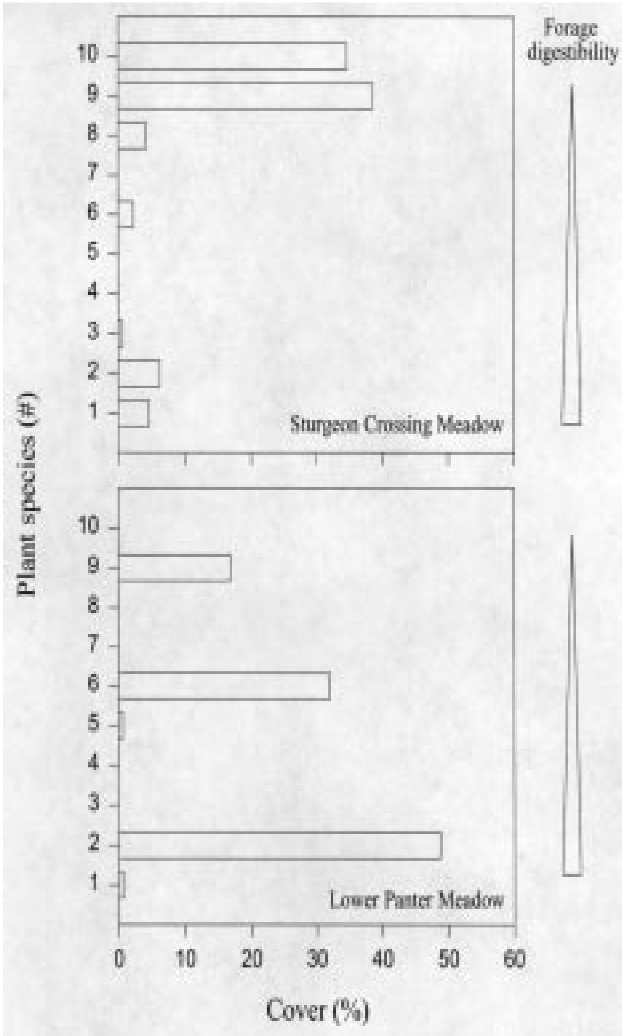

Figure 2. Percent cover of ten forage species found in two wet meadows in the PANP bison range. The trend in forage digestibility among plant species is indicated. (See Figure 1 for the plant species name associated with each number).

At a fine scale, we investigated whether bison selected the more digestible portions of a plant when grazing on five grasses—wheatgrass (*Agropyron spp*.), northern reed-grass, common river grass, fringed brome *(Bromus ciliatus*) and foxtail barley *(Hordeum jubatum*). For every species, stems were less digestible than leaves (paired *t*-test, $p < 0.025$ for all species). Nevertheless, selectivity for leaves was only apparent for wheatgrass, northern reed-grass and common river grass. The potential for an animal to select particular plant tissues is limited by morphological (e.g. jaw width) and environmental (e.g. plant structure, snow cover) constraints. For example, foxtail barley often lies entirely under the snow, which compacts the plant and prevents tissue selectivity even after a bison has partially cleared the snow. In contrast, the seed heads and stems of northern reed-grass usually emerge from the snow, indicating where most of the leaf biomass lies beneath the snow. For this species, bison can graze the prefered tissue (i.e. leaves) simply by foraging at the base of the exposed stems. In general, in the absence of morphological or environmental constraints, bison seem to choose more digestible plant tissues at the fine scale level.

CONCLUSION

These preliminary results suggest that bison generally select the most digestible forage at all three spatial scales investigated, contributing to non-random landscape use. Such scale-insensitive selection has been reported in other studies (cf. Schaefer and Messier 1995b), nonetheless, many additional factors could influence resource selection differently among spatial scales. For example, although snow provides widely available water during winter, water may become a limited resource during summer. In other landscapes, grazing intensity of some areas have been shown to relate to the presence of water (McHugh1958, Bailey et al. 1996). Therefore, at a landscape scale, meadows having water in or near them may be chosen at first and selection for highly digestible

Foraging Activities in Bison

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food may then become a secondary concern and so only become important at smaller spatial scales. The effects of water availability and other factors on habitat use at different spatial scales should be isolated pending further analysis of the data gathered during this research program. If such factors lead to a non-random use of the landscape, their effects could be used to direct bison movement away from park boundaries adjacent to agricultural activities, which would hopefully reduce the potential for conflict with the Park's neighbours. For instance, the creation of water holes effectively increased uniformity in grazing intensity in other landscapes (Bailey et al. 1996).

