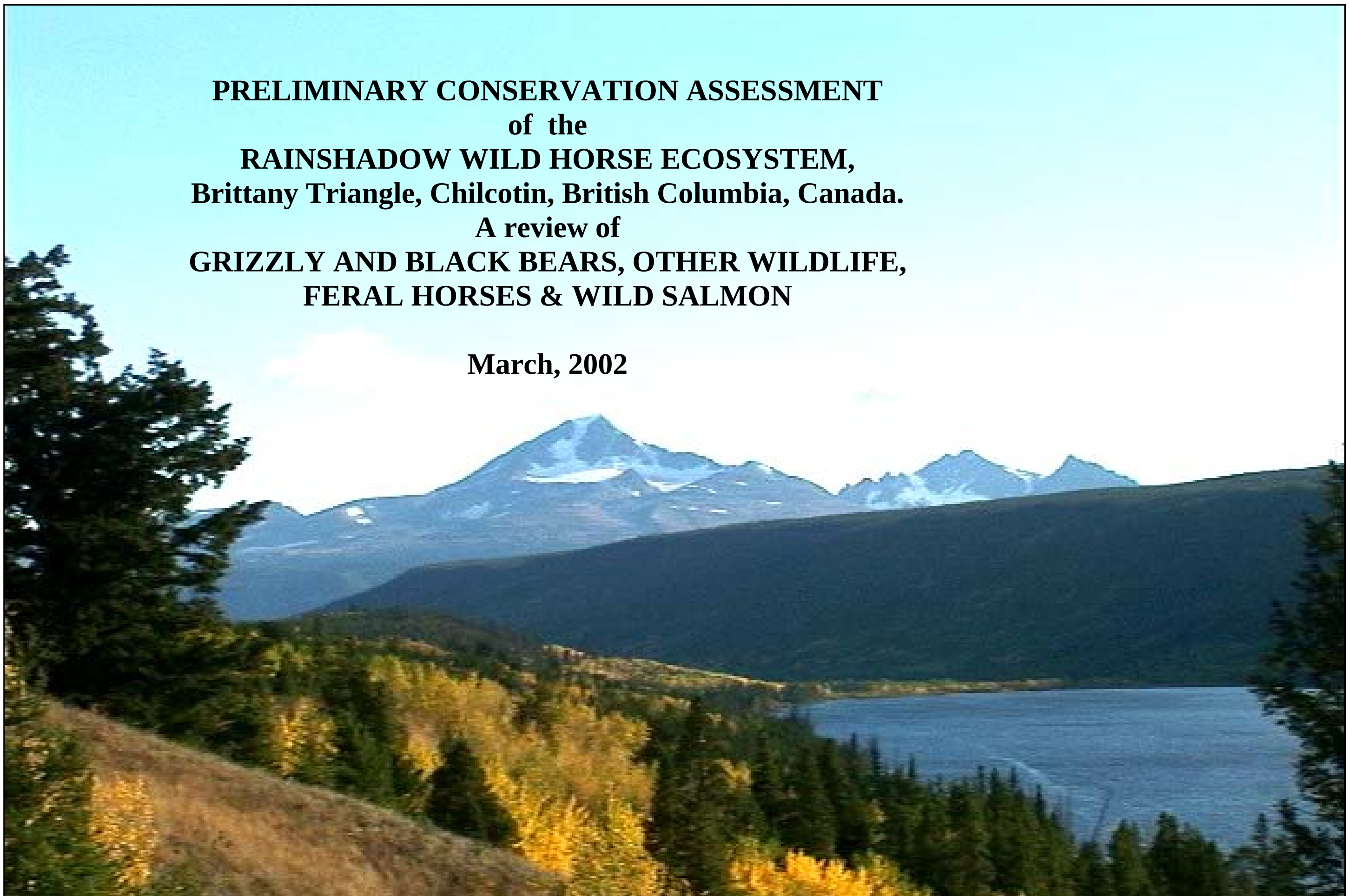
PRELIMINARY CONSERVATION ASSESSMENT
of the
RAINSHADOW WILD HORSE ECOSYSTEM,
Brittany Triangle, Chilcotin, British Columbia, Canada.
A review of
GRIZZLY AND BLACK BEARS, OTHER WILDLIFE, FERAL HORSES & WILD SALMON

March, 2002



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With thanks to the Xeni Gwet'in First Nation for welcoming us
on to their traditional territory to carry out this research

<u>Xeni Gwet'in Chief Roger William on trail in Brittany Triangle in September, 2001</u>

Suggested Citation:

McCrory, W.P. 2002. Preliminary conservation assessment of the Rainshadow Wild Horse Ecosystem, Brittany Triangle, Chilcotin, British Columbia, Canada. A review of grizzly and black bears, other wildlife, wild horses, and wild salmon. Report for Friends of Nemaiah Valley (FONV), 1010 Foul Bay Road, Victoria, B.C. V8S 4J1.

One of two wild horse herds studied in Nuntsi Provincial Park in 2001. Hundreds of these small and large meadows are scattered throughout the pine forests of the Brittany Triangle, providing important habitats for wild horses, grizzly and black bears, and other wildlife from spring to fall. Over the long Chilcotin winter, the horses survive on grasses and sedges in these meadow areas as well as pine grass in the adjacent forests. (Photo by Garth Woodworth).

"Because the wild horse was introduced into North America by explorers during the sixteenth century, he has frequently been denounced as an interloper and denied legal protection granted to our native animals. However, many who have condemned the wild horse for his alien status are unaware that it was North America that actually spawned the horse and gave this amazing creature to the rest of the world."
Hope Ryden. 1978. Mustangs. A Return to the Wild. Penguin Books.

With thanks to the McLean Foundation, Mountain Equipment Co-op, Robert and Birgit Bateman and Nature's Path for research funds, and Chilko Resorts and Community Group for funding the Xeni Gwet'in researcher

MOUNTAIN EQUIPMENT CO-OP

NATURE'S PATH

SUMMARY of FINDINGS AND RECOMMENDATIONS

This study was commissioned by the Friends of the Nemaiah Valley (FONV) to provide a preliminary assessment of habitat and conservation values for the grizzly bear (*Ursus arctos*), the North American black bear (*Ursus americanus*), other wildlife, the wild or feral horse (*Equus caballus*), and wild salmon (*Oncorhynchus* spp.) in the Brittany Triangle in the Chilcotin district of British Columbia. The study area is also called the Rainshadow Wild Horse Ecosystem (FONV). "Wild" horse for the purposes of this report also means the feral horse, an ungulate, which lives in the wilderness, has returned to ancestral wild behavioural patterns, and now has a survival-oriented life cycle.

Results are preliminary and further research is recommended. All comments of a scientific nature should be directed to the author.

<u>Study Methods and Study Area</u>

Research for this study included:

- Conducting an inventory using direct-sighting counts, recording instances of animal sign and censusing using remote cameras,
- Conducting detailed habitat transects, undertaken by two experienced bear biologists and Xeni Gwet'in wildlife researchers (June and August, 2001),
- Reviewing salmon data provided by the Federal Department of Fisheries and Oceans,
- Gathering and reviewing local knowledge and
- Extensively reviewing the scientific and historical literature.

An extensive literature review was made of wild horse ecology, origins, and range competition, management and conservation status under the laws and policies of Canada and the United States. Wild horse reserves or potential reserves were reviewed in both Canada and the United States. Impacts of proposed logging were subject to a preliminary review only.

The core study area was the Rainshadow Wild Horse Ecosystem encompassed by the Brittany Triangle. The "Triangle" is formed by the natural boundaries of the Chilko and Taseko Rivers and is approximately 155,000 ha in size. It includes the eastern ranges and foothills of the Coast Mountains. Most is a large foothills Plateau. The study area is within the larger traditional territory of the Xeni Gwet'in First Nation, known as the Nemaiah Aboriginal Wilderness Preserve (1989). Our field research was concentrated in Nuntsi Provincial Park (22,898 ha) and some adjacent surrounding areas, including the Elkin Valley. Xeni Gwet'in gave permission for this research and B.C. Parks provided a research permit for the work in Nuntsi Park.

Over 80 kilometers of habitat transects were conducted on foot, mountain bike and horseback. One aerial survey was also done. By assessing forest cover types, interpreting air photos and conducting field transects, we identified eight preliminary wildlife habitat types, with a priority for grizzly bears, black bears, and wild horses. These were then used to create a detailed GIS (Geographic Information System) habitat map and colour habitat codes. The base map was a GIS overlay of 1:20,000 forest cover and TRIM maps. We rated each habitat type according to its seasonal importance to grizzly/black bears and wild horses, with notations on other wildlife values observed. Seasonal importance values were based on habitat potential, supplemented by observations of feeding activities and other uses in the field and from dietary/habitat information from other studies in ecologically similar areas.

High habitat values

The eight habitats types included six vegetation types, salmon areas, and disturbed habitats:

- Lodgepole pine-kinnikinnick-pinegrass
- Douglas fir-aspen parkland
- Bluebunch wheatgrass riverine “breaks” grassland
- Wet meadow/sedge/shrubfield complex
- Dry meadow/grass/shrubfield complex
- White spruce – horsetail
- Riparian salmon-spawning/migration areas
- Disturbed areas (roads, dwellings, clearcuts, etc.)

The mix of the six natural vegetation types provides for a great variety and abundance of edible plant species for native ungulates, wild horses, grizzly and black bears. This heterogeneity enables the environment to be used productively by a variety of animal species eating different plant species. This appears to include shared but non-competitive winter use of the Wet and Dry meadow/shrubfield complexes by wild horses (grazers) and moose (browsers). The isolation from human encroachment of much of this large wilderness area enhances its security or seclusion value. The area supports a rich predator-prey ecosystem into which feral horses appear to have successfully integrated.

The six natural vegetation types were found to have a moderate to high potential to support grizzly and black bears from spring through fall. Five of these vegetation types are also of moderate to high year-round value for wild horses. Higher elevation areas were not sampled but should be the subject of further study. More detailed GIS mapping should be done to determine the relative extent of each of the habitat types, although it is obvious that all but one, White spruce – horsetail, are common. The most extensive is the Lodgepole pine-kinnikinnick-pinegrass type.

The two large river valleys (Chilko and Taseko), along with Elkin Creek, provide for an extensive zone of river “breaks” habitats dominated by the Douglas fir-aspen parkland and Bluebunch wheatgrass grassland types. Limited sampling indicates high quality spring (green vegetation) habitat for both bear species and all-season habitat for horses and mule deer (*Odocoileus hemionus)*. Salmon runs in the two rivers and Elkin Creek considerably enhance the area’s habitat value for bears (and possibly wolves [*Canis lupus*]) in the fall. Further study of bear use and activity sites along the salmon waterways is needed.

On the large Plateau and foothills, numerous Wet and Dry meadow/shrubfield complexes interspersed with large and small stands of lodgepole pine (*Pinus contorta*) comprise a large and surprisingly rich habitat mosaic.

High densities of sedges (*Carex spp.*) and grasses (*Graminoids*) in the Wet and Dry meadow/shrubfield complexes provide for a high spring/early summer (green vegetation) potential for both bear species. These complexes occur along low-gradient stream bottoms and numerous large and small lake/pond depressions. Many meadow depressions occur on a seasonal gradient from flooded to dry. The various meadow/shrubfield complexes are the most important all-season foraging habitats for wild horses and moose (*Alces alces*). Field observations and a separate background study conducted in the Chilcotin area suggest wintering moose and horses appear to forage on different plant foods, with moose concentrating on browse species such as abundant willow (*Salix* spp.) and horses concentrating on grasses and sedges. During spring, horses and both bear species fed in some of the same meadows.

The Lodgepole pine-kinnikinnick-pinegrass type was rated to have a moderate to high potential for bears. Abundant fruit of kinnikinnick (*Arctostaphylos uva-ursi*), which increases in sugar content over the winter, was of moderate density as an energy-providing bear food for the spring, while low-density soopolallie (*Shepherdia canadensis)* fruits appeared to be the most important food for the fall. Although further study is needed, in winter horses appear to do some feeding on pinegrass (*Calamagrostis rubescens*) within the Lodgepole pine type. These forests surround each meadow complex and winter scat piles suggest they provide important shelter as well as sheltered travel corridors. There is a large network of horse trails that link the many different meadows. Blow-downs are a constraint for habitat use and travel at some sites.

Salmon habitat values for the Brittany are very high. The Chilko River has large runs of Sockeye, Chinook and Coho, with lesser numbers in the Taseko. There is an average of 1.7 million Sockeye or 27% of the entire Fraser run. Elkin Creek in the Brittany is the only tributary of the Chilko/Taskeo Rivers that have salmon. Runs in Elkin Creek average about 600 Chinook annually.

For large carnivores, a high salmon biomass is available thereby enhancing the values of adjacent vegetation and "security" habitats. Signs of high bear use were evident but our surveys were limited. High grizzly bear use of salmon is reported at the main spawning grounds below the outlet of Chilko Lake.

<u>Habitat use & species occurrence/abundance</u>

Our nine remote camera stations were set out for a total of 356 camera-nights and triggered 85 photo events of mostly larger mammals. The cameras were set up to detect the passage of large, not small mammals, crossing an infrared beam. (In a few instances, small mammals were photographed when they investigated the instruments).

Of the 85 photo events, the highest number involved the coyote [*Canis latrans*] (n = 15), moose (n = 15), mule deer (n = 13), wolf (n = 11), red squirrel [*Tamiasciurus hudsonicus*] (n = 9) and feral horse (n = 8). In one instance, a series of photos recorded a daytime movement of a pack of 11 wolves. Eight horse movements were documented, both at night and during the day. We also photographed the mountain lion (*Felis concolor*), Canada lynx (*Lynx rufus*), and domestic cow (*Bos taurus*). We obtained photos of 2 different black bears. No grizzly photos were obtained, despite fresh signs; but most camera monitoring was done when grizzlies would have been away feeding on salmon.

However, tracks and several direct sightings indicate at least 4 or 5 grizzly bears use the study area. Remote camera results and tracks suggest about an equal number of black bears are present in Nuntsi Park. Habitat use studies showed that of 44 spring bear scats (grizzly and black bear), over-wintered kinnikinnick fruit and grass/sedges were of about equal importance in the bears' spring diet. Some use was noted of flowers of dandelion (*Taraxacum officinale*), ants (*Hymenoptera: Formicidae*), and mice (*microtines*). In the spring, we found signs of bears in all six vegetation habitat types. Of 13 bear scats examined from late summer, the majority (n = 10) contained fruits of soopolallie. We did not have time to examine bear use of salmon, but well-worn trails with mark trees along Elkin Creek, as well as anecdotal evidence, suggest salmon are an important dietary component in the fall. We identified 18 bear mark trees throughout the study area, with at least 10 used by grizzly bears. In one instance, bears were scratching and marking a large Douglas fir (*Pseudotsuga menziesii*) estimated to be about 800 years old.

Feral horse use was by far the most ubiquitous animal sign on the Plateau west of Elkin Creek. No recent use was noted east of Elkin Creek, likely due to a horse extirpation program there about 10 years ago. Only one lone stallion was reported on the Elkin Creek range during the course of the study, although other horse sign was noted 3 km downstream of the road. Heavy use by domestic cattle (*Bos Taurus*) occurs on the Elkin Creek wetlands and surrounding dry grasslands, appearing to cause some riparian damage. In spring, the two wild horse bands in Nuntsi Park concentrated feeding on grasses and sedges in the Wet and Dry meadow/shrubfield complexes on the Plateau. Our remote cameras recorded horses, bears, wolves, mountain lion, Canada lynx and other wildlife using the inter-connecting horse trails. One mare that appeared to have foundered was photographed; she later disappeared.

Sightings, vocalizations (howls), frequency of fresh scats and remote camera photos suggest at least one resident wolf pack in Nuntsi. In August, one camera site recorded the movement of about 11 individuals, including 6 young of the year. Home range size is estimated to be 250 – 400 km^2, larger than Nuntsi Park (200 km^2).

Although further documentation is needed, the Rainshadow Horse Ecosystem of the Brittany Triangle appears to support an abundant prey biomass of large and small species. For top predators such as the wolf, mountain lion, grizzly bear and black bear, feral horses likely contribute a valuable food resource that supplements their diet of native species. Foals, injured, foundered and winter-weakened individuals would be the most susceptible to predation.

Feral or wild horses

In Nuntsi Park, we consistently observed two wild horse bands, which totaled 25 to 27 animals. We crudely estimated the total for potential horse numbers for the Brittany Triangle – Rainshadow Wild Horse Ecosystem at 14 bands comprising a minimum of 140 to 200 animals, but this could be a conservative estimate. We observed social structure behaviour as complex as that of grey wolf packs, and similar to that reported elsewhere for feral horses. A single mature stallion would accompany a group of mares and various-aged offspring numbering 10 to 12 individuals. Remote camera movement data and repeated sighting of the same bands at the same locations suggested each band is territorial. The remote camera data also demonstrated that the horses made periodic night and daytime cross-country movements as single individuals or in small groups. The horses moved along established trails through pine forests, between their grazing meadows. Night was obviously not a constraint to travel.

These horse bands also exhibited an extremely wary behavioural response to humans and avoided human habitation and the more actively used roads. They used the pine forests adjacent to small and large meadows as escape habitat. Limited observations suggest no excess forage competition with other ungulates and bears' use of green vegetation, and only minimal evidence of range over-grazing. However, more intensive range use research is needed.

The horses we observed exhibit some of the inherited physical characteristics of original Colonial Spanish Horses, which were felt to have a higher heritage/conservation value than breeds introduced later. These characteristics include numerous colour types and very long manes and tails. Further study should be conducted to see if the Brittany horses exhibit another apparently inherited behaviour, forming guard circles against wolves. The local Xeni Gwet'in First Nation is a horse culture; they still capture horse stock from among the wild horses of the Brittany Triangle. A priority of our background research was to interview Xeni Gwet'in elders on the origins of their horses. However, this had to be deferred because of another Xeni Gwet'in interview project going on at the time. We believe Simon Fraser's recorded observations in 1808 of Chilcotin First Nations having horses is proof positive that horses were in the general area prior to the arrival of the first Europeans. These horses could only be derivatives of the original North American Spanish stock.

A remote possibility even exists that some of the Brittany Triangle wild horses may carry the bloodlines of the earliest introduced horses in America -- the bloodlines of the Conquistador's horse. Genetic testing is recommended for the DNA marker (blood variant *Q-ac*) distinctive to the Colonial Spanish Horse. Only a few of the surviving wild horse groups in the U.S. have preserved the pure bloodlines of the first horses introduced to the "new world" more than 500 years ago. Should the Brittany Triangle horses prove to be derived from these early horses, even if their bloodlines are somewhat diluted by interbreeding with European settlers' stock, their biological and natural heritage value is considerable.

Conservation values

Based on our preliminary study, we conclude that the Rainshadow Wild Horse Ecosystem encompassed by the Brittany Triangle forms a large, core, intact wilderness with high security and feeding values for grizzly bears, black bears, mountain lions, wolves and other carnivores as well as for four native ungulate species and one non-native, the wild horse. Two large salmon-bearing rivers form natural boundaries. An average of 1.7 million Chilko sockeye salmon spawn in the ecosystem providing a critical food resource for First Nations, grizzly bears, wolves and others. A small wild salmon run in Elkin Creek enhances a critical food resource. Elkin is the only tributary of the Chilco/Taseko rivers to support salmon.

The Brittany Triangle forms a natural corridor and security habitat for bears and wolves from the surrounding region to access this rich salmon resource. The area provides an important travel corridor between the river-salmon areas and the mountain terrain to the south and west, including Ts'il?os Provincial Park.

Our study shows that, as a non-native grazing ungulate, the feral horse has a high heritage value and appears to occupy its' own ecological niche. Our heritage rating was based on the protection afforded the similar feral horse in the United States. Both the feral "mustang", a mixture of Spanish Colonial stock and northern European breeds, and at least four herds with Colonial Spanish Horse gene typing, are protected and managed under Federal Law in the U.S. We speculate that the Brittany horse type is derived from the same ancestors.

Currently, wild horses in Canada and British Columbia are much reduced from historic times and have largely been extirpated in British Columbia. Government-sanctioned slaughter programs, including a bounty paid per pair of horse ears produced, encouraged European ranchers and settlers to kill wild horses. There is only one feral horse refuge in Canada, on Sable Island in Novia Scotia, while there are at least six in the United States. Federal Law protected wild horses in the U.S. in 1972 but Canada lags far behind in this regard. In British Columbia they have no legal protection and are still periodically trapped and taken to slaughterhouses.

Our study suggests that British Columbia's extirpative management policies and negative management attitudes toward feral horses has not kept pace with contemporary research, contemporary heritage/conservation initiatives elsewhere in North America, and contemporary public attitudes about wild horse preservation. These negative B.C. policies persevere despite research that clearly demonstrates that wild horses can generally co-exist with cattle and wild ungulates, depending on the circumstances, and with careful population control.

The horses in the Rainshadow Wild Horse Ecosystem have not only survived an aggressive 40-year B.C. government bounty and shoot-to-kill campaign, but appear to be well integrated into the ecosystem as a dominant and keystone species. The horses provide an alternate prey species for large predators without apparently competing directly with moose for winter plant foods. These horses were also likely resident in the area long before the first moose migrated into the region in the 1920's. Although further study is required, we could find no evidence of biological harm or interference, with the exception of a few small over-grazed sites.

We believe the Rainshadow horses should be accepted as a resident, rather than an alien, species within Nuntsi Provincial Park and managed accordingly. However, further study is needed of possible competition with domestic cattle on grazing allotments, and with California bighorn sheep at higher elevations.

From a conservation perspective, the fact that these wild horses live in an ecosystem that has a complete guild of top predators may not be unique in western Canada. But it is certainly unique in global terms. In the United States, where much larger wild horse populations are protected by law, most or all of the top predators have been extirpated or are extinct. In Europe, the original Colonial Spanish Horse is nearly extinct. Fully preserving the Rainshadow Wild Horse Ecosystem as a refuge offers a chance to protect wild horses in an intact, fully functioning ecosystem with a full complement of predator and prey species. From a conservation biology perspective, expanding the existing protected areas to create a large core, wilderness-protected area would make a valuable contribution towards protecting a globally scare resource.

Threats

Our review for this area, and knowledge from previous habitat mapping work, concludes that the extensive road building and clearcut logging proposed to commence in the Brittany Triangle area in the near future represents a serious threat to both wilderness integrity and long-term species survival. Only limited ecological protection of the Brittany will be provided by Nuntsi and Tsy?los Provincial Parks. Logging would mean the loss of a major conservation opportunity for a viable foothills extension to two important B.C. protected areas. As well, the opportunity for formal protection of B.C.'s first wild horse refuge would be foregone.