Analysis and reporting on the current phase of the Bison Research Program will be completed in 2000. These results will be used to develop management strategies that will allow free-ranging bison to persist in the PANP regional ecosystem adjacent to agricultural activities, and may assist in similar initiatives in other areas of historical plains bison range.

ACKNOWLEDGMENTS

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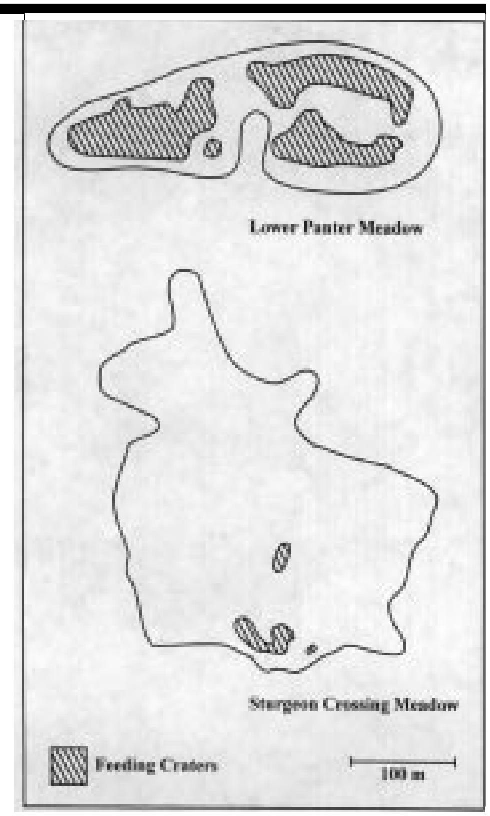

Figure 3. Location of bison feeding craters in two meadows of PANP between 12 January and 24 March 1998.

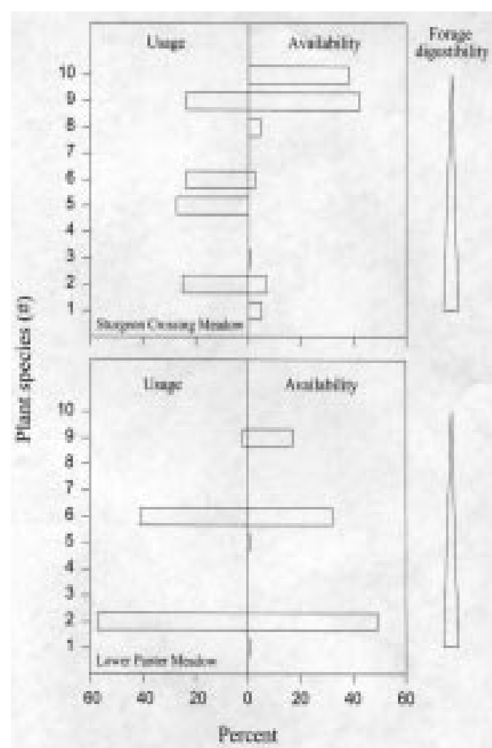

Figure 4. Relative use and availability of 10 forage species in two wet meadows in PANP bison range as estimated from meadow surveys. The trend in forage digestibility among plant species is indicated. (See Figure 1 for the plant species name associated with each number).

Fescue Grasslands

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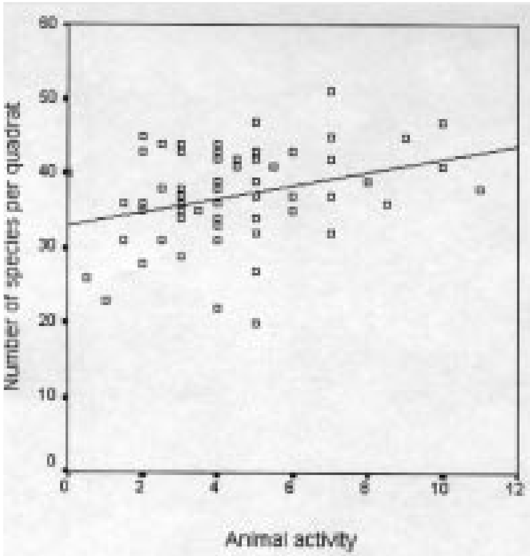

Figure 2. Quadrat floristic richness (QFR) in individual grasslands versus animal activity. (R2=0.11. F-8.3. p<0.01, df=68)

theory than TFR. QFR was not significantly related to grassland size or isolation, in contrast to expectations. This may indicate that small grassland 'islands' have yet to reach an equilibrium number of species, and that QFR may decline over time in individual small grasslands. However, QFR varied significantly with animal disturbance (Figure 2). Moderate animal disturbances, especially pocket gopher mounds and ant hills, create habitats for plants which are not competitive elsewhere. It appears some level of disturbance is necessary to maintain the highest per area richness, supporting both the intermediate disturbance and habitat diversity theories.

To determine whether grassland floristic richness would be impoverished in a landscape containing only very small grasslands, Elchuk (1998) counted the number of species absent from the 17 grasslands smaller than $1000m^2$. This area was chosen because it was a common fragment size, it included about half of the grasslands studied, and there was a gap in size between these smaller grasslands and grasslands 1500 m^2 or larger. Collectively, the small grasslands lacked 40 out of the total of 169 species.

CONCLUSIONS AND MANAGEMENT IMPLICATIONS

The results of this research suggest that grassland sizes can be allowed to decrease without an overall loss of floristic richness as long as several conditions are met. The remaining grasslands must include a range of habitats, from driest to moister. Animal activities are important in enhancing habitat diversity and therefore floristic richness. Floristic richness in grassland fragments may not have come to equilibrium yet, and the number of grassland species in smaller grasslands may decline over time if population sizes are too small to ensure long-term viability. Therefore some fairly large grasslands must be maintained to preserve the floristic richness of grassland species, and active management should be prescribed if continued forest invasion threatens to result in only small grasslands remaining in the landscape. Longer-term monitoring is needed to ensure that active management can be implemented if necessary to maintain the integrity of the fescue grasslands in PANP.

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Bugged About Dams

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start of the diversion. At some time between 1947 and 1962, a long groin was built at the start of the stream, the outlet of Kingsmere Lake (Figure 1). Hydraulically, the Kingsmere River is much less variable than the MacLennon River, indicating that the Kingsmere River is functioning more as a regulated canal than as a wild stream (Melville 1997).

METHODS

Five sites along the main channel of each of the stream were chosen for midsummer sampling, according to a stratified random design (Melville 1997). The strata correspond to four major habitat segments: stream outflow/receiving lake segment, including Kingsmere River diversion (site 1, Figure 1); midstream, flowing with no rapids (sites 2 and 3); rapids (site 4); stream inflow/headwater lake segment, including Kingsmere River impoundment (site 5, Figure 1).

Within each site, six sets of habitat measurements and invertebrate samples were taken in each of two years. The substrata were: 1) very fine surficial substrate particles, macrophytes frequent and abundant; 2) surficial substrate predominantly fine (clay to sand), no or very few macrophytes; and 3) substrate predominantly coarse (gravel to boulder), no or very few macrophytes. Field personnel collected invertebrates using Surber samplers (Figure 2) fitted with 500 μ mesh (Plafkin et al. 1989). The samples included all streambed materials of pebble size or smaller to a depth of 4-5 cm, as well as plant material and small pieces of wood. Organisms on larger materials were scraped into the sampler. Where necessary, subsampling (e.g. Mason 1991) occurred before picking. Organisms were preserved, identified to genus (for most taxa), and assigned to feeding groups based on the categories of Cummins and Merritt (1984).

Table 1. Percent of observations with silt as a dominant substrate particle size associated with invertebrate samples at sites on the Kingsmere and MacLennan Rivers.