A 40 km main haul road is planned to bisect most of the Brittany Plateau and this, combined with associated side-roads and extensive clearcuts of pine forests, would be the first thrust of a long period of mostly negative, cumulative impacts on the ecosystem. These cumulative impacts, which include high road densities, habitat alterations and escape-cover alterations and associated human disturbances such as increased hunting and poaching, have been well documented for sensitive "indicator" species such as grizzly bears and wolves. We suspect the reclusive feral horses would be negatively impacted as well although there is some evidence they can survive some logging activities over the short-term. We believe habituated animals of these and other species would generally have shortened survival. Increased conflicts between moose hunters and grizzly bears would contribute to human-induced grizzly mortalities. Studies conducted in various locations in North America show that more than 80% of human-induced grizzly bear mortalities occur within a half-kilometre of roads and human developments.

The proposed road building and logging will create a large "fracture zone" between two recently created provincial parks (Nuntsi and Tsy?los), eventually breaking down connectivity including bears' access to salmon. It is doubtful that Nuntsi and Tsy?los Provincial Parks would meet minimum conservation biology standards for the long-term protection of indicator species such as the grizzly bear and grey wolf without protection of the large Brittany core wilderness which lies between them. Previous land-use planning policies for protected areas (for example, the 12% guideline) and logging zones were mainly determined by political factors, not sound biological ones. The B.C. provincial government's proposed 1995 wildlife protection guidelines have not been forth-coming, guidelines which were intended to adequately protect, through the Forest Practices Code, “Identified Wildlife” (at risk) such as the grizzly bear. Given the current political regime, no improved wildlife protection guidelines are expected.

While Nuntsi Provincial Park is an important component for ecosystem protection, it comprises only approximately 13% of the total Brittany area. It protects only a small portion of the salmon-bearing rivers, supports only about two horse bands, and does not encompass the home range of even one grizzly bear or one wolf pack.

Recommendations

Conservation:

Despite the value of the wild horse as a component of both natural heritage and conservation, the species has been afforded no protection in British Columbia. In the U.S., Federal law, with some humane control measures, protects them. The U.S. has at least six wild horse refuges, including a number in the mid-west. In western Canada, feral horse populations have largely been extirpated and there are no horse refuges. The Rainshadow Wild Horse Ecosystem already serves as a wild horse refuge. There is reason to postulate that feral horses may have been integrated into this natural, still-intact ecosystem over several centuries. The horses’ survival in an intact predator-prey system, with all of the top North American predators featured, adds to this area’s unique conservation value.

We recommend that the Rainshadow Wild Horse Ecosystem (Brittany Triangle area) be recognized as wild horse refuge and be protected accordingly as western Canada’s first such sanctuary. It is a logical foothills extension of Tsy?los and Nuntsi Provincial Parks. B.C. Parks' policy should be adapted to include the wild horses, which appear to have been present long before the parks were established.

The viability of this, including a possible larger buffer of wild/horse protection in the Nemaiah Aboriginal Wilderness Preserve, should be the subject of a Conservation Area Design (CAD) review.

Further research on a number of “management issues” is recommended, whether or not the horse bands receive the protection we suggest is warranted. For example, while our field studies showed very limited over-grazing and competition problems this should be studied in greater detail. The following should be included:

1. More detailed habitat, population, and range impact surveys, including areas where feral horse use may overlap with the range of domestic cattle and California bighorn sheep (*Ovis canadensis california*).

2. Research into the current legal and policy status of feral horses in the area under Xeni Gwet’in First Nation’s policy, and provincial and national government law and policy, including the *B.C. Park Act*. In the U.S., an exception to National Park Service policy was made for Assateague Island National Seashore in order to protect wild horses. The exception allowed the horses as “a desirable feral species” that the public valued for cultural and historical reasons. Congressional interest in the animals when the park was established was also an important factor.

3. Further review of policies of conservation of feral horses in other protected areas in North America.

4. Further review of other potential management issues including testing for Equine Infectious Anemia (EIA), commonly called “swamp fever”.

5. Review of inception of a possible local rancher compensation fund for proven losses to livestock from grizzly bears, black bears and wolves.

6. A Conservation Area Design (CAD) should be done for the region, assessing the overall value of protected areas and corresponding linkage zones.

Biological:

More surveys are required including:

1. DNA testing should be done to determine possible linkages, if any, between the Rainshadow wild horse breed and the Colonial Spanish Horse.

2. More mapping and inventory of grizzly bears, wild horses, wolves and other wildlife. This should documentation of the distribution and numbers of wild horses.

3. A wild horse diet and habitat study using field plots and lab analysis of droppings. This should also include a preliminary study of wolf scats to determine whether horses are part of their diet. As well, the networks of horse trails should be mapped to measure connectivity of habitats.

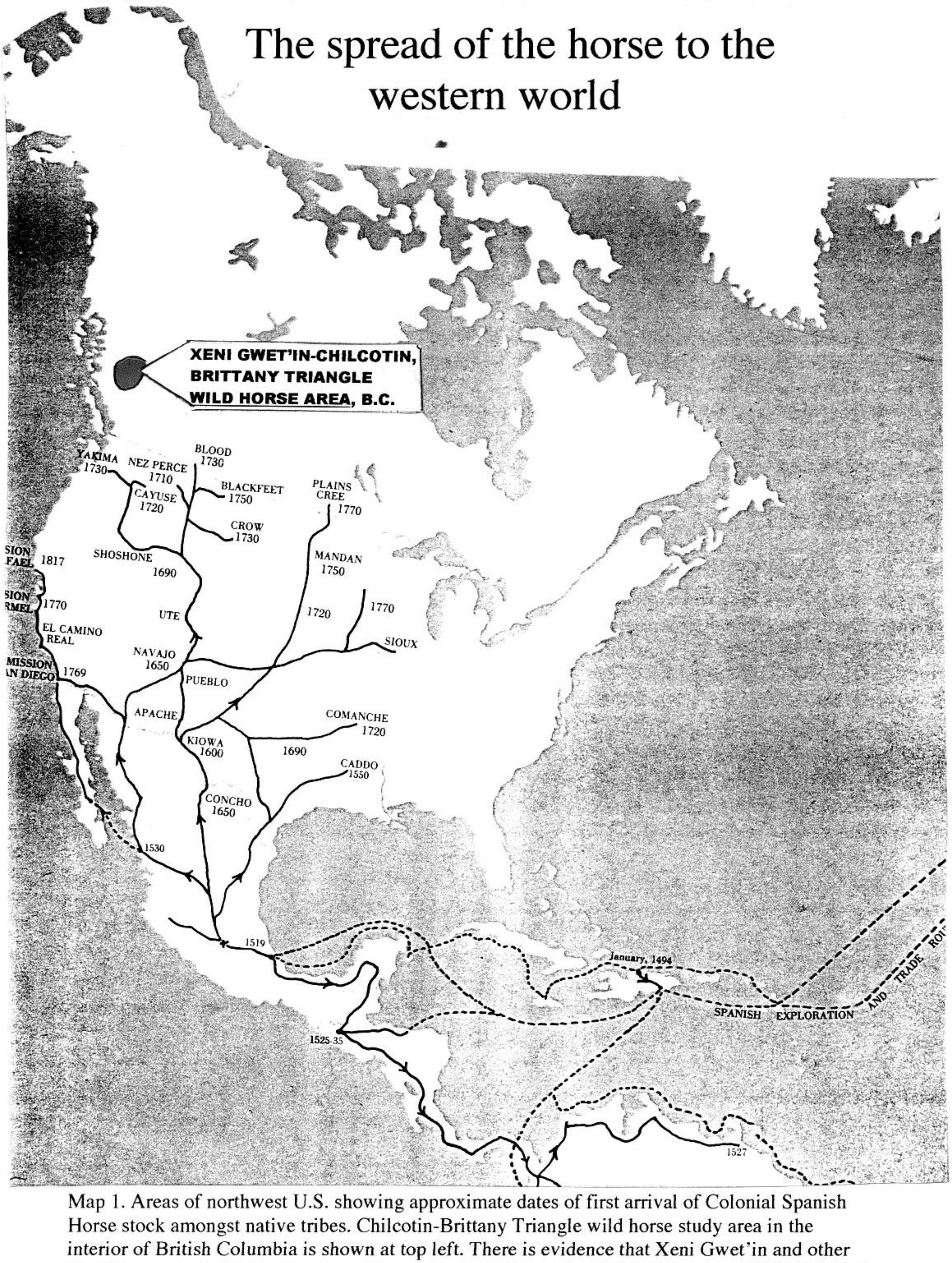
4. A more detailed impact assessment should be made of the logging proposed for the area. This should include short-term and long-term negative and positive influences.

First Nations traditional knowledge:

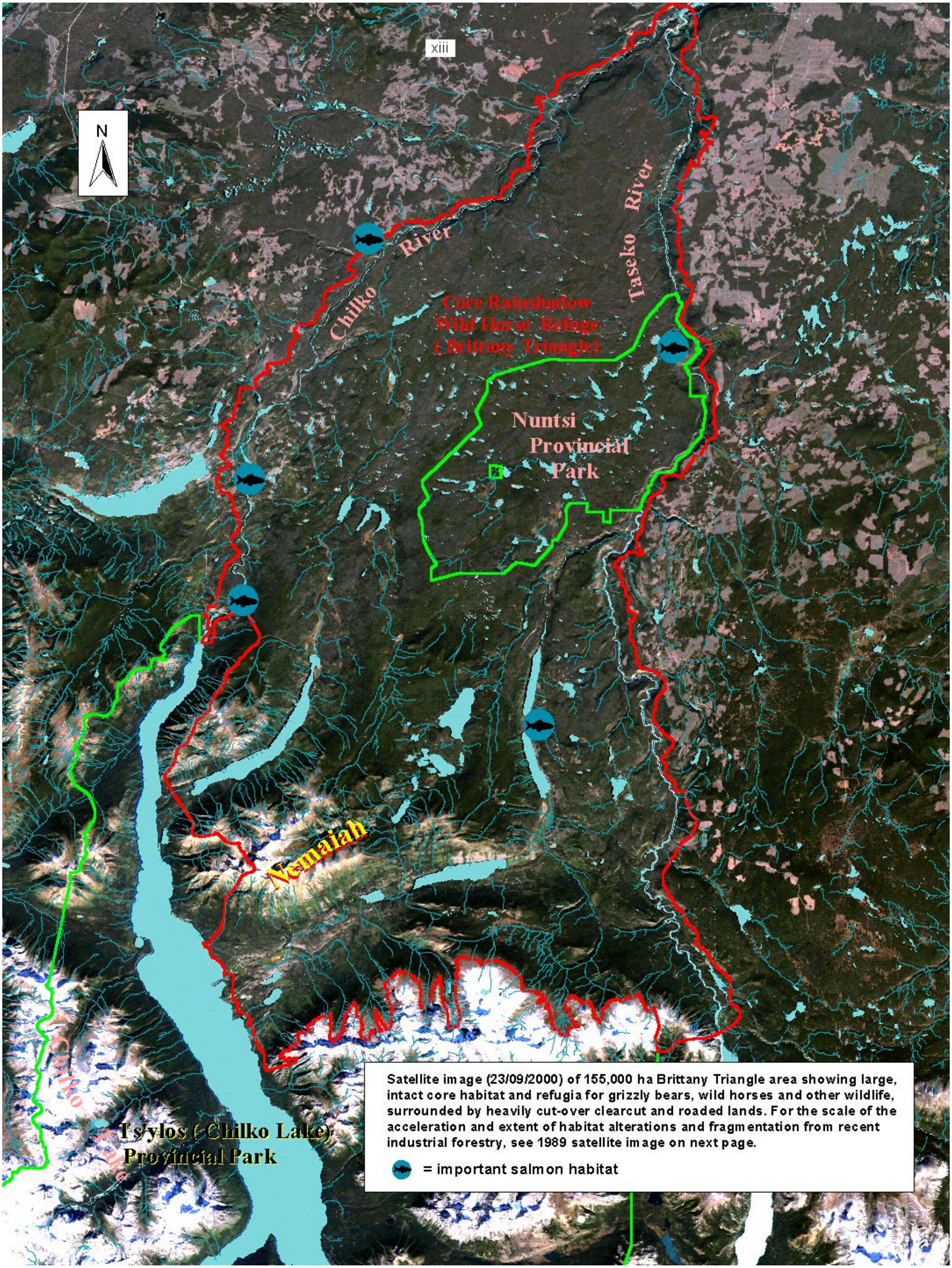
1. A further historic review should be done to assist in determining the origins of Brittany horses. This should include interviews of Xeni Gwet’in elders. Other wildlife knowledge such as on grizzly bears should also be studied and documented.

Key Words: Brittany Triangle, Chilcotin, Taseko, Chilko, British Columbia, grizzly bear, *Ursus arctos*, wild horse, feral horse, *Equus caballus*, salmon, Xeni Gwet’in First Nation, horse refuge.

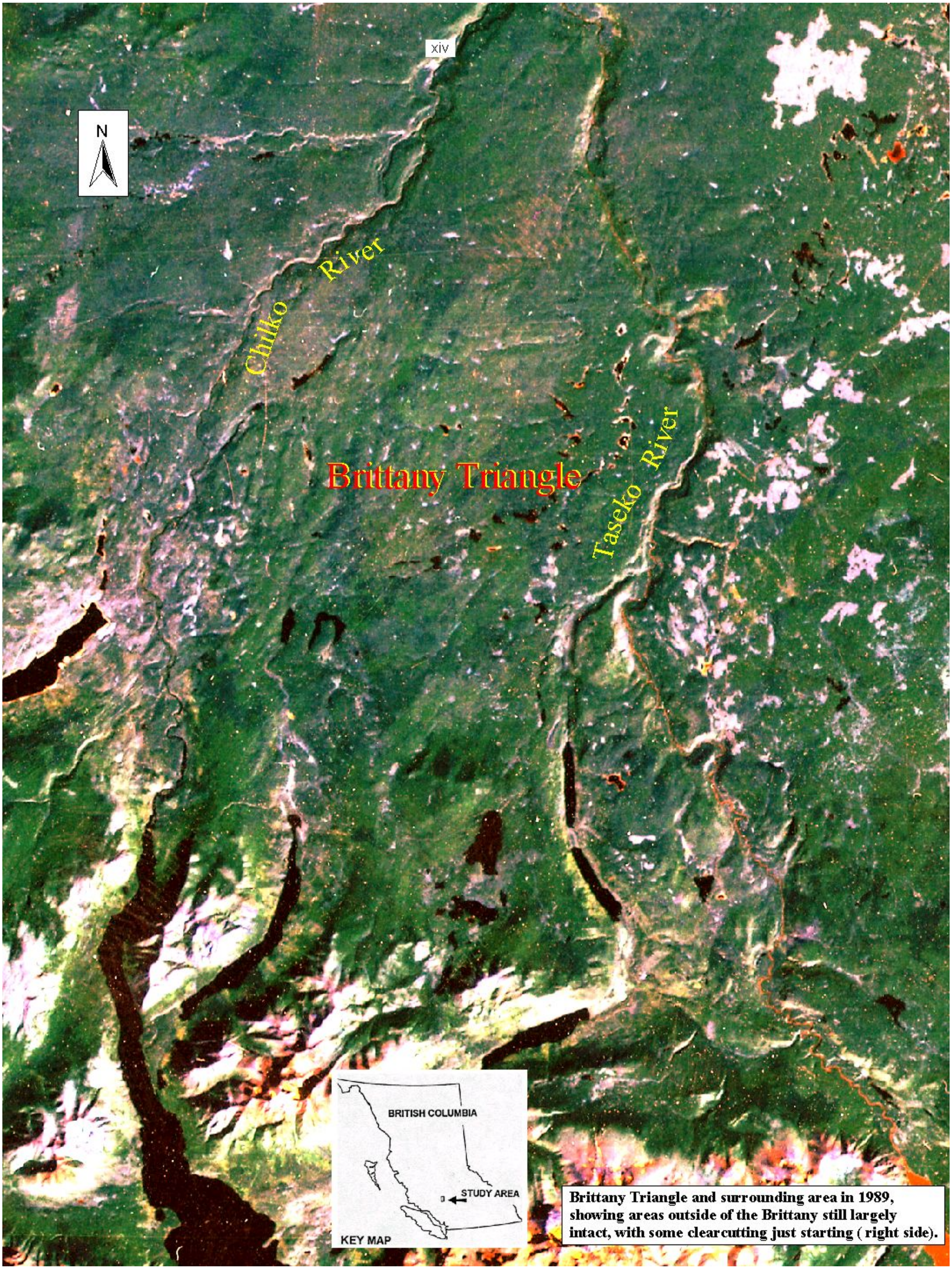
Tl'esqox students on wildlife training course on bighorn sheep range near confluence of Fraser and Chilcotin Rivers. It was near where the two rivers meet that explorer Simon Fraser encountered ancestors of these students in 1808. A number were on horseback indicating that First Peoples had horses in the Chilcotin prior to European contact. Fraser also recorded several local words for horses. Today, the Rainshadow Wild Horse Refuge area is about 100 km to the west, in the Coast Mountains in the "Nemaiah Aboriginal Wilderness Preserve" of the Xeni Gwe'tin First Nations. **(Photo by Wayne McCrory).**



Map 1. Areas of northwest U.S. showing approximate dates of first arrival of Colonial Spanish Horse stock amongst native tribes. Chilcotin-Brittany Triangle wild horse study area in the interior of British Columbia is shown at top left. There is evidence that Xeni Gwet'in and other First Nations in the Chilcotin area had horses prior to the early 1800's. [Map from **THE HORSE IN THE WEST**. Bradley Smith. 1969. Leon Amiel. New York].



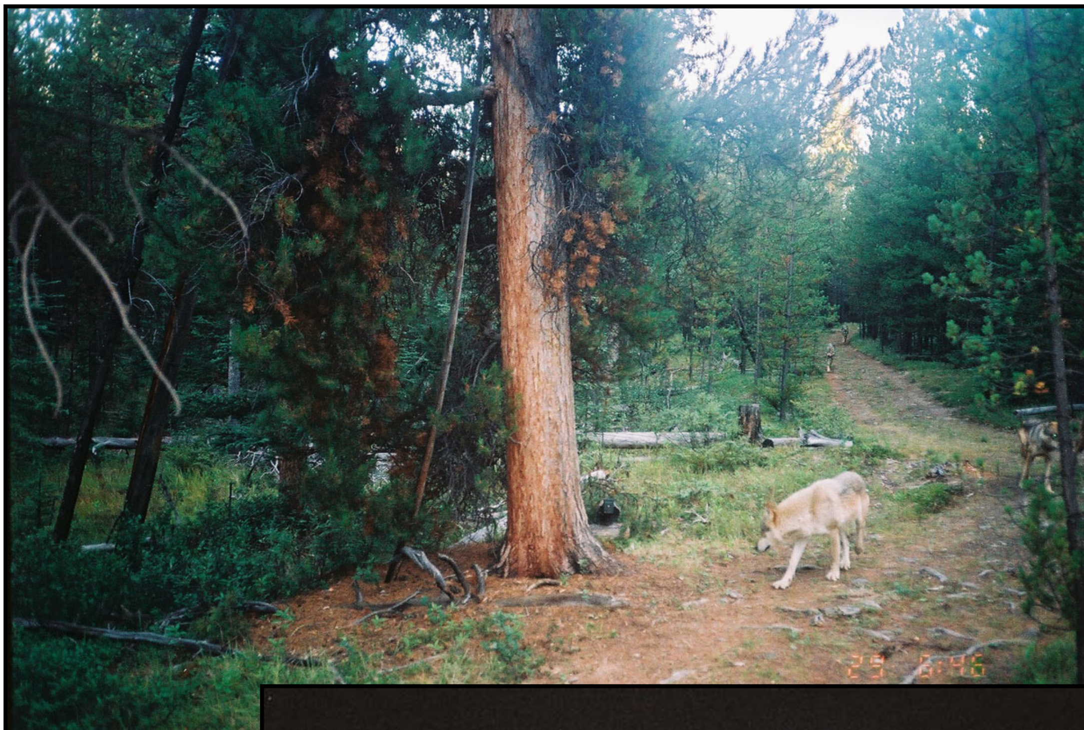
Satellite image (23/09/2000) of 155,000 ha Brittany Triangle area showing large, intact core habitat and refugia for grizzly bears, wild horses and other wildlife, surrounded by heavily cut-over clearcut and roaded lands. For the scale of the acceleration and extent of habitat alterations and fragmentation from recent industrial forestry, see 1989 satellite image on next page.



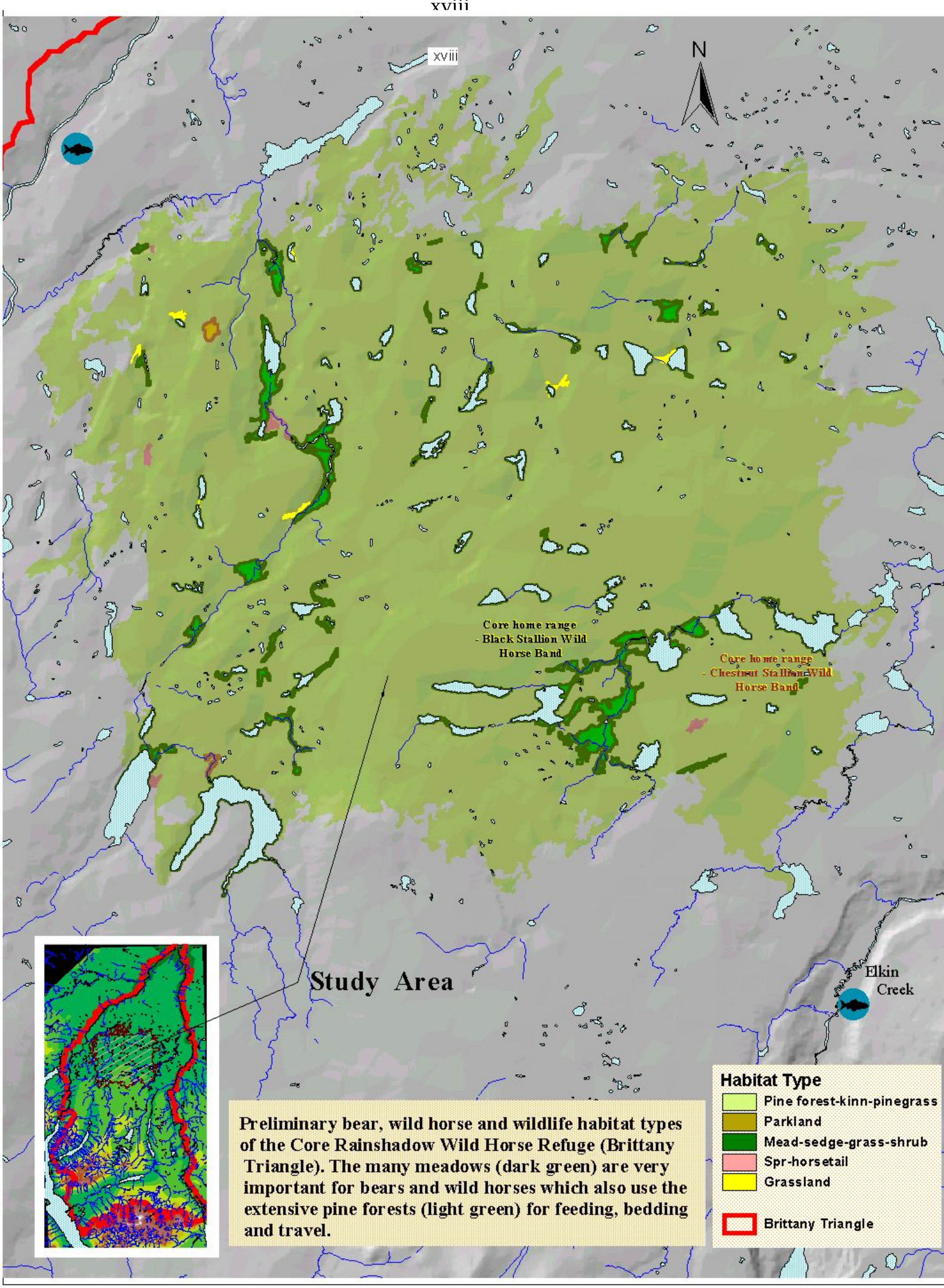
Brittany Triangle and surrounding area in 1989, showing areas outside of the Brittany still largely intact, with some clearcutting just starting (right side).