Site	River	
	Kingsmere	*MacLennan*
1	42	29
2	50	17
3	21	17
4	0	4
5	50	0

RESULTS

The Kingsmere River has slower currents than the MacLennan River (Figure 3), except in the rapids (site 4) which have the highest velocities of all sites in the study. Current flows decrease from upstream to downstream as the elevation gradient decreases in the MacLennan, but not in Kingsmere (Figure 3). In the Kingsmere River, silt tends to cover more of the streambed than in the MacLennan River (Table 1), except in the rapids (site 4) where currents are strong enough to remove silt deposits. Silt decreases as a major component of surficial substrates in the MacLennan River as one proceeds upstream (Table1), caused by the increased scouring action of faster currents.

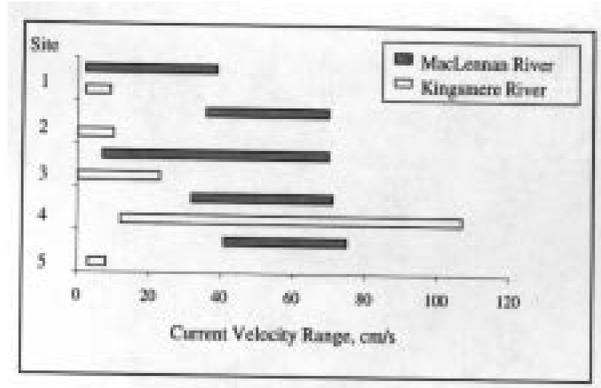

Figure 3. Current velocity for the Kingsmere and MacLennan Rivers

Of the different invertebrate feeding groups, gatherers (e.g. midge species: Chironomidae, Diptera) occur most frequently in the Kingsmere River, whereas filterers (e.g. black fly larvae: Simuliidae, Diptera) are more prevalent in the MacLennan (Figure 4). Both groups feed on fine organic particulates which are often decomposing. However, filterers feed while the material is suspended, carried along by currents, whereas gatherers feed after the material has settled onto surfaces such as the streambed.

The differences in the proportions of the two groups reflect the major habitat differences, with more gatherers associated with the low current velocities and silt particles that have settled in Kingsmere. More filterers are associated with the higher flows, which carry suspended particles, in the MacLennan River. Of note, the Kingsmere River has a higher frequency of shredders (Figure 4), which chew larger particles, particularly in the rapids (site 4). The shredders are associated with larger quantities of vascular plant tissue, which either grows instream or is trapped in areas which had higher flows prior to impoundment.

DISCUSSION AND MANAGEMENT IMPLICATIONS

The invertebrate-habitat associations clearly reveal the ecological changes by the dam and other alterations to the Kingsmere River, in comparison to the baseline associations observed in the MacLennan. However, the differences between the streams support the study hypothesis and suggest monitoring objectives. At sites other than the rapids, restoration of the Kingsmere could increase current velocities by at least fivefold, decrease the overall frequency of silt by one-third, hence double the proportion of filterers and decrease the percentage of gatherers by up to half.

The ecological changes caused by the alterations to the Kingsmere River are largely reversible. The feeding patterns across sites are generally similar for both filterers and gatherers (Figure 4), with filterers replacing gatherers upstream. The trends must be interpreted with caution because some of the filterers above the dam are taxonomically different and more planktonic (e.g. *Simocephalus vetulus*, Cladocera) than benthic. Despite the impoundment, the Kingsmere rapids still have substantial habitat diversity because they are so extensive, which might explain the higher feeding-group diversity at the site. The rapids have probably served as a refuge for many species requiring more dynamic flow conditions, from which they could disperse to recolonize other parts of the stream. Conversely, faster flows would decrease vascular plant material in the rapids following restoration, decreasing the relative abundance of shredders. It would probably take at least a decade, and perhaps many more, for the benthic invertebrates to recover following restoration actions (Petts 1987).

This study is one of only a few which attempt to forecast the ecological effects of stream restoration, despite the hundreds of

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Bugged About Dams

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thousands of dams (e.g. Vörösmarty et al. 1997, Babbitt 1998) that humans have built around the world). Thus environmental managers and policy-makers have as much to learn from the study process as they do directly from the results. Careful design, sample collection, processing and analysis can provide exemplary environmental assessment and monitoring tools (e.g. Hall et al. 1998). There is little risk that restoration actions will cause further degradation of the Kingsmere River; if ecological degradation is to be avoided in protected areas, dams, roads and other infrastructure should not be built.