The southern reaches of the proposed Rainshadow Wild Horse Refuge (Brittany Triangle) are more mountainous and border on **Ts'il?os (Chilko Lake)** Provincial Park (background). Much of the forested area of the Brittany Triangle is lodgepole pine with a diverse fire history, such as this wildfire near Nuntsi Provincial Park in September, 2001. (Photo on left by Garth Woodworth, on right by Wayne McCrory).

Both grizzly and black bears are common in the Brittany Triangle and, although largely vegetarian and salmon-eaters, may prey on weakened or young wild horses. There is a dark, adult grizzly bear feeding on spring grass along Elkin Lake (upper, left) and the large brown-phase black bear (lower, right) was using a horse trail. Green vegetation in meadows and over-wintered kinnikinnick berries in pine forests appeared to be the main spring-early summer foods while soopolallie fruits were one of the late summer-fall foods. Many bears likely move to the main salmon areas in the Brittany Triangle to fatten up before winter hibernation. Bear mark trees are common in the area. (Photos by Wayne McCrory).



Remote camera surveys and field sign showed large predators were common in the Brittany Triangle. This pack of wolves included pups and was traveling an old/road and horse trail. The adult wolf is sniffing at the ground near a large pine tree used by bears for rubbing and marking. Another remote camera recorded a large mountain lion hunting along a wild horse trail at night. Prey species for these top predators in the ecosystem would include small animals, mule deer, moose and even weakened or young wild horses. Horses and moose winter in the area, while mule deer migrate to areas with less snow. (Remote camera photos by Wayne McCrory and FONV).



Preliminary bear, wild horse and wildlife habitat types of the Core Rainshadow Wild Horse Refuge (Brittany Triangle). The many meadows (dark green) are very important for bears and wild horses which also use the extensive pine forests (light green) for feeding, bedding and travel.

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MCCrory Wildlife Services Ltd.

ACKNOWLEDGMENTS

Thanks are extended to the directors of the Friends of the Nemaiah Valley (FONV), especially David Williams for coordinating the study and providing a field research station at Far Meadows, and for logistical back up and field assistance. Dave Williams, Patricia Swift, and Elizabeth Woodworth are thanked for helping with an extensive background search of the literature on wild horses and their history in the Chilcotin. Garth Woodworth is thanked for providing technical back up on GIS mapping and photos, as well as help with formatting.

Chief Roger William and the Xeni Gwet'in First Nation are thanked for giving permission to carry out research in the Nemaiah Aboriginal Wilderness Preserve and for assisting with this research. Boise Williams is thanked for providing invaluable field research and historic perspectives.

Robert and Birgit Bateman, the McLean Foundation, Mountain Equipment Co-op and Nature's Path are thanked for funding the study. The Chilko Lakes Resort and Community Group are thanked for lending financial and other assistance for the hiring of the Xeni Gwet'in researcher.

Dr. Paul Paquet kindly acted as a scientific advisor for the project. Michigan bear biologist Marty Williams is thanked for helping with the field work.

My wife Lorna Visser provided copy editing, plus her abiding understanding and support.

Lucy, my specially trained bear research dog, was my guardian and an early-warning system for bears and other threats. She is to be commended for learning patience, sitting quietly to observe wild horses.

The Department of Federal Fisheries and Oceans (DFO) generously provided salmon information. Barry Huber is thanked for the salmon data.
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B.C. Parks, especially Area Supervisor Glen Davidson, is thanked for providing a research permit for Nuntsi Provincial Park.

The Valhalla Wilderness Society is thanked for the loan of the remote-camera equipment.

1.0 STUDY CONTEXT & OBJECTIVES

In 1989, the Xeni Gwet-in First Nation declared their traditional territory protected as the Nemaiah Aboriginal Wilderness Preserve (1989). In 1994, the B.C. government completed an extensive land use plan (LUP) for the Cariboo-Chilcotin Region (CORE 1994). For the 155,000 ha Brittany Triangle area, the plan recommended a Resource Development Zone (RMZ) along with a small Lower Taseko protected area. Subsequently, Nuntsi Provincial Park (20,898 ha) was established. To the south and west, a much larger Ts'il?os protection area (Chilko Lake Provincial Park) comprising some 247,000 hectare was also designated. This park also provided some protection to the area known as the Brittany Triangle or Rainshadow Wild Horse Ecosystem (FONV, pers. comm.). There were no provisions made in the land-use plan for a protected corridor between the two isolated parks. In this corridor, extensive logging plans are now in place, despite the entire area also being protected as part of the larger Nemaiah Aboriginal Wilderness Preserve. Large areas of the Aboriginal Preserve, outside the Brittany Triangle, have been logged since the 1989 declaration.

Along with other new protected areas, the Cariboo-Chilcotin Plan brought the total amount of protection for the region up to the provincial goal of 12%. Optimistically, the 1994 CORE plan (p.156) indicated that, while the proposed protected areas varied in size 3,000 to 130,000 hectares, "*the larger proposed Protected Areas are large enough to be ecologically viable, particularly when buffered by adjacent large Resource Management Zones*."

Both the 1989 Nemaiah Aboriginal Wilderness Preserve and the two new provincial protection areas were a major conservation step forward for British Columbia at the time of enactment. However, even at the time, the B.C. government's 12% protection goal was being criticized by internationally recognized conservation biologists as being based on politics rather than sound biological principles that were being recognized globally to achieve long-term protection of key indicator species such as grizzly bears. In fact, for such wide-ranging large mammal species many leading conservation biologists now recommend a minimum of 40-50% of ecosystems be protected in large core preserves, connected by well-managed linkage zones. A Conservation Area Design (CAD) for the B.C. central coast recently recommended this much of the coast, just across the mountains from the Nemaiah Aboriginal Wilderness Preserve, be protected (Jeo *et al*. 1999).

At the same time, it has now been well-documented that special wildlife management guidelines promised in B.C. for buffer zones adjacent to protected areas have not been forthcoming under the Forest Practices Code (FPC). Thus, today, the current 12% protection can only be regarded as a system of building blocks for future conservation. If nothing is done to enhance protection to even meet minimum viability, many of the protected areas could eventually become "*islands of extinction*" as clearcut logging and road networks accelerate across the Chilcotin Plateau.

This is some of the background related to the concerns expressed by the sponsors of our study, Friends of Nemaiah Valley (FONV), for what they call the Rainshadow Wild Horse Ecosystem. Several forest companies have made an application to build a bridge across the Chilko River upstream from its confluence with the Taseko River to provide logging access to the Brittany Triangle Resource Management Zone (RMZ). Large areas of clearcutting and roading are planned.

Because of FONV concerns about the impacts of this planned timber extraction proceeding with few wildlife guidelines and virtually no wildlife inventory, they commissioned McCrory Wildlife Services Ltd. to carry out a preliminary inventory and conservation analysis.

The study objectives were as follows:

- identify and map grizzly bear, wild horse and other wildlife habitats at 1:20,000 scale suitable for developing a Geographic Information System (GIS) habitat map.

- rate the seasonal importance values of habitats for bears, wild horses and other species using field data on feeding sign, travel routes/corridors, remote camera results and other means.

- identify and document other conservation values including wolves and salmon.

- carry out a background study/literature search relevant to conservation values including grizzly bears and wild horses.

- integrate all findings into a summary of overall conservation values of the Rainshadow Wild Horse Ecosystem including uniqueness, prey biomass, predator-prey mix, connectivity and other features such as possible origins of wild horses.

- conduct a preliminary review of threats to wild horse/wildlife conservation values from the current forest development plans, and provide preliminary conservation and management recommendations

- provide recommendations for direction of further research.

Research limitations included:

- there was a dearth of background information for the Rainshadow Wild Horse Ecosystem, and interpretation of importance values for bear and wild horse habitats depended largely on background studies elsewhere, combined with our own field observations of feeding sign and other use.

- sampling of habitat types was based on reliable, but visual estimates of plant densities rather than by detailed plot sampling.

- it was technically impossible to identify all bear/other animal travel routes and patterns in our intensive study area.

Nonetheless, it was felt that the information gathered was sufficient to meet the objectives of the study and to provide a preliminary and reliable conservation assessment.

Our research was guided by the "precautionary principle of biodiversity" which states that one should apply a cautious and conservative approach when faced with a lack of information on the potential for significant effects (Myers 1993).

1.1 STUDY AREA

The main study area is known as the Brittany Triangle and also the Rainshadow Wild Horse Ecosystem (FONV, pers. comm.), a large plateau and mountainous area of approximately 155,000 hectares located in the Cariboo-Chilcotin Region of British Columbia. The study area is approximately 120 kilometers southwest of Williams Lake, B.C.

It is located in the lodgepole pine (*Pinus contorta*) foothills of the Chilcotin Range of the Coast Mountains known as the Chilcotin Plateau. The “Triangle” is formed by natural boundaries of two large river valleys, the Taseko and Chilko; while the south side of the Nemaiah Valley in the Coast Mountains forms a natural boundary at the south end. Elevations range from about 1000 meters along the River bottoms to 1200 – 1400 meters on the large plateau to 2207 meter high Konni Mountain near the south end.

The study area is within the traditional territory of the Xeni Gwet-in First Nation, which is protected as the Nemaiah Aboriginal Wilderness Preserve (1989). The south end of the study area encompasses the Xeni-Gwet’in Reserve lands and the Nemaiah Valley community. There are also several private lodges around the periphery as well as some small, private ranches, other holdings, trap lines and cattle grazing allotments.

The Rainshadow Wild Horse Ecosystem also has two recently established provincial parks, Tsy?los and Nuntsi established by the Cariboo – Chilcotin Land Use. Nuntsi (20,898 ha) is in the southeast section of the Rainshadow Wild Horse Ecosystem while a small area of Tsy?los protects the southwest corner. There is also an ecological reserve on Cardiff Mountain at the south end. Currently, there is limited visitor use and access, including Nuntsi Provincial Park.

The study area represents 2 biogeoclimatic zones found in the province. The majority of the area is in the Sub-boreal Pine Spruce (SBPS) biogeoclimatic zone – (SBPSxc subvariant) while some is in the Interior Douglas fir (IDF) biogeoclimatic zone (IDFdk4) subvariant) [CORE 1994].

The large size of the study area and the various geological, soil, topographic and diverse vegetation associations combine to provide considerable habitat diversity for grizzly and black bears and other wildlife.

The area has a relatively high ungulate biomass representing three native and one introduced species with various seasonal ranges. These include mule deer and moose. The high elevation areas at the southwest end support California bighorn sheep. Caribou (*Rangifer tarandus*) were apparently present at one time (Dave Williams, pers. comm.).

The one introduced species, the feral horse, appears to be a dominant herbivore.

Besides the two species of bear, the study area supports habitat for a complete guild of carnivores including the grey wolf, coyote, red fox (*Vulpus fulva*), cougar, bobcat (*Lynx rufus*), Canada lynx, wolverine (*Gulo luscus*), Canadian river otter (*Lutra canadensis*), mink (*Mustela vison*), pine marten (*Martes americana*), fisher (*Martes pennanti*), short-tailed weasel (*Mustela erminea*), and possibly the least weasel (*Mustela rixosa*) and long-tailed weasel (*Mustela frenata*).

A number of salmon spawning watersheds are located within the Brittany Triangle as well as salmon migratory routes up both the Taseko and Chilko Rivers. There are some major spawning grounds below Chilko Lake, within the Brittany Triangle.

The climate is very dry with low rainfall, typical of the leeward side of the Coast Mountains. Because the region is proximal to the Pacific Ocean, it has more moderate temperatures that a true continental climate. However, winter temperatures may drop to –40 degrees Centigrade (Chilko Lake Study Team 1993).

2.0 METHODS & APPROACHES

2.1 Definitions

Habitat capability/potential The potential of an area or a unit of habitat to support a species or multitude of species. This is usually determined through measuring the abundance of important seasonal foods known to be of dietary importance, such as for bears.

Habitat effectiveness Refers to bear behavioural changes in response to human developments. As these occur in a landscape, access by bears to nutrient-rich food sources may become impaired or even blocked. Even though productive bear and wild horse foods may still be available, the animals may stop using them because of their sensitivity to disturbance or risk of being killed. This inability of all or some (the more wary) animals to use habitats that have become isolated or fragmented by roads, trails or other developments is termed "*loss of habitat effectiveness*".

Riparian This has been defined as "*the land adjacent to the normal high water line in a stream, river, lake, or pond and extending to the portion of land that is influenced by the presence of the adjacent ponded or channeled water*" (Bunnell *et al.* 1992).

Linkage zones These are combinations of landscape structural factors that allow wildlife to move through and live in human-dominated landscapes (Servheen and Sandstrom 1993).

Corridors Combinations of landscape structural factors where wildlife prefer to travel.

Bear habitat seasons:

I adapted definitions from former bear studies such as in Kakwa Provincial Park (McCrory *et al.* 2001). Approximate time periods of each of the 3 "*bear seasons*" were difficult to estimate since it was based on seasonal plant phenology (such as ripening of berries). This varies from year to year and from low to higher elevations.

I crudely estimated the black and grizzly bear seasons as follows:

Spring (Green vegetation): den emergence to July 1. Important foods would include over-wintering kinnikinnick or bearberry, green grasses/sedges, horsetail (*Equisetum* spp.), and carrion. Winterkilled, weakened or newborn moose, deer and wild horses would likely be utilized. Some bears likely prey on newborn young of ungulates, which might include foals. To the south and west in the mountains, bulbs of western spring beauty (*Claytonia lanceolata*) and glacier lily (*Erythronium grandiflorum*) and other root/corm species would be important for grizzly bears.

Summer (Berry): July to end-September. Primary foods are ripe berries especially soopolallie and kinnikinnick. Secondary foods would likely include green vegetation (grasses/sedges) and (in the mountains) root/corm plants. Salmon feeding would be an important food strategy.

Fall (Post-berry): Mid-September to den up in late October and November. Important foods would include late-ripening fruits [e.g. kinnikinnick], some green plants, and salmon. Moose and other ungulates may also be utilized.

Road density Road density is now one of the more accepted measures of impacts. It is measured as the number of kilometers of road per square kilometre of habitat or total area. Following is a broad definition:

"*The concept of road density appears to be a useful broad index of the ecological effects of roads in a landscape. It is readily measured as the total length of roads per unit area, e.g. in km/km squared or mi/mi squared, on a map. Road density affects many factors but especially faunal movements, population fragmentation, human access, hydrology, and fire pattern. As road density increases, road avoidance by wildlife results in less habitat being suitable. The number of road killed animals increases. The road with roadside reduces the amount of remaining habitat. Populations are fragmented into subpopulations, each of which is much smaller. Movement rates are lower among the subpopulations than they were in the original population. Human access increases, which results in more hunting, trapping, and disturbance of animals. Also trampling and other disturbance to natural ecosystems increase*." (Forman and Hersperger 1996).

Grizzly bear core security areas These are defined as contiguous patches of habitat where a female grizzly bear can meet its daily energy requirements and at the same time avoid contact with humans (Mattson 1993). In the Central Canadian Rockies, 9 km^2 was calculated as the minimum size (Gibeau *et al.* 1999).

Remote camera-night Defined as the 24 hour period in which a remote camera was considered to be operational at the monitoring site.

North American Colonial Spanish Horse The following background is provided by Dr. Sponenberg (1999), a world authority on Spanish horses: "*These horses are a direct remnant of the horses of the Golden Age of Spain, which type is now mostly or wholly extinct in Spain…. Colonial Spanish Horses are rarely referred to by this name. The usual term that is used in North America is Spanish Mustang. The term Mustang generally carries with it the connotation of feral horse, and this is somewhat unfortunate since many Colonial Spanish Horses have never had a feral background. The important part of the background of these horses is that they are Spanish. These are descendants of the horses that were brought to the New World by the Conquistadors, and include some feral, some rancher, some mission, and some Native American strains. Colonial Spanish type is very rare among modern feral mustangs, and the modern Bureau of Land Management mustangs should not be confused with Colonial Spanish Horses, as the two are very distinct with only a few exceptions to this rule.*

The Colonial Spanish Horse is the remnant of the once vast population of horses in the USA. The ancestors of these horses were brought to the New World by the Spanish Conquistadors and were instrumental in their ability to conquer the native civilizations. The source of the original horses was Spain, and this was at a time when the Spanish horse was being widely used for improvement of horse breeding throughout Europe. "

Technical acceptance today appears to be based largely on blood testing for the variant Q-ac, believed to be contributed by the Spanish horses of 400 years ago.

Spanish Mustang Originally from the Spanish "*mestengo*" meaning stray or stranger – an animal that belongs to "*la mesta*", or everyone in general or no one in particular (Bearcroft 1974). Mustang was first used by Zebulon M. Pike in 1807 and first appeared in print in 1810 (Dobie 1934). It's common usage today is in reference to feral or wild horses or domestic horses believed to be derived from the original North American wild horses from Barb-Arabian stock brought in by the Spanish Conquistadors in the sixteenth and seventeenth centuries.

Feral versus wild This involves confusing and contradictory terminology. For domestic horses, which have returned to a wild existence, the public and the literature tend to use "*feral*" and "*wild*" interchangeably. By one definition, the only true "*wild*" horse is the Asian horse (*Equus przewalskii*) of Western Mongolia (Linklater 2000). These have 66 chromosomes while all domestic and "*feral*" horses have 64 chromosomes (Benirschke *et al.* 1966).

However, since the horses in our Rainshadow study area likely originated from the original Spanish horses which went wild in North America, they are therefore are by one definition "*feral*" they are also "*wild*" in another different, behavioural sense. They survive, and possibly have done so for several centuries, in a totally "*wild*" predator-prey ecosystem. They also exhibit intricate social behaviour of their long-ago wild ancestry that is remarkably different than normal domestic horses kept in captivity. I therefore liberally elected to use the words feral and wild interchangeably, without constraint.

Wild horse nucleus brood band In the wild horse literature, social units have often been defined as "*harem bands*" (Turner *et al*. 1981. Turner and Kirkpatrick 1986). I chose to use nucleus brood band as a substitute. This was felt to be a more accurate term for this type of wild horse social unit as well as more socially acceptable since the term "*harem*" has connotations of slavery.

Stallion "*pile*" A large deposit of dung left by a stallion and inspected frequently by other horses (Momatiuk 1997).

2.2 General study approach

The study approach involved field surveys combined with background research that encompassed the scientific and historic literature. The Xeni Gwet'in researcher hired to do field work provided some Xeni Gwet'in wildlife information. However, our interview program on traditional wildlife and wild horse knowledge was deferred because of another, priority Xeni Gwet'in interview project going on at the time.

The field inventory focused on all wildlife species while emphasis was placed on "*indicator*" or "*focal*" species felt to be most suitable for a future conservation area design (CAD). These included grizzly bears, black bears, wolves, and wild horses.

2.3. Field inventory

2.3.1 Non-invasive research approach

Wildlife research often employs radio telemetry, where the subject animals are captured, immobilized and fitted with a transmitter. This technique yields high quality data, but can impose considerable stress on study animals (Cuthill 1991). Grizzly bears occasionally die following capture and immobilization (McLellan *et al*. 1999); as do wolves (i.e. Kreeger and Seal 1990). Radio telemetry studies are also expensive, logistically difficult to conduct in remote areas, and often hazardous.

I designed the Brittany study using a non-invasive approach where no animals were marked or radio-collared. This included not using bait to attract grizzly bears or other wildlife to our remote camera stations. I also began recording different wild horse colour and other traits to facilitate individual identification in the field. The techniques pioneered in this study will contribute to assessing the efficacy of these new approaches (Cooper 1998).

2.3.2 Global Positioning System (GPS) readings

Locations of most wildlife trails, horse trails, human trails, grizzly bear mark trees and other features were recorded with a 1996 Garmin GPS 45XL. Point locations were taken of many of the trails to help pinpoint accuracy. All data was transferred to either 1:50,000 topographic maps or 1:20,000 TRIM maps.

The government of the United States operates the GPS system, which is solely responsible for its accuracy and maintenance. This has a position accuracy of 15 metres RMS; subject to accuracy degradation to 100 metre 2DRMS under the US DOD imposed Selective Availability program. However, Selective Availability was turned off in May 2000.

2.3.3 Habitat transects & field mapping

The focus of our preliminary field work was on evaluating habitat potential and use based on detailed ground-truthing. This was designed to a level of accuracy required to develop a combined grizzly bear, black bear and wild horse habitat map that could then be modified to incorporate information on other wildlife.

Ideally, systematic vegetation plots should be used to establish relative wildlife food densities and wildlife use. For example, for grizzly bears in Kluane Park, Lindberg (1995) used the line intercept-releve sampling technique using Daubenmire vegetation plots. Such systematic vegetation plots were too time consuming for the large area to be sampled in the Brittany ecosystem.

Our habitat surveys for bears followed the strip transect methods developed for grizzly bears by Hamer and Herrero (1983) and McCrory *et al*. (1986). For strip transects, trained wildlife researchers walked human trails, wildlife trails and off-trail habitats. Each transect unit was assigned a number. These were divided into segments, which began and ended where there was a distinct vegetative or topographic feature.

Each segment was visually evaluated for general wildlife, horse and bear plant foods according to the perceived relative density of cover. I used the following abundance ratings: trace (Tr = 0-5%), low (L = 6-10%), moderate (M =10-50%) and high (H = 51-80%) and very high (VH = 80-100%).

Where potential root/corm habitats were located (for grizzly bears), I subjectively rated the suitability of soils for digging. A study in the Rocky Mountains showed that grizzly bears preferentially dug roots of sweetvetch in substrates of loose texture but did not excavate roots in similar habitats with hard soil texture (Holcroft and Herrero 1985).

For bears and other wildlife habitats I also recorded the following habitat information:

- mineral licks
- bear and wildlife trails
- winter browsing by ungulates
- snags and ground logs
- stones and ants
- disturbance
- micro-habitats
- bedding sites
- potential and active wolf/coyote denning areas
- bear mark or “rub” trees
- bear scats and feeding sites

For wild horses I recorded the following additional information:

- well-defined trails and networks
- obvious seasonal feeding sign
- seasonal bedding areas
- dust/mud rolling areas
- scat deposition areas (e.g. winter) such as stallion “piles”
- mortality remains (usually skeletons)

All information was then transferred to one or more of the following 3 base maps in the field: 1:20,000 TRIM map, 1:20,000 forest cover map and 1:50,000 topographic map. Some preliminary habitat typing was also done on the maps in the field.

2.3.4 Determination of wild horse and grizzly/black bear diet for ranking importance values of habitats

I used field observations combined with diet information from other studies in ecologically similar areas to develop a preliminary list of potential bear food items for our study area. The list of bear foods was segregated into three general food classes: green vegetation, root/corm species and animal protein (mammal, fish and insects). The list was later refined based on detailed feeding sign observations and scat analysis. For wild horses, graminoids (grasses, sedges) were used.

Diet information was then used to develop the importance values for each food item for each season for the habitat transects.

2.3.5 Field analysis of bear scats

Typically, dietary investigations of scat are carried out with a microscope under costly laboratory conditions. This was beyond our budget. For our final analysis, I used a crude field analysis of the food content of scats combined with feeding sign data to determine the annual diet of bears in our study area. Scat was the main source of seasonal dietary information.

For field determination of food content I estimated the volume of each visible food item (green vegetation, berries, insects, etc.) in each scat. Scats were teased apart in the field using several sticks. In many instances, food items were identified to plant class (e.g. grass/sedge, huckleberry) but often not to species except where positive identification could be certain.

2.3.6 Classification of bear/wild horse habitat types

Each habitat unit was coded according to the dominant forest cover type/tree species combined with the dominant bear food(s) or ground cover, where applicable. Where a forest cover type did not exist I used the dominant vegetation feature such as meadow. Where applicable, the habitat types were abbreviated. An example of the classification method would be the polygon Pl-kinn-pinegrass. This was a lodgepole pine forest with a dominant understory of kinnikinnick and pinegrass.

2.3.7. Development of a GIS base habitat map

Once I created preliminary habitat types in the field for bears and wild horses, I then developed a GIS base habitat map. I used digitized 1:20,000 TRIM (Terrain Resource Information Management System) to create a colour Digital Elevation Model (DEM) as a background map. I used elevations with contour intervals of 100 m. TRIM based river systems, lakes and other features were added as overlays to the base map. Using Ministry of Forests digital 1:20,000 forest cover maps I re-indexed digitized polygons to match our vegetation habitat types for bears and wild horses. This layer was overlain with the DEM to produce a final habitat map. Colour codes were created for the different bear/wild horse habitat types. For this project, I developed only one forest cover map sheet 920.071.

MapInfo Professional version 4.5 and Arc View 3.0a were used to digitize map features from paper maps.

2.3.7 Definition of bear seasons

These were adapted from our former bear study in Yoho National Park (McCrory *et al*. 1998) as follows: green vegetation (den-up/spring to mid-summer), berry (mid-summer to mid-fall) and post-berry (mid-fall to den up). For the Rainshadow Wild Horse Ecosystem study, the approximate calendar timing of the bear seasons was determined from observations of plant phenology in the field.

Bear seasons were used to approximate other animal seasons such as feral horses and wolves.

2.3.8 Evaluation of plant phenology and berry productivity

Measures included estimating the average height reached by individual species of green plants, as well as the development state (shoot, pre-flowering, flowering, seed). For berry species I recorded the appearance of flowers, first ripe fruits, the date at which fruit was all-ripe and dates when fruits had all but disappeared. Over-wintering fruits (e.g. kinnikinnick) were also documented.

I rated all berry production (nil, trace, low, medium, and high).

I also monitored the cone development of whitebark pine trees (Pinus albicalus) and cone middens left by red squirrels.

2.3.9 Ranking the seasonal importance value of habitat units

Each bear habitat type was assigned an importance value for each of the three seasons. The estimated food densities and knowledge of their importance in the seasonal diet of grizzly/black bears and to determine numerical values for each bear season. I used our standard scale of 1 to 10, with 10 having the highest food value.

For root and corm foods for grizzly bears, the suitability of the substrate combined with obvious diggings by grizzlies was another important factor besides plant density used in rating the seasonal value of the habitat. Despite occurrence of abundant root and corm foods for grizzly bears, if the ground appeared too compact and there was no evidence of digging, the unit was rated of lower value than a similar habitat with looser soils.

A similar preliminary system was developed for the wild horses, but winter was included as the critical habitat season.

2.4.0 Determination of habitat use through field sign

For each habitat transect, I also measured habitat use with an emphasis on bears and wild horses. For bears, I recorded all feeding sign, tracks and scats. For horses, I was less systematic since sign was ubiquitous.

Plant cropping sign

For vegetation feeding, I counted cropped stems such as stalks of cow-parsnip (*Heracleum sphondylium*) fed on by bears or sedges grazed by horses and/or bears.

For berry feeding by bears I identified the broken limbs of berry bushes such as huckleberry and soopolallie. Feeding signs for low growing shrub species such as bearberry and crowberry were more difficult to detect. I used minor branch damage, loose berries on the ground, and associated track or scat sign.

Aging of feeding sign was based on the plant state when used, often combined with weekly monitoring of plant phenology. For example, if I knew cow-parsnip was nearing the full leaf stage in a given location and noted several weeks later that it had been browsed by a bear, I could estimate date of use.

Diggings

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Since black bears rarely dig for food sources found underground, the following digging sign was always attributed to grizzly bears. Where possible I used tracks and other evidence to verify whether grizzly bears had created the field sign. Besides the presence of the food item itself, I used the following evidence:

- Diggings for glacier lily corms were typically overturned sods with dried plant remains obvious.
- Diggings for spring beauty corms were shallower scoops made by claws.
- Diggings for sweetvetch roots were usually deeper scoops than glacier lily corms, with attendant plant remains obvious.
- For diggings for Columbian ground squirrels (*Spermophilus columbianus*), the obvious sign was usually a hole the size of a trench, with the ground squirrel tunnel or nest usually obvious in the excavation.
- For microtines, diggings were shallower and usually followed near-surface tunnels.

The following sign was attributed to both bear species:

- Shallow diggings for ant or wasp ground nests, as well as stumps and logs ripped open.

Where conditions permitted, I estimated age, size, and number of digs. For glacier lily or spring beauty digs, I examined disturbed sods for age of decomposition and degree of revegetation. I aged digs by monitoring the decomposition rate of disturbed plants and, if older, recolonization of plants at the disturbed site. The rate of soil weathering and deposition of windblown debris were also factors.

All diggings were counted, based on an individual ground “*scoop*” by a grizzly bear paw. For multiple diggings, I estimated the size of each large area and the number of “*scoops*” per square meter.

Tracks

Tracks were used for both the documentation of use of all habitats as well as in studying movements. For example, whenever a grizzly or black bear track was observed, I collected the following information: location, elevation, estimated age, substrate, direction and distance of travel, and other factors. Bear species was determined from claw measurements, relative size of toes, and other track distinctions such as curvature of the front footpad.

Wildlife and horse trails

All obvious wildlife trails or human use trails used by wildlife were documented and mapped as accurately as possible. Particular attention was paid to mapping the complex network of wild horse trails in the ecosystem.

Trees stripped for cambium

Trees stripped by bears for cambium were recorded as to location, tree species, and portion of trunk de-barked. I used the pattern of alternating vertical light and dark narrow lines as positive proof that bears and not porcupines or other phenomenon had created the scar. Although direct field verification is needed, I believe the following bear behaviour causes this pattern. After they strip the outer bark layer with their claws, they then use their incisors to remove the thin cambium layer. This they do with vertical eating and licking motions. This incisor action leaves narrow gaps of residual cambium. Mold growth and dark stain is then believed to create the darker striped vertical lines, which remain for decades.

Crude attempts were made at aging this feeding activity. Re-growth of tree tissue around the scar was used to estimate older scars.

Identification of bear species was made by searching for hair on the scar or associated tracks.

Scats

All bear and other carnivore scats within 2 m of either side of a transect line or within each survey plot were recorded and aged and also crudely examined in the field for food content. The age of each scat was based on the general appearance, degree of decomposition and degree of discoloration of vegetation underneath. Species of bear was determined by associated track identification and in some cases, by elevation. (In this case, these was some assumed error since a small number of scats identified as grizzly bear may have been left by black bear)

Field determination of scat content deposited by carnivores was determined from appearance of food items (e.g., green vegetation, berries, insects, etc.). I crudely estimated the percent volume of each main food item.

For horses, I noted presence of scats and approximate season of deposit.

Bedding sites

Bears often bed near their feeding sites and appear to select for certain characteristics such as cover, dryness and bedding material (e.g. needles) at the base of large tree, wind direction and other factors. These sites are often called “day beds” although some would be used at night.

All bedding sites were mapped. Measurements included size, location from key habitat such as a slide area, nest material and proximity to a trail or other facility. Since bears generally bed under trees, I also recorded species, diameter at breast height (DBH) and whether the bed was on the uphill or downhill side of the tree.

Logs or stones disturbed for insects

I recorded all logs ripped open by bears for ants or wasps, or stones turned over for ants.

Dens

For both bear species, potential bear denning areas were searched such as cliff bands with caves or ridges with clay deposits under the roots of large trees. For grizzly bears, I also noted steep alpine meadows. Den sites were identified by size, presence of hair, and large spoil banks with an entrance hole and larger denning cavity inside. I also recorded any evidence of black bear dens. When a den was located I recorded: a) location, b) slope micro, c) slope macro, d) aspect micro and macro, e) elevation f) entrance type and width g) tree species and approximate diameter and estimated age, h) type of nest material, i) den stability, j) scats and other factors.

2.4.1 Determination of habitat use through direct observations

Direct observations were made on all wildlife use as the opportunity arose in the field. I recorded estimated age and sex of all animals observed. Site visits were also made after wildlife had left the observation area in order to determine plants fed on and other information.

Particular attention was paid to wild horses. I documented herd size, composition, physical condition and colour of individuals. This allowed us to identify the different herds.

2.4.2 Determination of habitat use by remote camera censusing

I used nine TrailMaster TM1500 active infrared monitors. Each set up involved a separate transmitter and receiver to create an infrared beam across an assumed animal travel route or activity site.

A cable was attached from the receiver to a Yashika T-4 remote camera (Goodson and Associates, Lenexa, Kansas). Night exposures were restricted to distances of <5 m and limited by film ASA and flash output. The cameras included data-backs that encoded the date and time of each exposure on the film.

Where possible, most camera units were set up at possible bear mark trees along trails or roads. Some were also set up along horse or wildlife trails.

The optimum sensor to subject distance was less than 13 m of the field of view. The distance varied slightly with the location and type of sensor used. I avoided pointing the sensor into direct sunlight. In some instances, I also avoided setting up the transmitter on a tree exposed to the wind, since the motion triggered the camera.

Sensor distance was tested by trial and error with the camera on. I camouflaged the sensor with dead branches and rocks from the surrounding area. Fine-mesh chicken wire was often placed over the receiver unit and camera cable to reduce damage by porcupines, squirrels and other rodents.

The film was loaded into the camera and the lid closed to ensure a weatherproof seal. I sometimes covered the camera box with branches and/or rocks, which provided camouflage and stability when disturbed by rodents.

The unit was usually tested once after each set-up.

I checked each monitor at least twice within the first week of installation and then at least once a week. Maintenance of each camera site included checking and recording the camera film counter, testing of cables, checking battery status, ensuring boxes were waterproof, and verifying that camera and sensor had not been moved.

All photo-records were collated as to species, sex (where possible), relative size, colouration, identification of individual animal (such as from body scars), marking behaviour and other factors. Date and time of day were also collated from the photo to help determine time of animal movement through an area.

2.4.3 Hair collection - genetic tagging of free-ranging bears

This was used to help determine individual grizzly bears and sex class. Collection of a fresh hair sample at a mark tree was also used as evidence of a bear having traveled through the area.

I used a fairly simple method to capture hair samples from bears. Our method was to collect hair from mark trees, especially those that also had a camera set up. I did not utilize the barbed wire plot-bait methods recommended by Woods *et al*. (1999) in order to avoid a sample bias in data on natural travel patterns by luring bears to sites with highly odiferous baits.

To enhance hair collection at mark trees I used a variety of methods including wide-headed tarpaper nails, small pieces of carpet with tacks driven through so that the sharp nail sides stuck out, and a carpet-nail hair-grabber, which had small barbs on the nails.

At the start of the season, all hair was cleaned from all mark trees. After collecting each new sample, the tree was always cleaned of all old hair. Each hair sample collected was stored in a paper coin package or plastic vial (with silica desiccant) and later stored in a freezer.

All hair samples were then sorted and linked to camera/movement events, including photos of individual grizzly bears. Where movement data showed that the same bear left a number of hair samples at different mark trees, I selected only the best hair sample.

Relevant hair samples were saved and frozen for eventual analysis by Wildlife Genetics International lab at Nelson, B.C. In the future, the hair will be analyzed according to the following sequence: mtDNA (to determine species); 4-loci micro satellite (to determine individuals); additional 4-loci micro satellite and Y-chromosome (for fingerprinting and sex determination).

2.4.4 Salmon habitats and their use by bears

These represented very important but specialized habitats within the ecosystem.

Information was obtained from the Department of Federal Fisheries (DFO) on salmon spawning areas, species and annual escapement levels. This included some information of grizzly and black bear observations.

In the field, I surveyed Elkin Creek prior to salmon spawning for evidence of bear use of the riparian corridor. Bear trails and mark trees were mapped. During August, a search was made of Elkin Creek for evidence of bear and salmon activity. A short field survey was also made to the Chilko River at Henry's Crossing.

2.4.5 Background review

A preliminary review was made of land-use plans, current logging plans, protected areas, First Nations areas of interest and other factors. This included Riverside's proposed logging plans at 1:30,000 scale.

A literature search was made of all wildlife studies in the general area.

I also made a fairly extensive search of the scientific literature on wild horse ecology, genetics and conservation status in North America. Some of this involved a website search as well as research at the library at Central Michigan University and libraries in Victoria, B.C.

3.0. RESULTS AND DISCUSSION

3.1 SUMMARY OF WILD SALMON VALUES

Of relevance to our assessment of overall conservation values, a background review shows that the Rainshadow Wild Horse Ecosystem has exceptionally high salmon values. This is also in terms of the biomass of salmon in the ecosystem adding to the life-support system for flesh-eating carnivores including the grizzly bear, black bear and grey wolf (McCrory *et al*. 2002).

Each fall, three species of salmon migrate up the Chilko and Taseko Rivers, passing through the Rainshadow Wild Horse Ecosystem: sockeye (*Oncorhynchus nerka*), chinook (*Oncorhynchus tshawytscha*) and coho (*Oncorhynchus kisutch*).

By far the largest runs are sockeye, which migrate up the Chilko from early August to the end of September, with the peak of spawning between September 15 and October 5. The majority spawn from the outlet of Chilko Lake for about 5 km downstream (Chilko Lake Study Team 1993). Most of this portion of the Brittany Triangle is protected in Ts'il?os Provincial Park. Abundance has ranged from 234,000 in 1981 to over 5 million in 1991, with abundance being defined as the total catch in all areas, plus spawning escapement. The mean total from 1979 – 1991 was 1.7 million, 26% of the entire Fraser River sockeye return (Chilko Lake Study Team 1993). The sockeye are unique in that emerging fry migrate upstream into Chilko Lake to rear. Most systems sockeye spawn in tributaries to the lake and migrate downstream into the lake to rear (Barry Huber, DFO, pers. comm.).

Chinook migrate up the Chilko from mid-July to the end of August. Peak spawning occurs between August 15 and September 15, with escapements estimated between 3,000 – 11,000 over the period 1979 – 1991 (Chilko Lake Study Team 1993). The peak of spawning is near Sept. 8 – 12, with the majority spawning near the confluence of the Chilko River with Lingfield Creek (Barry Huber, DFO, pers. comm.).

Chinook migrate up the Taseko later than the Chilko, in September (Chilko Lake Study Team 1993). There are no accurate counts due to the glacial turbidity of the Taseko and the majority is believed to spawn near the outlet of Taseko Lake. The Taseko sockeye are suspected to spawn in Taseko Lake (Barry Huber, DFO, pers. comm.).

Coho spawn in late fall in the upper Chilko River System and more accurate information on numbers is being obtained (Barry Huber, DFO, pers. comm.).

In Elkin Creek, Chinook spawn near Sept. 10 – 15, from Elkin Lake downstream to poorer spawning substrates in the lower reaches. Elkin Creek is unique as it is the only tributary of the Taseko/Chilko rivers that support spawning salmon. Between 1991 – 2001, escapement of Chinook averaged 610 annually ranging between 417 and 1,250 (Barry Huber, DFO, pers. comm.).

For the two large rivers, these salmon values have little protection afforded by the two provincial parks. Most of the salmon-spawning areas in the Chilko River system are several kilometers downstream from Ts'il?os Provincial Park. Nuntsi Provincial Park protects a limited area of the east side of the Taseko River. A smaller salmon-bearing tributary, Elkin Creek, drains into the Taseko from the east side of our study area, and is outside of Nuntsi Park. Affording protection to the entire Brittany Triangle would not only safeguard the very high salmon values, but also protect the riparian habitats used by grizzly bears, black bears and wolves during the time of year they forage on salmon.

3.2 SURVEYS OF BEARS, OTHER WILDLIFE AND WILD HORSES – HABITAT ASSOCIATIONS, NUMBERS AND SPECIES OCCURRENCE

3.2.1 Habitat types and habitat associations

3.2.1.1 Habitat sampling and types

We carried out a total of about 80 km of habitat transects in the study area between June 15 - 24 and August 20 - 27, 2001, with an emphasis on bears and wild horses. Habitat efforts focused in Nuntsi Provincial Park and adjacent areas including the Elkin Creek watershed. Results of habitat transects are provided in Appendix I, including bear food densities and observations for each transect section (Appendix I, Table 1).

In the spring and fall, a 50 km road reconnaissance was also made of the "breaks" along the north side of the Chilko River between Henry's Crossing and the Chilko-Taseko River junctions. Habitat use data was supplemented by the operation of nine remote-infrared sensor cameras at select travel trails and roads over a 4-month period.

The more intensive sampling area was approximately 5% of the Rainshadow Wild Horse Ecosystem and considered representative of lower elevations. We did not sample higher elevation sites at the southern end of the study area, which likely have important habitats for grizzly bears.

The typing of habitat units along with the rating of their potential was preliminary in nature and based mainly on bear and wild horse dietary and habitat values determined from field data, combined with detailed studies from ecologically similar areas. No detailed habitat studies have been done on bears in the Chilcotin that I are aware of although some bear habitat observations were documented in a study in the adjacent Taseko management zone (Sopuck *et al*. 1997).

Other background studies from similar dryland ecosystems that were used to help interpret seasonal diet and habitat selection included Banff National Park (Hamer and Herrero 1983), the Lillooet area (McCrory 1998) and South Tweedsmuir Park (McCrory and Mallam 1989).

For wild horse habitat values I was very fortunate in having one background study from a nearby area in the Chilcotin (Storrar *et al*. 1977). While caution was used in extrapolating from wild horse studies in prairie grasslands in Alberta and the U.S., some studies done in similar foothills lodgepole pine ecosystems elsewhere proved useful. These included a detailed study near Sundre, Alberta (Salter and Hudson 1979 and 1980) and another in the Green Mountain Wild Horse Herd Management Area of South central Wyoming (Crane *et al*. 1997).

Based on the results of our field surveys and our review of the background literature, I classed habitats into eight generalized types that I felt best represented both grizzly/black bear food selection areas and wild horse feeding and other associations. Some habitats were mapped to the micro-site level, such as small areas of white spruce (*Picea glauca*) with *Equisetum* spp. (horsetail) **-** an important bear spring and summer food.

The six vegetative habitat categories were named according to the dominant forest or vegetative cover as determined from 1:20,000 forest cover maps followed by the associated dominant bear and/or wild horse food(s), as follows:

- Lodgepole pine-kinnikinnick-pinegrass
- Douglas fir-aspen parkland-grasses
- Riverine “breaks” grasslands-bluebunch wheatgrass
- White spruce-horsetail
- Wet meadow/shrubfield/sedge complex
- Dry meadow/shrubfield/ grass complex

The other two habitat types were named according to either disturbed or because of salmon:

- Riparian salmon spawning/migration areas
- Disturbed (road, dwelling, clearcut, etc.)

3.2.1.2 Summary of habitat types and importance values

I would like to emphasize the preliminary nature of this analysis, especially where our interpretation of habitat importance relied more on detailed studies elsewhere than on adequate sampling in our study area. This only underscores the need for more in-depth field research. On the other hand, I felt that our habitat analysis provided an accurate tool to reliably evaluate ecosystem conservation values according to a number of high profile indicator or focal species.

Storrar in his habitat study of wild horses in the Chilcotin concluded that this was not a homogenous environment, and that the small clearings and watercourses provided a variety of edible plants. The heterogeneity enabled the environment to be used most productively by a variety of animal species existing on different plant species including moose and wild horses (as reported in Bearcroft 1974). I drew the same general conclusion for our study area.

Following is our evaluation of the different habitat categories.
a. **Lodgepole pine-kinnikinnick-pinegrass**

Since the dominant forest cover of the Brittany Triangle plateau and foothill ridges is comprised of extensive Lodgepole pine type, considerable sampling was done. It is also sometimes called "*Chilcotin pine*" forest (MOF 1983). In our surveys, I discovered that the Brittany pine forest complex has an incredible diversity in structure, age classes and composition. Site characteristics were dynamic, involving multiple variations caused by slope, aspect, age class, extensive wildfire history, and recent mountain pine beetle die-off and associated blow-down. For example, sites of greatest kinnikinnick (*Arctostaphylos uva-ursi*) density were often found in openings in mature lodgepole pine forest on drier, more exposed ridges created by eskers. Although these sub-types should eventually be mapped, this was beyond the scope of our current study.

Two dominant ground plants, kinnikinnick and pinegrass (*Calamagrostis rubescens*) were identified as the most important potential foods in this habitat type. These were the most ubiquitous, occurring in moderate to high densities, although availability to wildlife varied from stand to stand. Lesser densities of shrub species important to bears included soopolallie (*Shepherdia canadensis*) and several species of huckleberry/blueberry (*Vaccinium* spp). These were both rated to have an overall low density. I found no sites with important root species for grizzly bears, although sweetvetch (*Hedysarum* spp.) is found in other areas in association with lodgepole pine forests (Hamer and Herrero 1983). Ant colonies (*Hymenoptera:Formicidae*) were commonly available in this dry habitat type in stumps, ground logs and under larger stones. Field sign showed some use by bears.