The dam upstream must be removed to restore the ecology of the Kingsmere River. To date, the park has temporarily blocked the diversion, rerouted water down the original channel, and removed the groin. The park should remove the dam when actual and projected water levels are low, thereby protecting the restored features downstream. Park staff should also minimize the use of heavy machinery to protect stream riparian areas. Annual monitoring of selected habitat parameters along both the Kingsmere and MacLennan Rivers is required to evaluate restorative efforts. Monitoring of benthic invertebrates should occur during two-year periods, starting several years after dam removal and at intervals of about seven or eight years thereafter for at least several decades.

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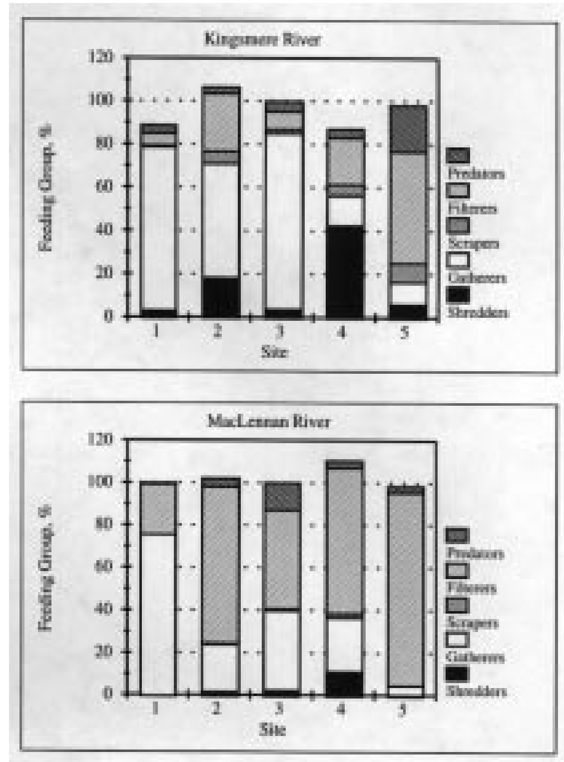

Figure 4. Invertebrate feeding group percentages for the Kingsmere and MacLennan Rivers

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PODIUM

Ecosystem-based Management

Is Parks Canada There Yet?

Since the early 1990's, many conservation and resource management organizations, including Parks Canada, have adopted an ecosystem-based management approach. The concept has gained general support and we talk "the right talk," but are we actually doing ecosystem-based management? The policy and direction are certainly in place: we have the *National Parks Act*, our policy document, management plans, business plans, conservation plans, vegetation management plans, and some parks even have ecological integrity statements. The road map is there. As an organization we also report on where we have been and what has been accomplished. The 1997 State of the Parks Report highlights a number of case studies demonstrating ongoing scientific study that contributes to measuring ecological integrity. However, the report still relies on subjective responses for much of its content.

There is a gap between our plans and the reports that come out at the other end of our ecosystem-based management approach. So what are the problems? I think they vary from park to park. Grumbine (1996) reviewed ten dominant themes of ecosystem management: hierarchical context (systems thinking), ecological boundaries, ecological integrity, data collection, monitoring, interagency cooperation, humans embedded in nature, adaptive management, organizational changes and values. These ten themes provide a template for assessing the strengths and weaknesses of an existing ecosystem-based management program. I will examine one of these themes—monitoring.

Monitoring is a common stumbling block in many park programs. Discussion is never ending but sooner or later a park has to pick a suite of indicators and get on with measuring them. This task is not rocket science, but if it was, we would be at T minus 30 and holding. Some may retort that insufficient research funds preclude conducting the work necessary to determine the right indicators or to monitor them. I would counter that all agencies involved in research or performance management confront this problem. We need to develop a research agenda and monitoring program that is practical and affordable. We also need to prioritize indicators. We would be better off to measure a few things well and develop reputable data sets than to measure many indicators superficially. I would add that, over the short -term, all park-funded research must be directly linked to determining or refining indicators. Further, monitoring should measure only the selected indicators. We must stop monitoring programs and projects that do not contribute to this goal. If others think the programs are valuable then they can fund them. Conversely, we should make use of relevant indicators that are monitored by other agencies, or work with other agencies to develop common indicators. Some Model Forest programs attempt to do this. Finally, we must remember that ecosystem-based management involves a multi-disciplinary approach. Environmental, social and economic interests must be considered. A monitoring program must mirror that thinking and be designed to address the needs of the park and the region. Bio-monitoring is critical but other factors such as visitor behaviour, level of use and level of satisfaction must also be considered.