In some instances access to these various foods by bears and wild horses appeared restricted by extensive blow-down. It was noted, for example, that wild horses were creating new trails to bypass recent blow-down that blocked older trails.

It was difficult to assess the importance of the grassland understory of these pine forests to bears and feral horses given the large extent of this habitat and the difficulty in detecting bear and horse cropping of understory grass at the best of times. As noted, the main graminoid species was the pinegrass. It is important forage for livestock in areas where pine dominates the cover (Campbell *et al*. 1969). The critical growth period in the Cariboo is in July and it may have a productive increase in response to canopy removal. For cattle, its' palatability has been noted to drop after mid-June and nutritional values decrease after mid-July (MOF 1983). A study just north of the Brittany suggests that wild horses make some use of pinegrass in forest habitats of pine and aspen (Storrar *et al*. 1977).

Limited evidence (winter scats piles) suggested that wild horses in the Brittany were utilizing pine grass areas in pine forest for winter foraging; although the large number of scat piles suggested the open grass and sedge meadows surrounded by pine forest appeared to be the primary winter feeding sites. I suspect pinegrass may be a survival food for horses during periods of deep snow. Deep snow would make cratering for grasses and sedges in the open meadows more difficult than the adjacent pine forests, where shallower snow would occur because of the canopy cover.

Further study is needed to ascertain whether bears are using pinegrass in the pine forests in the spring in association with their feeding on the over-wintered berries of kinnikinnick.
Wild rye (*Elymus* spp.) is another species that warrants investigation in our study area as a possible spring food for bears and winter food for wild horses. The common species for southern B.C. is blue wild rye grass (*Elymus glaucus*) [Angove and Bancroft 1983]. However, Sopuk *et al*. (1998) did not report it in their study area at nearby Taseko. A similar species, hairy wild rye (*Elymus innovatus*) appears to replace pinegrass in lodgepole pine forests in the Rockies (see

Hubbard 1969, Holland and Coen 1982). Hairy wild rye is a known spring food for grizzly bears in the Rockies (Hamer and Herrero 1983); as well as an important winter food for wild horses in pine forests in the Alberta foothills (Salter and Hudson 1980).

Besides serving as winter foraging sites, the pine forests appear to provide a number of other important habitat and behavioural functions for wild horse ecology. Winter dropping piles were common in pine forests along the edges of meadow-type feeding habitat such as along Brittany Creek. This suggests use as sheltered bedding and resting sites in winter, especially during inclement weather. The pine forests were also noted to serve as horse escape cover from intruders infringing on the smaller open meadow feeding habitats. Four times during our study, a herd of wild horses fled from open meadows into pine forests and disappeared on a horse trail, when disturbed by our study team. The pine forests also provide travel zones between the numerous meadow associations. A large and intricate network of well-defined horse trails traverses the pine forests of the plateau. Remote cameras set up along some of these trails provided some information on horse travel. During winter, reduced snow depths within the pine forests would result in energy savings for travel by wild horses between primary meadow sites used for feeding.

Based on preliminary observations of food resources, feeding and bedding sign, escape cover value and travel importance for wild horses, I rated the Brittany pine forests to have a high all-season potential for the wild horses.

A similar value was derived for black and grizzly bears. Spring foraging values were higher than I expected, deserving a high rating. As noted in the next section, feeding on over-wintered kinnikinnick mast accounts for approximately half of the spring diet observed in bears. Most of this fruit appears to occur in the pine forests. As stated earlier, pinegrass may be another plant utilized by bears in the spring. In the summer and fall, huckleberry and soopolallie shrubfields and a new crop of kinnikinnick berries add to a viable berry resource. Soopolallie was observed to be the main bear food. For these seasons, the pine forests were rated to have a moderate potential for bears during the berry season.

Extensive logging plans are planned in the near future for mature stands of this pine forest type to the north and west of Nuntsi Provincial Park (Riverside – Cariboo Woodlands Forest Development Plan, Forest License A54417, Brittany 2001).

b. **Douglas fir-aspen parkland-grass & Riverine "breaks" grasslands-bluebunch wheatgrass**

These two types occur in association with each other as well as having some mixes of the Lodgepole pine type. Extensive areas occur along Elkin Creek and Elkin-Vedan Lakes as well as along the "*breaks*" and valley slopes of the Chilko and Taseko Rivers. Limited ground transects were done, along Elkin Creek and the south side of the Chilko River.

Grasses, overall, were of moderate to high density and in the flush of "*green-up*" during June surveys. Bluebunch wheatgrass (*Agropyron spicatum*) is of moderate-high density on the drier slopes, while patches of bluegrass (*Poa* spp.) and other species were common. There were also small isolated patches of soopolallie shrubfields and kinnikinnick in association with more wooded sections of lodgepole pine. However, these bear foods were of overall trace-low density when compared to the lodgepole pine forests on the plateau. Some of the more open grasslands on the east side of Elkin-Vedan Lakes were also noted to have trace densities of arrow-leaved balsamroot (*Balsamorhiza sagittata*), a known bear food in the Taseko (Sopuck et al. 1997). I also recorded one small patch of sweetvetch (*Hedysarum* spp.) – an important grizzly bear root food wherever it occurs.

Some spring bear use was evident by both species. Besides a number of grizzly bear and black bear tracks (and scats) noted in June, we also observed a large adult grizzly bear on June 15. The bear was grazing in the Douglas fir-aspen parkland-grass type near Elkin Lake. The access road along the east side of Elkin Valley would be a disturbance factor for warier bears.

Horse use of this type in Elkin Creek was noted to be very low but this would appear to be related to a combination of human disturbance and a recent extirpation program. A few winter droppings were noted on wheatgrass slopes in lower Elkin Creek (w. side) while a well-worn trail with fresh use was also evident. Any apparent feral horse use in semi-open grasslands in Elkin Creek was at least 2 km from the nearest active road but on the plateau, horses used meadows and pine forest along the primitive road.

Domestic cattle were making high use of these grassland types where they adjoin private land wet meadows in Elkin Creek.

Overall, I rated this type to have a high spring (early green vegetation season) capability for both bear species, but a low summer value. Since this type fringes all of the valley salmon-bearing waterways, it has some fall importance for travel, bedding and shelter in association with salmon feeding by bears. For horses, it would have high year-round value beyond an estimated 0.5 km zone of road disturbance.

c. **White spruce-horsetail**

This type is important to both bear species because common horsetail (*Equisetum arvense*) is a well-known black bear and grizzly bear food wherever it occurs (Herrero 1985). I found only microhabitats of this type, such as narrow fringes along some lakes and small creeks, including Elkin Creek, Chaunigan Creek and Brittany Creek. This habitat was rated to have a high spring-early summer potential but, overall, was restricted in extent.

d. **Wet meadow/shrubfield/sedge complex & Dry meadow/shrubfield/grass complex**

Both Wet and Dry meadow complexes were numerous on the plateau, comprising a significant habitat interspersed throughout the pine forests. These meadow complexes occur in a variety of associations: large and small stream riparian zones, marsh zones around permanent lakes, and drainage-fed lake/pond depressions that seasonally dry up. Many of the important Dry meadow associations appear to be old lake/pond beds that have mostly dried up to create large and small glades that provide for a rich diversity of plant associations.

Size and plant associations vary considerably from meadow to meadow. Overall, sedges (*Carex* spp.) and grasses were of high density in these meadows, with some rushes and horsetail occurring. In the small drainage seasonal lakebed meadows, sedges occupied the wetter bottom areas while grasses formed fringe zones. Some of the drier meadow lakebed associations have extensive patches of common dandelion, an invasive species but an important known spring food for both bear species, which eat the flower.

Dominant grasses would appear to include northern reed grass (*Calamagrostis inexpansa*) and Altai fescue (*Festuca altaica*). Shrubfields often but not always occurred in association with the meadows, with willow (*Salix* spp.) and bog birch (*Betula glandulosa*) common.

Based on field observations combined with a background literature review of wild horse diet, I ranked these complexes to have high all-season value for wild horses (and moose) and a high spring-early summer value for both bear species. In all of our transects, with the exception of areas in the "*zone of disturbance*" along Elkin Creek, spring-summer and winter horse use appeared high of grasses and sedges in these meadow types. Horse trails were noted to lead to the most remote, isolated meadows where both horse and bear feeding activity would be readily observed. Horses also used seasonally dried lakebeds in these meadow types for dirt wallows for rolling. The meadows with shrubfields are also important seasonal habitat for moose and other ungulates and thus are of high value to the wolves, which feed on these animals. In our opinion, it is because of these extensive meadow complexes in association with forested habitats that the Rainshadow Wild Horse Ecosystem is so biologically productive.

e. **Riparian salmon-spawning/migration areas**

More detailed information on salmon distribution and abundance is provided in our section on salmon. This information indicates that salmon habitats in the study area are quite extensive and very significant.

I carried out limited surveys to observe salmon areas during the spawning season, including bear and wolf use of the fish. A well-rutted grizzly bear trail with several well-used mark trees was mapped along the edge of Elkin Creek, in the lower canyon. I was unable to survey this area during the Chinook salmon spawning period in September but this should be done. Many grizzly bears have been observed in the upper reaches of the Chilko River during the salmon spawning season (Barry Huber, DFO, pers. comm.). I suspect that salmon carcass feeding by carnivores takes place along the entire Chilko and Taseko River corridors during the fall.

The Douglas fir-aspen parkland-grass & Riverine "breaks" grasslands-bluebunch wheatgrass habitat types along the Chilko River are potential spring feeding areas for bears. Annually, about 1.7 million Sockeye salmon as well as some Coho and Chinook migrate up the river and many Sockeye and Chinook spawn below the outlet of Chilko Lake. This provides a rich food source for bears, wolves and other species resident in the Brittany Triangle. (Photo by W. McCrory).

f. **Disturbed (road, dwelling, clearcut, etc.)**

Disturbance regimes are currently low, but a GIS analysis should be made of human developments including the secondary road-primitive trail system and the proposed logging roads/clearcuts. A system of secondary roads occurs around the periphery of the Brittany Triangle. The Nemaiah access road crosses the Taseko River above its confluence with Elkin Creek. A secondary road occurs on the west side between Chilko Lake, Tsuniah Lake and Henry's Crossing on the Chilko River.

I observed that human disturbance appears to be a factor in some habitat use. In the spring, summer and fall, I noted that the wild horse bands appeared to be avoiding meadow associations with higher levels of human activity. For example, no spring to summer use was noted in the suitable habitat meadows at our research base, Far Meadow, even though I was within 0.5 km of wild meadows being heavily utilized by both horse bands. More noteworthy, with the exception of one lone stallion (apparently wild), the extensive bottomland wet meadows along Elkin Creek (on private lands) received no horse use despite its high capability. This area did receive high cattle use. I believe the limited horse use is a result of surviving horse herds avoiding areas more frequented by humans as well as the horse herds in this area being shot off about 10 years ago. Noteworthy, however, was that 2 km to the north of this area, a well-rutted and active horse trail descends towards the Taseko River.

3.2.2 Grizzly and black bears

Currently, the grizzly bear is considered to be a species at risk within the Cariboo-Chilcotin. The Cariboo-Chilcotin Land Use Plan (1994) states: "*Habitat requirements for many species at risk are not well defined because of their low numbers, which constrain inventory and limit habitat use studies of these species. Continued efforts to inventory species at risk and identify their habitat requirements, if combined with appropriate management actions, will reduce the concern for these species.*" Since this 1994 report, there have been no grizzly or black bear habitat studies and no formulation of scientifically adequate management guidelines. At the same time, extensive roading and clearcutting has continued unabated in the Chilcotin.

3.2.2.1 Results of habitat surveys

As noted earlier, numerous Wet/Dry shrubfield meadow types (often associated with lakes and marshes) intersperse the generally dry lodgepole pine landscape adding significant habitat diversity for grizzly and black bears.

During the course of the study, we observed one grizzly bear and one black bear (brown-phase) as well as evidence of 2-3 other individuals of both species. Remote cameras detected two different black bears. Bear use appeared well dispersed across the landscape because of the availability of seasonal bear foods throughout the mix of habitat types.

Surveys along Elkin Creek, a salmon-spawning stream (prior to the August spawning period) suggested grizzly bears make high use of the salmon resource. Deeply rutted bear trails and five well-used grizzly bear mark trees were located along the streamside zone.

In addition, the two major rivers (Chilko and Taseko), which form the borders of the Triangle, both have major salmon runs which would provide for both up-stream migration and post-spawning carcass feeding opportunities for grizzly and black bears, wolves and other flesh-eating carnivores. Records obtained from Fisheries and Oceans Canada for the year 2000 months of August, September, and October indicate major grizzly bear activity on the Chilko lake and river system as far north as Henry’s Crossing. This clearly indicates the need for connectivity protection for the entire Brittany Triangle southward to Ts’il?os Park.

The availability of moderate densities of moose, mule deer, and feral horses adds another food-source component that should not be under-rated for opportunistic predation or carcass feeding by bears, wolves and other carnivores.

Overall, the habitat values for grizzly and black bears were rated high for the green vegetation (spring and early summer) season and high for the late summer-fall berry and salmon-feeding period. The southwest side of the Rainshadow Wild Horse Ecosystem also appears to have some important subalpine/alpine grizzly habitat that warrants further study. This would include an evaluation of potential denning habitat for resident grizzlies. Generally, the limited road and other access and widespread forest cover provides for a large (155,000 hectare) core area of relatively undisturbed and isolated lodgepole pine plateau as ideal security habitat for grizzly bears and other wildlife. Adjacency to a prime coast range grizzly habitats at higher elevation (including Ts’il?os Provincial Park) is another important factor.

Grizzly bears in the Rainshadow Wild Horse Ecosystem at the periphery of the Chilcotin grasslands zone of extirpation and, combined with sub-populations in the Taseko and Chilko Lakes area, would act as an important buffer or source population for the region.

Our preliminary results suggest grizzly bears were making some use of all generalized habitats at lower elevations. This is similar to habitat surveys in the nearby Taseko area where widespread grizzly bear use was also noted, including the lowland floodplains and sedge-willow wetlands (Sopuk *et al*. 1998).

I did not sample higher elevation sites at the southern end of the study area where I would expect high quality feeding habitats for grizzly bears as well as denning sites (which normally den at higher elevations than black bears). At Taseko, Sopuk *et al*. (1998) found most of the grizzly sign at higher elevations in the Engelmann spruce – subalpine fir zone (67%) and the alpine (10%). In the Rainshadow Wild Horse Ecosystem, I would expect the higher elevation areas to have the potential for digging sites for western spring beauty or "potato" (*Claytonia lanceolata*) and feeding areas for such green plants as cow-parsnip. In the Taseko, Sopuk *et al.* (1998) found that grizzly bears utilized nuts of whitebark pine (*Pinus albicalus*), either by digging middens built by red squirrels or climbing the trees. They also fed on arrow-leaved balsamroot and hoary marmot (*Marmota caligata*).

Use of low elevation habitats - green vegetation season foods

During June field surveys, the following evidence of grizzly use was detected:

-1 large adult grizzly feeding on grasses along Elkin Lake.
-1 possible grizzly track along the w. slopes of Elkin Creek.
-8 scats associated with positively identified grizzly tracks.
-grizzly mother and young tracks @ 'alkali' lake near Far Meadow research station.

I documented a total of 44 bear scats (Table 1) during the green vegetation period in spring and early summer. Of these, 23 could not be identified to species, while 8 were attributed to grizzlies and 13 to black bears. Although fewer grizzly scat had kinnikinnick berries I attributed this to a sampling bias. For purposes of convenience, I lumped the two species and assumed they were utilizing the same foods. The results indicated that about an equal amount of green plants (grasses/sedges) and over-wintered kinnikinnick (bearberry) fruits were being consumed. Selection by bears for this over-wintered berry is not surprising since the red fruits increase their energy value over the winter. In Nahanni National Park, kinnikinnick berries were reported to increase their sugar content over the winter from 16.7% to 33.4% (D.Henry as reported in Herrero and Hamer 1983). In Banff National Park, grizzly bears were found to eat over-wintered fruits of kinnikinnick in the spring (Hamer and Herrero 1983). Many of the spring berry scats were noted on horse trails or old roads through the Lodgepole pine forest type where kinnikinnick fruits were fairly abundant. This suggested feeding activity in this habitat type.

About eight of the scats were detected in meadows where horses were also active. In one moist meadow, I noted tracks of a grizzly (and possible young) associated with feeding on dandelion flowers, sedges and mice. I saw no evidence of feeding on cow-parsnip, although several scats appeared to have remains of horsetail.

Other feeding sign included scratching and routings for ants, stones over-turned for ants, two trees that indicated some feeding on cambium, and one small trench dug in a meadow by a grizzly bear searching for a mouse or vole.

Berry season

In August, one adult grizzly was sighted near the Far Meadows research station and several tracks were noted. At this time, I also recorded 13 bear scats of which 2 were attributed to grizzlies and 6 to black bears. The majority of scats (n = 10) were comprised of soopolallie fruits, while 2 had kinnikinnick fruits and one was comprised of berries and green plants. Soopolallie was observed to have a low-moderate productivity and some fruits still remained on isolated shrubs in late September. This limited data suggests both bear species were selecting for soopolallie at this time of year when frequenting habitats on the plateau; although salmon is likely the key food for most bears which would I would assume would travel to the salmon-spawning areas.

Feeding on cambium was uncommon. I noted 4 cambium-fed trees along a grizzly trail along lower Elkin Creek (3 white spruce and 1 lodgepole pine - Table 2).

Table 1. Grizzly and black bear scat/dietary observations, Brittany Triangle grizzly study, June 15-24 and August 20-27, 2001. Gb = grizzly bear. Bb = black bear.

Date	Type of Scat	**Location/Transect**	**UTM Co-ordinates**	**Estimated age, contents and Comments**
SPRING SCATS				
June 16	Bb or Gb	Cabin-Horse meadow to n.w. (B11-12)		2 scat: kinnikinnick berries, 1 week. Green vegetation, 1 week
June 17	Bb or Gb	Transect w. of Elkin Cr. (B21-22)		kinnikinnick berries, <4 days
June 17	Bb or Gb	Transect w. of Elkin Cr. (B21-22)		kinnikinnick berries, <4 days
June 17	Bb or Gb	Transect w. of Elkin Cr. (B22-23), D fir.		kinnikinnick berries, <2 days
June 17	Bb or Gb	Transect w. of Elkin Cr. (B22-23), D fir parkland		kinnikinnick berries, 2 weeks
June 17	Bb or Gb	W. slopes of Elkin Cr.		kinnikinnick berries, 1 week
June 17	Bb or Gb	W. slopes of Elkin Cr.		kinnikinnick berries, 1 week
June 17	Bb or Gb	W. slopes of Elkin Cr.		kinnikinnick berries, 1 week
June 17	Bb or Gb	W. slopes of Elkin Cr.		kinnikinnick berries, 1 week
June 17	Bb or Gb	W. slopes of Elkin Cr.		Green vegetation, 1 –2 days
June 17	Bb or Gb	W. slopes of Elkin Cr., road		Green vegetation, 1 –2 days

June 19	Bb or Gb	Old rd., near "Horse Meadow"		kinnikinnick berries, 1 month
June 21, WM	Gb, B44-45	Meadows, Old rd. near "Horse Meadow" to Quicksand Lake-Lost Wayne Lake		4 green vegn. scats. <1 week. 1 @ e. end has Gb tr., 40 dandelion plants fed. Bb & Gb tracks along lake. 1 scat is grasses, 2 from small bears @ w. end. 1 fresh Gb dig for microtines in meadow
June 21, WM	Bb or Gb, B45-48	Meadows area to Far Meadows Lake		-1 green vegn. scat, last year. -1 green vegn. scat, 3 days. 90 % grasses, 10% kinnikinnick berries @ e. end of Far Meadows Lake
June 21; MW/DW	Bb	Lower Nuntsi Cr.; B49-B50		4 green vegn. scats <1month, all within 5 m
June 21; MW/DW	Bb	Lower Nuntsi Cr.; B52-B53		Green vegn. < 1 month
June 21; MW/DW	Bb	Lower Nuntsi Cr.; B53-B54; in timber just s. of meadow		Green vegn. < 1 month
June 21; MW/DW	Bb	Lower Nuntsi Cr.; B54-B55, in dandelion mead.		-2 kinnikinnick berries & vegn. >1 month -1 kinnikinnick berries vegn. < 1 month -1 vegn. and Bb hair< 2 weeks
June 21; MW/DW	Bb	Lower Nuntsi Cr.; B55-B56, 0.5 km n. of meadow.		Green vegn. < 1 month
June 22	Bb or Gb	Meadow with horses, n.e. of Far Meadow		2 kinnikinnick berries. 1-2 days old. Were on horse trail between 2 meadows, since June 18.
Aug 22	Bb or Gb	On trail between e. and w. double meadow to n.w. of Far Meadow		1 kinnikinnick berries; mod. large spring scat
Aug 22	Bb or Gb	On trail to n. from vicinity of 1st meadow s. of road and w. of Far Meadow		1 kinnikinnick berries; mod. large spring scat
Aug 25	Bb or Gb	E. side of Elkin Cr. near top of willow meadow		2 mod. large; 1 sedge/grass, 1 kinnikinnick berries from spring
Aug 25	Assumed Bb	Chaunigan Cr. on plateau above Elkin valley		2 kinnikinnick berries from spring; in vicinity of Bb rub tree

Aug 25	Bb or Gb	Df parklands just above Bob's cabin to the w.		2 kinnikinnick berries from spring
TOTAL	**Bb or Gb: 17** **6** **Gb: 0** **8** **Bb: 3** **8** **2** **44**	-20 kinnik. ber. -22 green plants -2 both foods		-kinnikinnick berries(spring) -green plants -kinnikinnick berries(spring) -green plants -kinnikinnick berries(spring) -green plants -kinnik. berries & green plants
BERRY SEASON				
June 15	Bb or Gb	Cabin-Brit. rd. w. (B3-4)		kinnikinnick berries, last fall
June 15	Bb or Gb	Cabin-Brit. rd. w. (B5-6)		kinnikinnick berries, last fall
June 21;	Bb or Gb	Lower Nuntsi Cr., B53-B54		Vegn. and berry; last fall; immediate vicinity of June 21 green vegn.scat.
Aug 20	Bb	On road 2 km w. of Far Meadow		3 Soopolallie; < 2 weeks
Aug 20	Bb or Gb	On road 1.5 km w. of Far Meadow		2 Soopolallie; 1 small < 2 weeks, 1 mod. large < 10 days
Aug 20	Bb	On trail to mark tree vicinity 3rd meadow w. of Far Meadow		2 Soopolallie; < 2 weeks
Aug 20	Gb?	In 3rd meadow w. of Far Meadow		2 Soopolallie; 1 small< 2 weeks, 1 mod. large < 10 days; Gb and wolf track in meadow
Aug 24	Assumed Bb	5 m off trap line trail w. side of Chaunigan Cr. 1 km n. of lodge road		1 Soopolallie w/tr. ants; mod. large < 4 days; Bb hair present on scratch tree in vicinity
Total	**Bb or Gb: 2** **2** **1** **Gb: 2** **Bb: 6** **13**	-2 kinnik. ber. -10 soop. ber. -1 ber. & vegn.		-kinnikinnick berries (fall) -soopolallie -green vegn. & berry -soopolallie -soopolallie

Trees used by bears

Bears use trees for a variety of purposes other than the more obvious uses for shelter as bedding sites and for escape from other bears. One of the most common usages is for marking and rubbing. Frequent rubbing behaviour at select “mark” trees is believed to serve a signpost function so that an individual bear can leave it’s body scent to let other bears know it is in the area, as well as to detect the presence of other bears in the area (McCrory *et al.* 2001). During field surveys we identified a total of 18 bear mark trees ranging in species from white spruce, lodgepole pine and Douglas fir (Table 2). There were generally located along wildlife trails, old roads and other trails throughout the study area. The largest concentration was a cluster of four within 100 m of each other along a well-rutted bear trail along Elkin Creek. These were coated with grizzly bear. Elkin Creek is a salmon creek, which is known to attract grizzly bears.

Of the 18 mark trees, hair samples on trees indicated that 10 were used primarily by grizzly bears, 2 by black bears and 2 by both bear species. I was unsure which species used the other 4. Bear hair coated in sap as well as wear and tear on some of the larger, older trees suggested they had been used for decades. The largest was a Douglas fir estimated to be about 800 years old.

I also noted 7 trees, which had been clawed, and/or chewed, but which did not appear to be mark trees.

This number of active bear trees scattered throughout the ecosystem suggests a fair population of both bear species utilizing the habitats for feeding and travel.

Table 2. Inventory of grizzly and black bear trees in the Rainshadow Wild Horse Ecosystem study area, 2001. This includes bear mark trees; bear scratch or clawed trees and cambium-fed trees. Gb = grizzly bear. Bb = black bear.

Name &Date	Location	GPS or UTM Co-ordinates	Tree Species/ Bear species	Est. DBH (cm)	Degree of Use and Comments
MARK TREES					
June 15	On road to Brittany Cr., 1 km from Far Meadow		Pine, Gb	15 cm	Bark was stripped on east side at 2 m height; no claw marks; light use; Gb hairs collected.
June 17	On road to Nuntsi Cr. near Big Meadow	N51 42.737’ W123 49.246’	Pine, Gb	30 cm	Classic bear tree and scuff marks; indicating several years of use. Gb hair removed. Remote camera set-up.
June 17	Douglas fir parkland, west ridge of lower Elkin Creek	N51 41.978’ W123 45.071’	Douglas fir, Gb or Bb	70 cm 800? years	Claw marks obvious. Claw and scratch marks continuing well above ground level; possibly used as an escape tree by cubs as well. No hair evident but classed as mark tree.

June 19	Lower Elkin Creek on river bottom. East side	N51 40.549' W123 46.273'	Spruce, Gb	15 cm	Classic bear tree and scuff marks; fishing site; Gb hair removed; shows many years of use.
June 19	Lower Elkin Creek on river bottom. East side	N51 40.549' W123 46.273'	Spruce, Gb	20 cm	Classic bear tree and scuff marks; fishing site; Gb hair removed; shows many years of use. 50 meters downstream of above-mentioned site
June 19	Lower Elkin Creek on river bottom	N51 40.789' W123 45.554'	Spruce, Gb	28 cm	Classic bear tree and scuff marks; fishing site; Gb hair removed; shows years of use
June 19	Lower Elkin Creek on river bottom	N51 40.549' W123 46.273'	Spruce, Gb	5 cm	Same general vicinity as previous but across river and 100 m downstream; Gb hair removed.
June 21	Lower Nuntsi Creek trail; near Far Meadow		Spruce, Gb or Bb	25 cm	Brown bear hair removed. 200 m n. of cabin road; west side of creek.
June 21	N. shore of Lake 2, margin trail		Pine, Gb or Bb	15 cm	Low use; brown bear hair present
Aug 20	Third meadow, 2 km w. of Far Meadow road	N 51 43.979' W123 53.652'	Pine, Gb	15 cm	The rub tree is on a wildlife trail that leaves but parallels the road about 2 km w. of Far Meadow; recent light Gb hair on the tree and tracks in meadow to the w.
Aug 22	On road to Brit. Cr. about 4 km w. of Far Meadow	N 51 44.186' W123 55.249'	Pine, Bb	6 cm	Bb hair present; scratched and peeled; mod. open, uneven aged timber
Aug 22	On road at Brit. Cr. meadow	N 51 44.259' W123 58.156'	Pine, Gb	17 cm	Gb hair present; moderate use; open meadow to n.e., mod. dense Lp (15-20 yr.) to s.w.
Aug 24	W side of Chaunigan Cr. 3.5 km n. of Lodge rd. on trap line ATV trail	B75-B76	Spruce, Gb & Bb Pine, Bb	30 cm 34 cm	2 trees; 1-old, long-used by Gb (20 years) marked to nearly 3 m above the ground but recent use apparently only by Bb; fresh brown Bb hair present, 2-50 m n. of the above, brown Bb hair present
Aug 25	East side of Elkin Cr. and meadow n. of Bob's cabin	N 51 40.135' W123 47.277'	Spruce, Gb & Bb	11cm	Bb and Gb hair present; light use as recent as May/June
Aug 26	North shore of Cheewit Lake	N 51 43.005' W123 52.785'	Pine, Gb Pine Gb or Bb	20.5 cm 25 cm	2 trees; 1-Gb hair present; 2-20 m e. of first tree

Aug 27	Near spring just above Bob's cabin on road	N 51 40.636' W123 47.308'	Spruce, Gb	4.5 cm	Long use; top bit off at 2 m above ground; scratched and chewed; high amount of fresh Gb hair present; Lp, spruce, aspen riparian. Set up camera in Sept. but no grizz. photos
SCRATCHED -CHEWED TREES					
June 19	Rd. near Far Meadows		Pine	12 cm	Claw marks obvious. Tore off bark at 2 meters height.
June 21	N. Lakeshore margin trail;	B58-B59	Pine	15 cm	Claw marks apparent. Tore off bark at 2 meters height.
Aug 24	W. side of Chaunigan Cr. 1 km n. of Lodge road on trap line ATV trail	B73-B74	Pine	10 cm	Gb or Bb claw marks present; spacing mod. Large, scratched this year but no rubbing apparent; fresh scat observed in vicinity
Aug 24	W. side of Chaunigan Cr. 2 km n. of Lodge road on trap line ATV trail	B74-B75	Pine	10 cm	2 trees along trap line trail upslope of riparian corridor in very open timber; inadvertent Bb hair present
Aug 24	W side of Chaunigan Cr. 3.5 km n. of Lodge road on trap line ATV trail	B75-B76	Pine	10 cm	Vicinity of last Aug. 24 rub tree entry; brown Bb hair present; top was bitten off 2 m above the ground
Aug 25	On plateau above Elkin Lk. N side of Chaunigan Cr.		Pine	5 cm	Inadvertent Bb hair present; tree was scratched and the top torn off; vicinity beaver pond and grass-sedge meadow
CAMBIUM-FED TREES					
June 19	Lower Elkin Creek		Spruce	22cm	3 fed on last year, along bear trail along creek
June 21	Meadow w. of "Horse Meadow", east rd.		LpPine	22 cm	Cambium stripped from base 4-5 years ago at edge of meadow.
Others – see field notes					

3.2.2.2 Grizzly Bear numbers

During our field surveys we documented evidence of at least 3-4 grizzly bears and 3-4 black bears in our study area, which represents about 1/10 or less of the total area of the Rainshadow Wild Horse Ecosystem. We detected 2 different black bears at remote camera sites, but no grizzly bears were photographed despite recent grizzly bear hair on 4 mark trees, which we monitored with remote cameras. One of the problems is that our main monitoring period was in late summer and fall when many of the grizzlies were likely at the salmon-spawning areas outside of our study area.

Although it is not possible to accurately derive a population estimate from our limited database, it does suggest a fairly healthy wildlife population supported by a rich, mix of productive habitats largely free of human disturbances.

Using B.C. Wildlife Branch estimates of 1 bear/140 to 160 km^2, a crude estimate of 10 - 12 resident grizzlies can be assumed for the Rainshadow Wild Horse Ecosystem. One can assume that late summer-fall concentrations of grizzly bears would be much higher due to the high number of spawning salmon.

In 2001, three grizzlies were destroyed at Alexis Creek in 2001 for killing calves (Chris Schmidt, B.C. Wildlife Branch, Alexis Creek, B.C. pers. comm. to Dave Williams). This is a high control mortality considering that grizzly bears have been largely extirpated to the east.

I made no attempt to estimate black bear numbers but they appear to be higher than grizzlies.

3.2.3 Grey wolves

As noted in the next section, wolves were one of the more common species photographed at our remote camera sites. Sightings, vocalizations (howls), frequency of fresh scats and remote camera photos suggest at least one wolf pack is resident in Nuntsi Park. In August, one camera site recorded the movement of about 11 individuals, including 5-6 young of the year. This was near a grizzly bear mark tree about 2 km east of Far Meadow. Wolves were photographed 11 times moving along the various horse trails and access roads/trails, both at night and during the day. In several instances we recorded wolves sniffing at grizzly bear mark trees, but no wolf urination scent marking was noted. Most wolves appeared grey but one black was sighted on Sept. 3.

I postulate that the relatively high prey biomass of our study area (horses, moose and mule deer) combined with the lack of development, relative isolation from human activities, and excellent security cover provided by the extensive pine forests is a contributing factor to a healthy-appearing wolf population.

A crude estimate of home range size for an individual pack in the area is 250 – 400 km^2 (Dr. Paul Paquet, pers. comm.). In other words, Nuntsi Provincial Park (220 km^2) would protect about one wolf pack of 6 – 12 individuals. There might be 4 – 7 packs in the Brittany and up to 80 wolves.

3.2.4 Occurrence of other species – remote camera monitoring results

I used remote camera monitoring, tracking and direct observations to document the presence of other species in the study area. Each camera transposed the exact date and time directly on to each photo when an animal crossing the infrared beam took the image. The photos were stored separately while some were transferred to compact disc (CD) storage. All photo-records included location, species, individual identification, behaviour, date and time of detection (Appendix II, Cameras #1 to #9).

Our nine remote camera stations documented the following species in the study area: mountain lion, Canada lynx, grey wolf, coyote, red squirrel, moose, mule deer, feral horse and domestic cow (Table 3).

The cameras were aligned to detect the passage of larger mammals crossing an infrared beam. The beam was approximately 30 – 40 cm above ground level and thus missed smaller mammals such as wolverine, pine marten, snowshoe hare and fisher. Squirrels or other smaller creatures were photographed only when they were close enough to the transmitter to trigger an event.

All except one camera were set up in Nuntsi Park. Of the nine, five were set up along a road or trail at a grizzly bear mark tree and four were set up along a horse trail or combined horse, human or wildlife activity trail. One camera was set up in late June and the remainder in August or early September. The last camera was removed on October 13.

A total of 356 camera-nights triggered 85 events where one or more wildlife or wild horse photos were generated. The majority (209) of camera-nights were in September, with lesser numbers as follows: June (12), July (30), August (44) and October (61). I felt that more photographs should have been obtained during the spring period rather than during the very dry summer and early fall period. No cameras were destroyed by bears, wolves or other wildlife as has been documented in other research (McCrory 2002).

Of the 85 photo events, the highest numbers involved coyote (n = 15), moose (n = 15), mule deer (n = 13), wolf (n = 11), red squirrel (n = 9) and feral horse (n = 8). The horse photos documented both night and day time movements of single individuals or small groups moving along horse trails in pine forests. This merely verified that the horse bands do make periodic movements between the various meadows to graze and that darkness is not a constraint. Some data such as individual movements and daytime versus nighttime activity still needs to be analyzed.

Some cattle grazing allotments occur in the study area. At least 100 cattle graze seasonally along Elkin Creek, mostly on bottomlands in private ownership.

Table 3. Results of remote camera surveys, Rainshadow Wild Horse Ecosystem study area, 2001.

Species	**Total number of camera detections**	**Comments**
Grizzly bear	0	Some tracks near sites, but no bears recorded. Likely at salmon areas
Black bear	2	2 adults, one very large
Grey wolf	11	One pack of 11
Coyote	15	
Mountain lion	2	
Canada lynx	4	
Moose	15	
Mule deer	13	
White-tailed deer	0	
Feral horse	8	Movements on horse trails
Domestic cow	2	
Gray jay	1	
Red squirrel	9	
Ruffed grouse	3	

Canada lynx photographed by remote camera at night, traveling along a horse trail in Nuntsi Park. (Photo by W. McCrory and FONV).

3.3 ASSESSMENT OF FERAL HORSES

During field surveys, this species of introduced ungulate was found to be common as well as integrated into the ecosystem. However, because its' origins and conservation status were unclear and appeared to be controversial, I devoted a complete section of the report to a comprehensive background review.

3.3.1 First Nations Cultural Associations

The Xeni Gwetíin First Nations in the region still practice a horse culture and closely identify themselves with their horses. They conduct periodic roundups of the wild horses of the Rainshadow Wild Horse Ecosystem and train them for their own use. These horses represent both an economic and spiritual resource to the people. A main feature of their annual rodeo at nearby Nemaiah is a mountain race down which daredevil riders race at breakneck speed on horses specially trained to accomplish this difficult task. Some band members still hunt annually for wild game following historic trails in the Brittany Triangle. They ride domestic horses derived from domestic stock in the area (FONV 2001).

3.3.2 Results of field surveys

3.3.2.1 Estimated numbers and reproduction

Horse sightings, remote camera results and sign were all collated. Horse sign (droppings, etc.) was so ubiquitous that it was not always recorded. It was beyond the scope of this study to analyze in greater detail our individual sighting and movement data over the season for each horse group, but this should be done.

For our localized study area, we recorded a total of 25 - 27 horses, comprised of two separate horse bands: the Black Stallion Band and the Chestnut Stallion Band. These appeared to occupy much of the 21,898 ha area of Nuntsi Provincial Park. Occasionally, smaller numbers were observed. These may represent outlying subadult or other satellite groupings.

Horse distribution appeared spotty. Surveys between the Taseko River and Elkin Creek showed no sign of wild horses although network trails of previous occupation were evident towards Fish Lake. Approximately 10 years ago, wild horses in this area of the Brittany were deliberately shot out to make way for a cattle-grazing allotment for a local rancher (Lester Pierce, local trapper, pers. comm. June 2001).

Based on this limited data, I crudely estimated that 14 bands comprising about 140 – 200 horses could potentially be resident in the Brittany Triangle. If one were to examine the entire area strictly from the perspective of a wild horse preserve, the total Brittany area might meet minimum viable population goals from a genetics standpoint, while Nuntsi Park would be far too small to support anything that might be considered to be genetically viable over the long term should the horses, over time, become isolated to that protected enclave.

The B.C. Ministry of Forests at Alexis Creek, B.C. conducts annual aerial surveys of wild horses each February and indicates a total of about 400 horse in the Alexis Creek Forest Service District, including about 75 in the Brittany Triangle (Range Manager King Campbell, pers. comm. to Dave Williams).

Although horse data gathered from field sightings and remote cameras represent a small sample size and sample period, the results nonetheless gave us some preliminary estimate of numbers, herd composition, home range areas, and reproduction and foal survival. More detailed counts are recommended in the future.

During the June, August and September-early October survey period, two distinct bands (Black Stallion and Chestnut Stallion Bands) were consistently observed in similar adjoining, but generally separate, home ranges of Nuntsi Provincial Park. This definitely suggests the territoriality reported by others (Ryden 1978, Kirkpatrick 1994).

I did not accurately record age structure on a consistent basis. For the Chestnut Stallion Band, I was able to classify animals accurately on June 23, 2001. There was 1 stallion, 9 adult mares and 3 foals. The lack of subadults suggested a possible low survival rate; although allowances must be made for subadult males eventually being expelled from the band as well as live capture by the Xeni-Gwet'in that selects for younger-aged animals (Dave Williams pers. comm.).

Survival of young from spring to fall appeared high despite the documented presence of all large carnivores in the area. By September, the Chestnut Stallion Band still had 3 colts while the count in the Black Stallion Band increased from 2 in June to 4 in September. I could not account for this, other than the possibility of late foaling. In June, our remote cameras twice photographed a badly foundered bay mare with a healthy colt. I suspect this mare did not survive and I do not know what would have happened to her foal.

Of the total of about 25 animals, foals in the spring and fall accounted for 20 – 28% of the total number. This is similar to foaling rates reported in for Montgomery Pass Wild Horse Territory on the central California – Nevada border. Of a population of 162 individuals > 1 year old, there was an average of 9 yearlings, 8 two-year olds and 144 adults. These produced an average cohort of 33 foals annually (i.e. 17% of total).

Survival rate of foals in the Brittany appeared high when compared to the Montgomery Band, which had a foal loss of half by October (Turner *et al*. 1992). There, mountain lion predation on foals has been shown to regulate the population.

Reproductive age of Brittany horses is likely similar to that reported in other North American bands. Age of first foaling has been reported at 3-4 years (Keiper and Houpt. 1984) but more a recent review indicates 2-3 years, with females commonly producing foals in consecutive years (Garrott *et al*. 1991). The same authors also report that mares remain reproductively active throughout their lives with only a slight reduction in foaling in the oldest age classes. Males usually establish nucleus brood bands at 5-7 years (Keiper 1985; unpubl. data).

Table 4. Horse observations in Brittany Triangle study area during field surveys in June, August, September and October 2001. Does not include remote camera results.

Date	**Location & Obs.**	**Tot. #**	**Classification**	Comments
June 13	"Horse Meadows", 3 km east of Far Meadow (DW)	15		6:30 p.m. Fled from vehicle. 3 colts. One was grayish. May be same as on June 21.
June 15, June 22	Large Meadow west of North Trail (survey team)	11	Black Stallion Band 9 adults and 2 colts	Stallion is black with white star on forehead. Saw us hidden in bushes and ran back and forth; stallion snorts. Then ran off into woods. Bear scat in meadows as well. Same gp in same meadow on June 22. Fled. One fresh bear scat on horse trail
June 18	Trapper's Cabin Mead.	3	2 dark brown adult, 1 colt	Were bedded at edge of meadows. Spooked by vehicle @ 200 m
June 21	Lost Wayne meadow, s. of Far Meadow (WM)	13	Chestnut Stallion Band: 1 stallion, 9 adult mares, 3 colts. NB: no ylgs. or 2-yr. olds.	Stallion is black-chestnut. 4 black mares, 3 brown mares, 1 grey with brown-orange head, 1 grey-brown. Obs. for 1 hr., then ran away into woods as suspicious of me & Lucy the bear dog.
June 21	Horse meadow East of Far Meadows on road	8	Chestnut Stallion Band: 1 stallion, 2 ylgs. or 2 year olds, 1 foal, 4 mares.	Stallion is roan, 1 of the mares is a bay. Obs. for 30 mins.; took photos; spooked to eastern end of

	(MW)			meadow; then spooked onto horse trail in timber to SE.
June 22	Frozen Bob's ranch, Elkin Cr. (DW)	1	1 stallion?	"Old recluse". Been there for a few years.
Aug 22	North Tr., w. meadow of Double meadow 2 km n.w. of Far Meadow (DW & MW)	13	Black Stallion Band: Brown, Bay, Gray, and Black w/wht spot on forehead observed; the latter mare believed to be the lead mare	Ran off on approach; observed this band about 6 km n. from the air on Aug 24
Aug 23	Lost Wayne meadow (DW & MW)	13	Chestnut Stallion Band: 3 colts-1 brown, 2 roan; 1 yearling-brown; 8 mares-1 brown, 4 black, 2 roan, 1 bay-the lead mare	Observed for about 30 minutes undetected; horses became attentive and nervous when we departed in full view but did not run-off
Aug 26	W. meadow of North Tr. Double meadow (MW)	12	Black Stallion Band: 7 mares-bay lead mare, gray, black w/white star on forehead, 4 dark brown, 4 colts	13 horses were present in this band; foundered lead mare (remote camera photos) is apparently missing and 4 colts now present in band.
Sept. 18	Near Alkali Lk., trail to Lost Wayne Mead. (DW)	3+	3 black-brown individuals	
Sept. 23	Horse Meadow (DW)	12?	Chestnut Stallion Band: 1 stal., 1 bay mare, 4 dark-br. mares, 1 black lead mare, 2? roan mares, 3 colts	Commonly see this band here
Oct. 8	Tiernan N. Mead. 3 k n.w. of Far Mead. (DW)	11	Black Stallion Band	Bay mare appears to be lead mare
Oct. 13	Near Indian Summer Mead. (DW)	Band	Not i.d.	Edge of swamp
March 2002	Between Far Mead. & Trapper's Meadow		Chestnut Stallion Band: **Captured**: 1 last year's colt, 2 mares, 1 branded gelding	Reported to DW. Captured by Xeni-Gwet'in for domestic use. Available for blood tests for Colonial Spanish horse genes. Caught in home territory.

3.3.2.2 Colouration

The 25 - 28 or more horses we observed in the study area came in many colours. This is indicative of the early Spanish influence (Sponenberg 1999). Blacks, roans, grays, chestnuts, buckskin were some of the colour types we observed. Adult horses generally appeared on average, fairly large. While more sampling is needed, there appeared to be a higher proportion of black and black based colour, which is also consistent with a Spanish origin (Sponenberg 1999).

As well, the black lead stallion was noted in June to have an unusually long mane and tail, which is also indicative of possible Spanish influence (Sponenberg 1999).

Colouration needs to be more carefully analyzed.

3.3.2.3 Social structure

When compared to the general solitary or loose social behaviour of the grizzly and black bear, moose and mule deer inhabitants of the Brittany Triangle, the wild equids have social structures as complex as grey wolves that co-habit the same wilderness.

Our limited field observations of the two localized bands demonstrate these local wild horses exhibit the same traditional social structure of feral equids elsewhere in North America. The basic herd unit is a nucleus brood band with one “guard” stud stallion, 6-10 breeding-age mares and their dependent offspring. [Some research indicates that the brood band stallion does not sire the 1/3 of foals in feral horses (Bowling and Touchberry 1990)].

Limited observations also suggest other social grouping described by Keiper (1976) including lone stallions (“outcast”) and non-reproductive mixed-sex bands comprised of a number of males and females. The lone horse that frequents Elkin Creek would appear to fit this category, although there is some suggestion this could also be an escaped domestic gelding.

3.3.2.4 Seasonal diet and habitat preferences

Unlike our bear surveys, our horse survey results were more observational in nature. I made no effort to systematically quantify habitat use, such as counting numbers of scats. However, our generalized observations of ubiquitous horse sign was such that I was lead to tentatively conclude that wild horses were a dominant ungulate in the study area, while not appearing over-populated.