So have we achieved ecosystem-based management? No, but we are pointed in the right direction. It is time to put the map away for a while, select a forward gear and pop the clutch. We should accelerate and see what this baby will do. Full-fledged ecosystem-based management might be over the next hill.

Bill Fisher is Superintendent of Prince Albert National Park, Saskatchewan

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MEETINGS OF INTEREST

Research Links

Spring 1999
Volume 7 • Number 1

WRITE TO

Research Links
Parks Canada
#550, 220-4 Ave. SE
Calgary, AB T2G 4X3

Internet Address
RESEARCH_LINKS@
PCH.GC.CA

April 23-24, 1999

Learning From the Past, A Historical Look at Mountain Ecosystems. Revelstoke, BC. The Columbia Mountain Institute for Applied Ecology, in conjunction with Mount Revelstoke and Glacier National Parks, will host a workshop that highlights the use of historical information to understand and advance the management of current ecological issues. Speakers include academics, Parks Canada employees, historians and First Nations representatives. Contact Rod Heitzmann, Program Chair. Tel: (403)292-4694; e-mail: Rod_Heitzmann@pch.gc.ca

April 27-28, 1999

CMI Annual Researchers Workshop. Columbia Mountains Institute of Applied Ecology, Nelson BC. At this annual get-together of researchers working in the Columbia Mountains, researchers present updates on their work and renew acquaintances. This is a great opportunity for students, contractors, government staff and academics to meet and learn from each other. A short Annual General Meeting for the CMI will be part of the agenda. To register: Tel:(250)837-9311; fax: (250)837-4223; e-mail: cmi@junction.net; website: http://www.cmiae.org

May 17-22, 1999

Wilderness Science in a Time of Change. Missoula Montana. This conference will present research results and synthesize knowledge and its management implications. This conference should result in a state-of-the-art understanding of wilderness related research. It will also improve our understanding of how research can contribute to the protection of wilderness in the 21st century. Considerable attention will be devoted to the ever-changing role of wilderness in society and the need to better integrate diverse social and biophysical sciences. Plenary sessions will explore: the values of the transactions between science and wilderness, the need to precisely define “wilderness” so scientific process can be effectively applied to wilderness management, the implications of increasing technological development and external pressures. For information contact: Natural Resources Management Division, Centre for Continuing Education, The University of Montana, Missoula, MT 59812. Tel: (406)243-4623 or (888)254-2544; e-mail: ckelly@selway.umt.edu

August 25-27, 1999

Ecology and Management of Ungulates: Integrating across spatial scales. Prestige Lakeside Resort - Nelson, BC. In a three-day conference, biologists and managers will share information on the challenges of integrating information about the ecology and management of ungulates across spatial scales, The conference will focus on topics related to foraging at the scale of the individual, ungulate use of heterogeneous landscapes, linking population management to landscape management, and the role of ungulates in ecosystems. The early registration deadline is Aril 15, 1999. Registration materials and information on accommodation are available through: Karen O’Reilly, NCASI, Box 458, Corvallis, OR, 97339; Tel: (441)752-8801; fax: (441)752-8806; koreilly@wcrc-ncasi.org, or on the website: http://wildlife1.uwsp.edu/ungul99

September 23-25, 1999

1999 Society for Ecological Restoration International Conference. Presidio of San Francisco, CA. Stewardship, science, art and practice are the fundamental elements of ecological restoration. These elements will be brought together by restorationists from around the world. The plenary symposia are: restoration on public land; watershed planning and politics; community, connection and stewardship. Field trips and special workshops will precede and follow the main conference. The early registration deadline is July 23, 1999. For information or a registration brochure, contact: Society for Ecological Restoration, 1207 Seminole Highway, Suite B, Madison, WI 53711, USA. Tel: (608)262-9547; fax: (608)265-8557; e-mail: ser@vms2.macc.wisc.edu

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