As noted previously, evidence of horse use (droppings, tracks, and cropping) was most abundant from all seasons in the numerous meadow-type openings within the Lodgepole pine forests. The most used habitat types were the Wet meadow/sedge/shrubfield and Dry meadow/grass/shrubfield complexes. As will be noted, a large labyrinth of well-rutted horse trails connects all of these. However, signs (droppings) of some winter feeding were also noted in the Lodgepole pine-kinnikinnick-pinegrass type. The limited horse use noted of Douglas fir-aspen parkland-grass type and Riverine “breaks” grasslands-bluebunch wheatgrass type may have been the result of the low number of sample transects, as well proximity of our sample sites to human disturbance and a recent horse eradication area.

In all of our transects, with the exception of areas in the “zone of disturbance” along Elkin Creek, spring-summer and winter horse use appeared high of grasses and sedges. Our limited field observations are consistent with wild horse diet observations reported elsewhere. Wild horses are considered primarily grazers (Hanley 1982). I assumed that the winter browsing noted on willow shrubs was from moose and not from wild horses. A wild horse ecology study in the Chilcotin suggested that horses are primarily winter grazers while moose are winter browsers (Storrar *et al.* 1977).

There was some indication in our study area that sedges were being preferred over grasses in the spring. I noted several meadows where the moist sedge areas were more heavily cropped than the adjacent grass fringes.

Storrar *et al*. (1977) found that wild horse foraging in the Chilcotin was positively associated with sedge cover. Many species of sedge have high forage value and are utilized by livestock, including horses (Hermann 1970). In the Pacific Northwest, several riparian sedge species outrank upland forages in sustained protein and energy content (Kauffman and Krueger 1984).

In a study of feeding ecology of feral horses in western Alberta, sedges, hairy wild rye and fescues (*Festuca* spp.) were the most important dietary component, never falling below a level of 83% in monthly diets (Salter and Hudson 1979). They identified 43 different plant categories utilized by the horses. Hubbard and Hanson (1976) found sedges to constitute 6 – 46% of the diets of feral horses in different vegetation zones in the Piceance Basin of Colorado. In the Green Mountain Wild Horse Herd Management Area in south-central Wyoming (Crane *et al.* 1997) found that streamsides and bog/meadows were 2 of 3 habitats preferentially selected. There was no apparent selection behaviour shown for grassland and coniferous forest habitats. Sedges found in streamsides and bog/meadows were important forage of the wild horses, but not in all cases.

3.3.2.5 Travel trail networks

Horse trails observed and followed were extensive, numerous and complex. We mapped several by taking GPS readings at different locations. We walked about 40 km of horse trails. Using remote cameras, we documented eight horse movements on horse trails and/or human trails/roads within the study area (Table 3). Some of these represented movements of an entire horse band but others involved one or several individuals. Several night movements were recorded. All movements were assumed to be related to travel between the isolated meadow complexes used for feeding.

The horse trails create easy travel routes for many other species. As noted, our remote cameras recorded movements on horse trails of moose, mule deer, grey wolf, mountain lion, Canada lynx and others.

In order to demonstrate the unusual importance of the Lodgepole pine forest type as "*horse connectivity areas*" I did map some of the horse trails on the one habitat map sheet. I would recommend that the various established horse travel trails be accurately mapped. I believe that developing a ground-truthed horse connectivity layer will be important to identifying the conservation values of the Brittany pine forests.

Lead stallion (left) of Chestnut Stallion Band making what appeared to be a lone nocturnal movement on a horse trail through pine forest. Herd of horses (right) of the Black Stallion Band traveling another horse trail through the pine forest, diligently scenting the ground. The area has a large network of horse trails that connect the various small meadows and other habitats. (Photo by W. McCrory and FONV).

3.3.3. Possible origins of the "Chilcotin" horse of the Rainshadow Wild Horse Ecosystem

In reviewing available information on wild horses in Canada and British Columbia I found the topic steeped in contradictory information, with very little original scientific research having been done. Many questions could not be answered by a superficial review, as I had hoped, and I thus researched the topic extensively. Since the animals are "*feral*" do they belong in the ecosystem? Although a portion of their range has recently been protected in Nuntsi Provincial Park will the feral horses be eliminated because they do not fit in with provincial park policy of preserving natural ecosystems and native species? What are their real origins: escaped domestic stock from early fur brigades, gold rush pack trains and cattle ranches or escaped Spanish stock from Chilcotin First Nations who acquired horses before the first white explorers arrived on the scene?

In order to provide a better background perspective, I also felt it necessary to do a general profile of wild/feral horses from the global to local level.

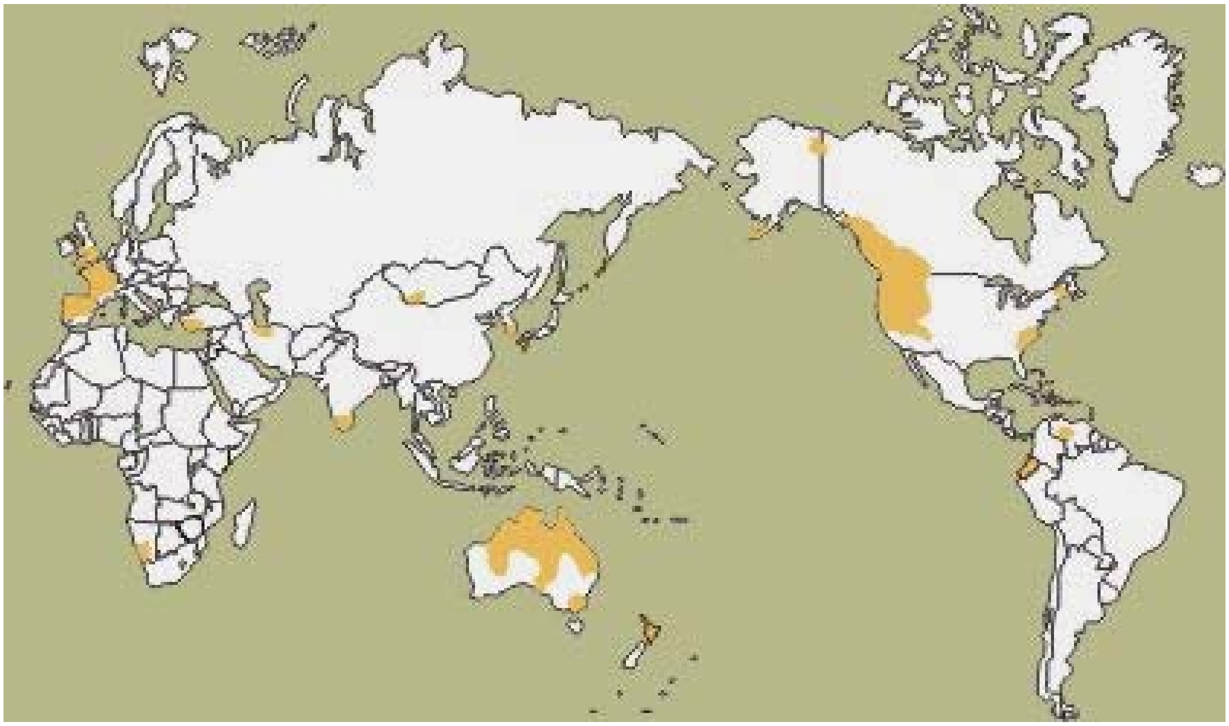
3.3.3.1 Global profile of feral horses

Linklater (2000) provides an excellent global summary of feral horses, which exist in many countries today:

"*Feral horses are the most widely dispersed of equids and populations are found throughout the world. Horses were domesticated from Eurasian populations of wild horses similar to Przewalski's horse (Equus przewalskii). Przewalski's horses are wild only in Mongolia and are the subject of an international breeding and reintroduction program. Domestic horses were introduced to most parts of the world in the 18th and 19th centuries by European colonists (Ed. Note: According to most sources, in North America it was the late 1500's and early 1600's).*

The breeds represented in different populations vary, however all are descended from domestic horses that were released or escaped and became feral. The largest populations are now found in North America and Australasia. Most populations are managed, particularly to reduce competition for food and space with other wildlife and domestic sock, or to limit their impacts on botanical bio-diversity. The amount or intensity of management varies.

Some populations are unmodified and others are periodically hunted or mustered to control population size. More intensive management involving supplementary feeding, treatment for intestinal parasites, the annual removal of young stock, particularly males, and the control of stallion numbers, and mare and stallion fertility by castration or immunocontraception occurs in many populations. Some populations are confined by artificial or topographical barriers while others range without restriction. Thus, the density of populations has varied from 0.1 to 35.4 horses per km^2 *and adult sex ratios varied from 0.03 in extremely female biased populations to 1.85 males per female. There is a rich literature describing many populations and their environments*."



GLOBAL DISTRIBUTION OF FERAL HORSES (with permission from Linklater 2000). Horse bibliography. [Online] Available: http://www.invasive-mammals.org.nz/horses/ [retrieved Jan. 24, 2002]. The map on the web site was redrawn from Lever, C. (1985) [Naturalized Mammals of the World. Longman, London.] and updated using the bibliography associated with the region buttons below the map and described in greater detail in Linklater (2000) [Adaptive explanation in socio-ecology: lessons from the Equidae. Biological Reviews of the Cambridge Philosophical Society, 75, 1-20].

3.3.3.2 North American origins

What must be kept in mind is that horses are actually a true native species of North America. Paleontological evidence indicates that they evolved on this continent but went extinct about 8,000 years ago, but not before their ancestors crossed the Bering land bridge to Asia (Ryden 1978)

Ryden (1978) also provides a most interesting perspective on this: "*Because the wild horse was introduced into North America by explorers during the sixteenth century, he has frequently been denounced as an interloper and denied legal protection granted to our native animals. However, many who have condemned the wild horse for his alien status are unaware that it was North America that actually spawned the horse and gave this amazing creature to the rest of the world*."

Ryden (1978) also summarizes well the recent history of wild horses in North America: "*The Spanish conquistadores brought the horse back to North America in the sixteenth century. Many of those animals escaped, thereby forming the original nucleus of the herds wandering the west today. These horses were a strong breed known as the Andalusian bred Arab-Barb. Over the years, these herds provided North American tribes, the U.S. cavalry, and cowboys with countless sturdy mounts. The horse revolutionized the lives of the plains Indians. The Spanish Barb, with a* *desert ancestry, quickly adapted to the harsh landscape of the North America prairies and deserts many of them becoming wild. During the first quarter of the nineteenth century, when plains explorers found large herds of wild horses commingling with the buffalo, they assumed these were indigenous and referred to them as "aboriginal" stock*".

Bearcroft (1974) provides detailed coverage of the first Spanish horses brought to the New World starting with Columbus' second expedition in 1493, as well as various early introductions to Eastern Canada.

Bradley Smith (1969) also provides a historical review, including a map of the approximate spread of the horse in the western world (reproduced elsewhere in our report). Some of the first Spanish horses from breeding farms in Cuba were landed at Vera Cruz (now Mexico) in 1519. However, the Spanish conquistadors carefully guarded their horses and the spread of horse amongst the Indians was gradual. There were still apparently no horses in New Mexico until after 1598.

Sponenerg (1999) provides the most documented and intricate review of the path and fate of these original Spanish horses starting with the 1500's –1600's introductions to what is now the United States and Mexico; and the eventual widespread distribution by the 1700's; he also provides an overview of the massive extirpation of feral and Indian Spanish-derived stock in the U.S. and replacement with larger horses of the dominant Anglo derived culture in the 1800's.

According to Sponenberg (1999), most feral herds in the U.S. today, including the "mustangs" protected by the Bureau of Land Management (BLM), are crossbreeds with non-Spanish horses. Only four relic Colonial Spanish herds have been identified through genetic testing in the U.S. wilds today, largely in the most isolated areas. These are considered a direct genetic remnant of the horses of the Golden Age of Spain. These few relic herds are now being given a high preservation priority since the original Colonial Spanish horse is now mostly or wholly extinct in Spain. This includes the horses in the Pryor Mountain Refuge in Montana. According to Sponenberg (1999): "*The Colonial Spanish Horses are therefore a treasure chest of genetic wealth from a long time ago. In addition, they are capable and durable mounts for a wide variety of equine pursuits, and their abilities have been vastly undervalued for most of the 1900s*".

The few surviving purer stocks have been used as foundation strains for registered Spanish horse breeds. According to Sponenberg (1999): "*The result is that the New World remnants are very important to conservation since the New World varieties are closer in type to the historic horse of the Golden Age of Spain than are the current horses in Iberia*".

3.3.3.3 Canada and British Columbia

Bearcroft (1974) in her book "**Wild horses of Canada**" provides a fairly definitive review of origins of feral horses in various parts of Canada; some material, though convincing, is somewhat anecdotal and would have benefited from more careful citations of source references.

Based on her review of early explorer journals, "*pure Spanish horses*" appeared with Plains Indians in Saskatchewan and Alberta in the early 1700's. In our own review of Alexander Mackenzie's journal of his travels across central Canada in the late 1780's and early 1790's (Mackenzie 1801, pp. 77-78), it is noteworthy that he recorded that the plains Indians of Canada had great numbers of horses: "*which are brought, from the Spanish settlements in Mexico: and many of them have been seen in the back parts of the country, branded with the initials of their* *original owners' names…they are turned out loose winter and summer to provide for themselves*".

Good documented reviews are found in the literature. Wissler (1914) notes that the cavalier Spanish carried horses across the Mississippi in 1541 and provides a table detailing when Indians in Canada may have acquired horses: Assiniboine (1742), Blackfoot (1751) and Plains Cree (1738). La Verendrye and his sons recorded many of the sightings.

In his 1938 article "*Where did the Plains Indians get their Horses*?" Francis Haines states: "*Possibly the most detailed work on this topic has been done by Clark Wissler, who has written on the influence of the horse on the culture of the Plains Indian. He indicates that animals lost or abandoned by the DeSoto and Coronado expeditions in the period 1540-1542 probably furnished the parent stock. With such an early introduction, horse could have reached the limits of their natural range by 1600. He says "*for all we know, the Crow and Blackfoot, for instance, may have had horses for 150 years before their first mention in 1742 and 1751.*" While few writers agree that the horses could have reached their northern limits so soon, many favor this theory that the strays from either or both of the expeditions multiplied rapidly on the plains and were adopted by the Indians before their next contacts with the whites.*" Haines concluded that the available evidence indicated then that the Plains Indians began acquiring horses some time after 1600, the center of distribution being Santa Fe. This development proceeded rather slowly; none of the tribes becoming horse Indians before 1630, and probably not until 1650.

Roe (1939) in his article "**From dogs to horses among the western Indian tribes**" also reviews some interesting historical accounts for those who wish to delve further into the subject.

The origin of wild horses in British Columbia appears to have remained a matter of conjecture. However, even a partial review of the historic literature strongly suggests that First Nations inhabiting the grassland interior areas of southern British Columbia had adopted wild Spanish Mustang stock, or versions thereof, some time before the white man arrived (see also Bearcroft 1974).

For example in the East Kootenays, Graham (1945) attributes the Kootenay Indians with having introduced the horse to the province: "*Horses were brought to America by the Spaniards and the Indians of the southwestern United States were among the first to make use of these animals. The Kootenays, while they made their home in the basin of the Missouri river or before that time, obtained horses and when they moved north into what is now Alberta and later into the mountains they brought their horses with them*".

One of the first white explorers who kept records provides irrefutable evidence. In 1807, David Thompson built a trading post in what is now the East Kootenays and describes hunting wild horses for food including eating from the carcass of one he disputed with a coyote. Thompson wrote that: "*The horses all come from Spanish horses, which have now very much multiplied….There are several herds of wild horses in places along the mountains…They are always fat, with fine coats of fur. For the greatest part of two summers I hunted them, took several of them, and tamed them*."(Tyrrell 1916).

This has some relevancy to our historic investigations as to the probable origins of the Chilcotin wild horses.

3.3.3.4 Possible Origins of while horses in the Chilcotin and Rainshadow Wild Horse Ecosystem

"*At least six factors must be considered in the reproductive biology of the wild horse if we are to understand both the success and the variability seen across North America and the world. First, genetics provides a foundation from which to examine any variation in reproductive success. Horses with older genetic origins - that is, more primitive types - may be assumed to have taken less time to become adjusted to their harsh environments than those with more recent historic origins. Second, habitats and other environmental factors will drive the process of natural selection, and the more hostile the environment, the more dramatic the changes in the biology of the horse. Third, the greater the length of time any given population of horses has been living in its environment, the longer the process of natural selection can be assumed to have worked its biological magic. Finally, three other factors affect reproductive success. Changes in population densities, age-class profiles, and sex ratios - whether caused by man through roundups and removals or by nature - have brought about rapid changes in the reproductive biology of the wild horse...........* "**Into the Wind: Wild Horses of North America**" by Jay Kirkpatrick (1994).

During field surveys in the Brittany Triangle, I saw darkened skeletal remains of horses half buried in swamps and weathered old bones with lichen growth suggesting some antiquity of occupation by the wild horse population there. For this aspect of our study, I was unable to interview Xeni Gwet'in elders but this needs to be a priority.

A partial review of the historical literature shows a contradictory interpretation of the origins of Chilcotin wild horses. Some sources suggest they originated from escapees from pack trains associated with the Fur Brigades and Cariboo gold rush in the early-mid 1800's. Others suggest they originated earlier from First People bringing in the horses that were derived from the original Spanish Mustangs to the south.

As will be noted further, the historic evidence clearly indicates that First Nations in the Chilcotin has horses prior to the first Euro-contact in 1808. Horses that escaped or were turned loose to fend for themselves from fur brigades and the Cariboo gold rush were secondary infusions but it is also likely that these horses were also derivatives of the same original Spanish stock as the original Chilcotin horses.

LeBourdais (1946, B.C. Archives) claimed that wild horse bands in the Cariboo-Chilcotin originated from the pack trains of the fur brigades from more than a century previous. He noted that the route of the "Brigade Trail" started from Alexandria on the Fraser River in the Chilcotin down through the Okanagan to Fort Colville on the Columbia River and that these pack horses originated from the U.S. mid-west and as far away as Texas. That some pack animals escaped from these pack trains and went wild is unquestionable, although conditions were described as harsh.

Morice (1978) in recording the history of the early fur trade in the Cariboo confirms the use of horses: "*Fort Alexandria was the northern terminus of the land route yearly followed by the Company's pack-trains…..the letters of the managers of Alexandria are replete with references to the large number of horses which died on the way or at their winter-quarters*." Morice also noted that at the trading posts: "*Horseflesh, though not mentioned in 1836, was nevertheless recognized as an article of diet, and in the Company's book a column is reserved thereto. It was not until 1845 that the General Council forbade its use on the employees table*."

Lamb (1966) notes that in 1814, just 6 years after Simon Fraser's explorations determined that the Fraser River was unsuited for a supply route for the new fur trade established in the interior of what is now B.C., the North West Company made its first overland supply of its posts from the mouth of Columbia. This was the Fur Brigade Trail that ended at Fort Alexandria on the Fraser River. It is hard to imagine that anything but Spanish-blood horses obtained from native people were used at that time.

Another infusion of escaped horses appears to have resulted from the Cariboo gold rush. A letter to the Victoria Colonist on May 7, 1863 refers to the countless dead horses in the Cariboo on the gold rush trail to Barkerville, B. C. as a result of packers leaving them to over-winter on their own. This account also indicated that some survived (McFadden 1965).

Unquestionably, some wild horses in British Columbia and the Chilcotins originated over the past 180 years from domestic stock brought in by Europeans. However, as in the past in the U.S., this factor, in ignorance of earlier origins of many wild horse stocks, appears to have been used by some authorities to justify the quite massive horse slaughter programs in B.C. As recent as 1974, the official government position as expressed by J. Hatter, Director of the B.C. Fish and Wildlife Branch was that "*wild horses*" were " *domestic stock turned loose for the winter*" and that "*It is these animals that are shot under government authority*." According to Hatter: " *I am not clear what is meant by the term 'wild horses'. If you are referring to horses that have not been touched by man, have not been branded, and live off the land, then B.C. has such horses. However, we prefer to call them feral, as they are offspring of domestic horses, and someone is usually able to claim ownership. The existence of such horses is mainly due to bad management of domestic stock*." (J. Hatter, Letter dated March 29/74 to Ontario Wildlife Conservation Coalition. B.C. Archives).

Echoing this more recently in addressing the question of wild horses in the Chilcotin, Jodie Kekula, rangeland specialist for the B.C. Ministry of Forests stated in 1995 that they might be descendents of workhorses left behind by homesteaders who gave up the land. "*You can't compare them to horses of Nevada where they have a mustang background and date back to the Spanish*." (Canadian Press article, June 18, 1995).

Others claim different. For example, a recent B.C. Provincial Museum publication on hooved mammals (Shackleton 1999) states the following:

"*Feral horses are found mainly in the central interior, west of Williams Lake. Some were present in the interior when European explorers first arrived in British Columbia. Presumably, they originated from horses brought to the southwestern United States by the Spanish in the 17th century; later, First Peoples brought these horses northward*."

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In a recent book on native cowboys, Baillargeon and Tepper (1998, p. 93) derive a similar conclusion: "*By the time early fur traders and explorers made their way to the Canadian Plateau in the early nineteenth century, horses were already present. Native people in the area claimed that they had always had horses, an attitude suggesting that the animal had been used for many generations. Routes from the Plateau into the Plains, used for travel on horseback to buffalo* *hunting areas, were well established. The riding skills of Native horsemen and women showed long familiarity and experience with the animal*."

The "*Canadian Plateau*" is described in this book as that area from the U.S. border in the Okanagan north to Alexandria on the Fraser.

In a map of the spread of the horse to the western world, Bradley Smith (1969) notes that in areas south of the B.C. – U.S. border, the Yakima First Nations had horses by 1730, the Cayuse by 1720 and the Nez Perce by 1720. Another review of the Washington Plateau states that: "*the end of the archaeological period is marked by the appearance of European introduced items, particularly the horse which was acquired by Plateau peoples by at least 1730 AD. This transitional period brought changes to the Plateau yet again, nevertheless the changes can be seen as transitions and modifications of cultural development*". (Online: http://www.cr.nps.gov/aad/kennewick/boxberger.htm. Accessed: March 2002).

In a review of the impacts of the white man on First Nations history of B.C., Duff (1964) notes: "*In the interior, the Indians felt the effects of the white men's presence before they actually saw any. Horses, guns and other trade items passed quickly from tribe to tribe from the south and east in advance of the first explorers*." He also notes that in the interior, the arrival of guns and horses stimulated warfare and caused reshuffling of tribal territories.

Early explorer journals – Differences between Mackenzie and Fraser

Since few if any records have been kept on the origins and status of horses in western Canada it is not surprising that interpretations vary. Given such contradictory conclusions from some historical sources and B.C. governmental authorities, I decided that one litmus test would be to review the journals of the first European explorers in the Chilcotin to see if there was any evidence that horses pre-dated European contact.

I reviewed Alexander Mackenzie's journal (Mackenzie 1801) and found, when he traveled the area of the West Road River area from the Fraser River to Bella Coola in 1793, he reported no wild horses nor horses being used by the many Indian People he encountered. This included his journey across the headwaters of the Peace River. His journal lacks any mention of horses once he crossed the Rockies. However, he had, as I have already noted, reported earlier that the plains Indians had horses derived from the Spanish.

The slightly later journey of Simon Fraser in 1808, the first European to canoe the lower reaches of this large River now named after him, made a high number of first references to horses in the Chilcotin (Lamb 1966) that are most revelatory. Also interesting is that, several years previous in 1804, Lewis and Clark made some of the first reports of Indians having horses in contiguous grassland areas to the south (now Montana, Idaho and Washington). This included the Appaloosa. In Shoshone territory, Lewis and Clark recorded no wild horses but that the original stock was procured from the Spaniards and bred by the Indians (Lewis 1961).

Why the difference between Fraser and Mackenzie? There are two possibilities. One is that First Peoples had not brought in horses to the region before Mackenzie arrived. The other, which I favour, is that Mackenzie did not go as far south as Fraser who, canoeing down the same river (16 years later), did not encounter horses either until he reached the more northerly pockets of extensive grassland prairies and canyons of what is now the Chilcotin. These Chilcotin grasslands are the northernmost limit of native grasslands in North America (Hooper and Pitt 1994) and

Mackenzie traveled just north of the native grasslands that First Nations' horses had reached at that time. Mackenzie actually made his journey across to the Pacific on an Indian trade trail that was just north of the Chilcotin "*horse country*". This Indian trail was through lands that were often heavily wooded and very swampy and very rugged once the Coast Range was traversed.

Simon Fraser's journal

In the spring of 1806, Fraser left the North West Company trading post at Fort Chipewyan on the east side of the Rockies, followed the established route of Mackenzie and later colleagues across the Rockies from the Peace River, and spent several years at trading posts (Fort McLeod, Fort St. James) established on the west side of the Rockies. As with his predecessors, Fraser did not report any evidence of horses in the general region but in a letter (prior to his trip down the Fraser River) from Fraser Lake on February 1, 1807 he reported: "*I am Positively informed that the Nascudenees have horses that they get from the east*". I assume he was referring to First Nations further to the south, although I could not locate any further reference.

Fraser established a post, Fort George, on the Fraser River at what today is Prince George and from here, commenced on May 28, 1808, his famous journey down the Fraser River to the Pacific Ocean. He reported no horses until his group had canoed south of the West Road River – which was about the southern terminus reached by Mackenzie in 1793. A day's journey south of this tributary he observed "*some vestiges of horses*" at an Indian encampment. On May 30, a few miles upstream of Soda Creek, he noted the following: "*Those who came to see us from below were on horse back, But tho' animals are plenty and the country in many places clear of wood, they do not use them to hunt, but use them to carry themselves and baggage, which is the chief cause of their not going much in Canoes*".

The next report was several days later when, near the Soda Creek Rapids, some Indians mentioned that the trip could be performed with horses.

After arriving in canoes near the mouth of the Chilcotin River, Fraser mentions the "*Chilk-odins*" Indians and that "*The natives make use of horses*." His party "*took five horses to transport baggage*". On June 2 he mentioned that he "*tries to find horses for Mr. Stuart, who has had enough of the river, and he wastes a good part of the day in anxious suspense, as none of the Indians seem willing to part with their animals. His patience is, however, rewarded on the morrow, when he gets four horses, one of which on that same day tumbles, with his load, over a precipice and is lost*." He also mentions that the Indians told him that there was a "*good road*"(i.e. trail) along the hills to the Thompson River, which was "*only four nights with horses loaded*". Fraser also recorded several native words used for horses. He mentions that the native people seem acquainted with buffalo as they recognized the buffalo powder horns of Fraser's party and the painting of a wounded buffalo on one of his canoes. They claimed they had seen buffalo on the other side of the mountains where they had been on a war party (Lamb 1966). This would be suggestive of journeys to areas where horses could also have been acquired.

One his return back up the River, Fraser encountered (July 14) a different group of Indians from "*the interior*" camped near the confluence with the Thompson River and recorded that their country was well stocked with horses. He also noted Shoshone Indians with horses.

All of this is clear evidence that, prior to the early 1800's, some First Nations in the Chilcotin had horses, had established horse pack trails, were well-familiar with horse use, and had created their own words for horses in their native tongue. It is very likely that Chilcotins acquired horses some time in the 1700's, as did native groups to the south. Smith (1969) notes the following approximate periods that native groups just south of the border acquired Spanish horses: Yakima (1730), Nez Perce (1710) and Cayuse (1720).

Xeni Gwet'in First Nations

On July 24, 1808 Fraser reported that some of the Indians near the mouth of the Chilcotin River were on horseback. He also noted (on July 26) that the Chilcotins were from the head of the Chilcotin River (Lamb 1966). The Xeni Gwet'in reside at the headwaters of this River. They remain a strong horse culture that has lived until very recent times in semi-isolation in the lee of the Coast Mountains that fringe the Chilcotin grasslands. Today, they still replenish their domestic stock from the capture of Brittany wild horses.

Once I carry out the interview program, I hope to be able to establish from oral history the relationship of the Xeni Gwet'in to Chilcotin wild horse, including possible origins.

In the U.S. a small number of Native American tribes have bred horses, which have contributed to the survival of the Colonial Spanish Horse today, such as the Cheyenne, Lakota, Paiute and Navajo. A few others have been bred as distinct strains (Sponenberg 1999).

Rainshadow Ecosystem horses and original Spanish stock

Given that there is strong evidence that some First Nations in the Chilcotin had horses nearly two centuries ago or earlier, and that these early horses could only have originated from the Indian/wild stock in the U.S. from the early Colonial Spanish Horse vintages, it is natural to postulate that the horses of the Rainshadow Wild Horse Ecosystem had these same origins.

According the (Sponenberg 1999), in about 1700 the purely Spanish Horse occurred in an arc from the Carolinas to Florida, west through Tennessee, and then throughout all of the western mountains and great plains and were the "*common mount of native tribes*".

However, Sponenberg (1999) also notes that few of the original Colonial Spanish Horses survive today in feral populations because of extermination in the 1800's, combined with dilution by Northern European types favoured by Anglo derived culture. As I noted previously, of the wild U.S. mustangs today only four different herds have been identified with original genes of the Colonial Spanish Horse.

One of the few herds of Colonial Spanish Horse stock that did survive live in the U.S. Pryor Mountain Horse Refuge. Sponenberg (1999) feels that these horses probably had their origin in tribal horses, as they are along a major Crow and Shoshone migration route.

What is of interest is that Dr. Sponenberg's genetic and other background research on U.S. wild horses has helped to resolve a long-term debate about their origins and current genetic make-up. When Hope Dryden was carrying out research for her well-documented 1970 book "**America's Last Wild Horses**" she uncovered considerable conflicting information on the origins of many horse bands. Generally she found, as I have in our study, that western residents often attributed wild horse bands in their region to recent domestic runaways rather than from earlier Spanish blood types (pp. 198-200).
By tracing a variety of reliable but anecdotal sources for the originators of the Pryor Mountain herd, she was able to establish that wild horses existed there prior to the first settlers; but that

there had also definitely been some dilutions in more recent times. She also felt that domestic runaways such as large, farm horses and high-strung, grain-fed race horses were the least likely to survive when mixed with the earlier wild strains. Through circumstantial evidence she also established that the Pryor Mountain horses "*indeed did carry the blood of the Conquistador's horse*". Decades later, genetic testing reported by Sponenberg (1999) validated Dryden's supposition by confirming that the Pryor Mountain horses are indeed surviving Colonial Spanish Horse stock.

The founder of the Spanish Mustang Registry felt that feral horses in Canada and the U.S. have the colours and characteristics of their Spanish ancestors, proving that they carry Spanish blood (Dryden 1970). In recent times, at least one horse of some Spanish blood derivative has been captured for breeding stock from the Rocky Mountain foothills of Alberta. Steve Howlett of Saskatchewan has a mare whose mother was captured in the Kootenay Plains area. The horse has been tested for DNA and shows some Colonial Spanish blood origin (Steve Howlett, pers. comm. to Dave Williams. March 2002).

In terms of the Colonial Spanish Horse in the U.S., Sponenberg (1999) feels that: "*If any other feral Spanish herds remain besides these four, they are probably very, very few in number*."

There are a number of historic factors that support a hypothesis that the wild horses in the Rainshadow Wild Horse Ecosystem could be a surviving remnant of the original Colonial Spanish Horse genotype, or a close dilution thereof. These would include the following:

- They exhibit some of the horse colour varieties claimed to be derived from original Spanish Mustang influence (Sponenberg 1999).

- Some exhibit very long mane and tail, which is also typical of Colonial Spanish Horse influence (Sponenberg 1999).

- They exist near the far northeast extremity of the North American native grasslands and thus the theoretical natural range extremity of Spanish mustang horse distribution introduced by First Nations.

- They have survived in relative isolation in a largely inaccessible foothills pine forest that is remote but in proximity to a traditional Tribal horse culture. The Brittany Triangle area, being bounded by two large river systems, enhances this wild horse isolation.

- The isolation and inaccessibility of the horses may have protected some of the original stock from the widespread wild horse slaughters in the Chilcotins from 1924 to the 1930's. This was supported by a bounty system until 1967. If any other original Colonial Spanish Mustang stock was surviving elsewhere in the more open Chilcotin grasslands prior to this extirpation period, it is likely that the were accessible were killed off the range or shipped to slaughterhouses, while the more remote may have survived.

- Over the past century or more, horses in the Rainshadow Ecosystem have survived under more extreme wild conditions than most feral horse herds in the U.S. where most or all of the top potential predators of horses have been extirpated from the range. In our study area there still survives a complete guild of top North American predators: grizzly bears, black bears, wolves and mountain lions. Natural survival mechanisms in the Brittany may have selected more for the hardier Colonial Spanish Horse strain over more recent introduced domestic stock. Some writers (Dobie 1934, Ryden 1978) suggest that the Spanish types formed circles to protect their offspring from attacking wolves. This may have given such horses a selective advantage in places as wild as the Rainshadow Ecosystem.

However, given the adjacency of cattle ranching interests since the 1860's including small abandoned homesteads within the Brittany, successive dilutions have likely occurred from escaped ranch stock derived from North Euro breeds. One local resident indicated that some 10-15 years ago about 8-10 domestic horses escaped to mix with the Brittany wild horses (N. Nancy Oppermann to Dave Williams, pers. comm.). In 2002, of four horses captured in the study area by the Xeni-Gwet'in, one was a gelding with a brand.

Thus, the possibility also exists that even though the wild horses in the Brittany area may have been derived from the original Colonial Spanish stock, successive dilutions may have influenced their genetic make-up. Genetic testing will help to determine this.

Recommendations:

1. Further historic research, including traditional First Nations knowledge, should be carried out to help establish approximate origins of the remnant Chilcotin-Rainshadow horse group.

2. Genetic testing should be investigated as a means to ascertain ancestry, including sampling for the blood variant Q-ac, believed to be contributed by the Spanish horses brought to the America's some 500 years ago. Easily lost through genetic drift, Q-ac has been documented in the Puerto Rican Paso Finos, the isolated mustang population of Montana's Pryor Mountains, and the horses of Shackleford Banks. Detection of this variant has helped to protect Shackleford horses (The Foundation for Shackleford Horses 2001).

3. Whether or not Brittany horses still retain genetic evidence of Colonial Spanish Horse origin, I recommend that other conservation/heritage values deserve further investigation and recognition. For example, it is clear that Chilcotin horses were in the area before the white man, including those in the Brittany.

Some cognizance should therefore also be given to their integration into a natural wild predator-prey ecosystem with a full complement of major North American carnivores – a natural selection eco-situation not paralleled in any of the feral horse populations that are protected today in the United States. In our study area horses, behavioural responses to wolves and other large predators should be investigated in the field.

Other ecological attributes should also be given greater recognition, including the fact that Rainshadow Ecosystem horses or their ancestors likely preceded moose by at least 120 years. Moose did not arrive in the Chilcotin until the 1920's (Cowan and Guiget 1978).

4. The Chilcotin-Rainshadow horses should be studied as possibly representing the northern limits of the original distribution of feral horses in North America. This should include their ecological associations with the northern extremity of the North American native grasslands. B.C. grasslands are unique in Canada because they are dominated by bluebunch wheatgrass and other species that occur only rarely east of the Canadian Rocky Mountains (Hooper and Pitt 1994). As well, these grasslands are distinguished from their ecological counterparts in Oregon and

Washington by a great proportion of boreal rather than austral plant species (Daubenmire 1978 in Hooper and Pitt 1994).

3.3.4 Conservation assessment and status of wild horses

The following review indicates that, despite their interesting genetic, ecological and heritage attributes, feral horse populations in British Columbia have received the least protective attention of this species in Canada and North America. Currently the have no legal protection.

Even in our study area, which encompasses Nuntsi Provincial Park, I am unsure how the provincial management agency will regard a species classified as non-native and "feral". Presently they are unofficially managed as an undesirable species under the B.C. Grazing Act under the Ministry of Forests. Management policy in the past has led to extensive extirpation programs of feral horses in British Columbia and lack of protection will eventually lead to total extirpation, in our opinion, if some measures are not taken to study and protect surviving herds, where appropriate.

A review of the management history and conservation status was felt necessary to derive some perspective on the "*feral horse situation*".

3.3.4.1 Conservation of wild horses in the U.S.

Historic origins are noted in the previous section. While no means a complete review, following is a partial synopsis of key conservation initiatives undertaken to protect free-ranging horses in the United States.

Historically, the U.S. wild horse populations grew to large numbers, but became persecuted after the defeat of the plains Indians and near-extinction of the buffalo. According to Ryden (1978): *"…. hundreds of thousands of wild horses were rounded up to serve in the Boer War and World War; hundreds of thousands were captured and converted into chicken feed, fertilizer, and hides; hundreds of thousands were captured and broken into cow ponies; hundred of thousands were killed by stock-growers who wanted all the free grass on the public lands for their cattle; hundreds of thousands were killed by the United States Grazing Service which, finding itself unable to cope with the human abusers of the vast piece of federal real estate it administered, took action against the wild animal occupants; hundreds of thousands were killed by game managers intent on making more habitat available for target species; and hundreds of thousands were shot by air-borne cowboys merely for the excitement of it. No law protected wild horses*."

From an estimated 2,000,000 wild horses in the U.S. at the end of the 1800's, fewer than 17,000 appeared to exist by 1968. Populations were declining at such a rapid rate that it was estimated that the mustangs would be extinct in the United States by 1980. Up until 1971, feral horses occupying rangelands in the western U.S. had no legal status with respect to ownership or management or preservation (Ryden 1978).

Prior to this, the 1934 Taylor Grazing Act passed by Congress legalized the round up and shipment to slaughterhouses of thousands of wild mustangs. One of the statements in this Act was that: "*worthless fuzz-tails were grazing unlawfully on public domain*." (Bearcroft 1974).

As a result of growing public concerns, a number of preservation initiatives took place to protect some remaining stocks. One example involved Robert and Ferdinand Brislawn who searched out original Colonial Spanish Horse stock in the wilds and then implemented a captive breeding program on their ranch. In 1957, they developed the "*Spanish Mustang Registry*". Many of these horses were released into a wild horse reserve they maintained on their ranch (Ryden (1978).

A large public outcry concerning the fate of the remaining endangered wild horse herds led to the U.S. Congress passing protective legislation in 1971, as follows. At that time, fewer than 10,000 mustangs survived in scattered bands in eleven Western states.

Wild Free-Roaming Horse and Burro Act. 1971

After much controversy, the U.S. Congress passed bill P.L. 92-195. This made it a federal offense to harass or kill a wild horse. The act established federal ownership of feral horses occupying public lands and declared that the animals were to be protected in perpetuity as a symbol of the pioneering spirit of the American west. However, the act did not address ways to control the feral horse populations. Mustang herds can grow at a rate of 15-20% a year (Gillis 1994). This led to additional legislation.

Public Rangelands Improvement Act. 1978

Concerns about conflicts between livestock interests and increasing horse numbers led to the passage of this act, which empowered federal agencies to manage wild horse populations by removing excess animals (Boyles 1986).

By 1993, over 46,000 feral horses were estimated to inhabit federally owned rangelands in 10 western states (USDI-BLM AND USDA-FS 1993). In Nevada alone, the Bureau of Land Management (BLM) manages 26,000 wild horses and burros in 100 herd management areas across 19 million acres. The BLM runs an Adopt-A-Horse program, which places 8,000 animals per year (Gillis 1994). However, some U.S. sources indicate that some horses are held in enclosures for up to one year and that some are still bought and sent to slaughter (Dave Williams, pers. comm.).

Preservation of foundation strains of the Colonial Spanish Horse

As noted previously, efforts in recent times to preserve the surviving wild horse populations in the United States, partly as foundation strains for the Colonial Spanish Horse, has met with considerable success. Because the Colonial horses of the Golden Age of Spain are mostly or wholly extinct in that country, today they are regarded as "*a treasure chest of genetic wealth from a time long ago*" where they survive as the original strain in North America (Sponenberg 1999).

There are a number of areas where special refuges have been established off the eastern coast and in the mid-west. This is in addition to the protection of wild horses BLM lands under the Wild Free-Roaming Horse and Burro Act.

Although there appears to be a least six horse refuges in the U.S., following is a description of four:

Assateague Island National Seashore and Chincoteague National Wildlife Refuge

There are two adjacent islands with wild horses off the east coast of the United States. They are federally protected. The upper (Assateague Island) is 56 km long and in both Maryland and

Virginia (Rutberg and Keiper 1992). It has a 126,500 ha National Seashore protection area. A separate population of horses living in the 23,440 ha Chincoteague National Wildlife Refuge in the southern island (in Virginia) and is managed by the Chincoteague Volunteer Fire Company (Gillis 1994).

The wild horses of these barrier islands are believed to have originated historically from tax-evading settlers who pastured their animals on the island to avoid the English king's tax on fences (Gillis 1994). Over time, the horses have become stunted, standing less that 142 cm (56 inches) at the withers. This is the result of a harsh environment of a barrier island where fierce storms and hurricanes are common. The horses diet consists largely of salt marsh cordgrass and American beachgrass, plants that are protein-poor, abrasive and salty (Gillis 1994).

Despite the U.S. National Park Service policy that defines horses as exotics or alien species, an exception is made for the horses because of congressional interest when the park was established. They are managed as "a desirable feral species". The public values them for cultural and historical reasons (Gillis 1994).

For the Assateague horses, management concerns by the Park Service include possible horse damage to sensitive marsh habitats and subsequent impacts on other animal communities, particularly small mammals and birds (Gillis 1994). The pony population, which has no natural predators, grew from approximately 45 in 1975 to approximately 175 in 1988 (Rutberg and Keiper 1992). In 1985, a population ceiling of 150 animals was set, which was based on a previous carrying capacity study (Gillis 1994).

Hundreds of thousands of tourists visit the National Seashore annually to see the Assateague horses. This has caused some habituation through illegal food handouts; as a result, some tamer horses live around the campground (Gillis 1994).

Control measures have focused on experimental wildlife contraceptives (Gillis 1994). This involved darting the horses with immunocontraception.

The Chincoteague horses are rounded up each July and made to swim across the channel between Chincoteague and Assateague Islands for "Pony Penning Day", a famous annual foal auction.

The Chincoteague fire department brought in 40 western mustangs to infuse some diversity into the southern herd, but only five survived the first year (Gillis 1994).

Cumberland Island National Seashore, Cape Lookout and Cape Hatteras

On the east coast of the U.S., feral horses also occur in Cumberland Island National Seashore (91,000 ha) in Georgia and, in North Carolina, the Cape Lookout National Seashore (70,000 ha) and Cape Hatteras National Seashore (75,000 ha) [Gillis 1994].

Shackleford Banks Horses-North Carolina

The Shackleford Banks Wild Horses off the east coast are considered a unique historic and cultural legacy. Historical research and gene testing indicates that the horses descended from a core group of the old type, the Colonial Spanish Horse. It is believed they survived shipwrecks in the 1500's. One genetic marker, the blood variant Q-ac, is believed to be contributed by the Spanish horses of 500 years ago (The Foundation for Shackleford Horses 2001). The history of the horses and their roles in early North American Anglo culture, coupled with good, sound scientific information (including genetics), have been the means by which the Shackleford Horses have been protected (Carolyn Mason, Foundation for Shackleford Horses, pers. comm.).

Pryor Mountain Horse Reserve - Montana/Wyoming

This refuge was established in 1968 as the first officially designated wild horse range in the U.S. (Detling 1998). The protected area is 148 km^2 but the horse herd also uses 41 km^2 of adjacent land. By the mid 1970's, the horse population was confined to the area by boundary fences that also prohibited entry of domestic stock.

Current management objectives are to maintain a population of about 120 horses (plus foals) by using periodic roundups (Adopt-A-Horse) to control numbers (BLM 1984). A bighorn sheep population of 125-211 and a mule deer population of about 150-780 occupy the horse range for at least part of the year (Detling 1998).

A range study showed that feral horses in this reserve are being managed at sufficiently low densities and are not causing any major changes to this grassland ecosystem (Detling 1998). As noted further, they represent a surviving gene pool of the Colonial Spanish Horse (Sponenberg 1999).

Preservation of foundation strains for Colonial Spanish Horse

Efforts in recent times to preserve the surviving feral horse populations in the wild in the United States has led to preservation of important foundation strains for the Colonial Spanish Horse that dates back more than 5 centuries. Only 4 remote areas have been found in the U.S. where wild horses have the original genetic marker. Because the Colonial horses of the Golden Age of Spain are mostly or wholly extinct there, where they survive in original strain in North America they now have a high value (Sponenberg 1999). Sponenberg (1999) also felt that very few other feral Spanish horse herds likely have survived in North America

3.3.4.2 Conservation of wild horses in Canada

Canada

Unlike the U.S., no scientific attempt appears to have been made to determine historic and present numbers and distribution of feral horses in Canada. According to the Canadian Food Inspection Agency today, there is still no single agency that monitors feral horses (and other feral animals) in Canada, including their current status (Fisher 1999).

Bearcroft (1974) in her book "**Wild horses of Canada**" provides the most comprehensive review I could locate, including considerable historical documentation. Based on her review of early explorer journals, "*pure Spanish horses*" appeared with Plains Indians in Saskatchewan and Alberta in the early 1700's and at the time of her book, a few relic herds apparently still survived in the Cypress Hills in Saskatchewan, with greater numbers in Alberta.

For Canada, an export market developed in 1943 in Europe and the United States and thousands of wild horses were rounded up and shipped for both food consumption and domestic use. In 1967, over 25,000 head were slaughtered in Canada (Bearcroft 1974). However, no accurate records appear to have been kept on the total numbers of wild horses versus domestic horses slaughtered during this period.

In Canada, wild horses now occur only in small numbers in Alberta and British Columbia (Storrar *et al*. 1977) as well as on Sable Island off of the east coast of Novia Scotia (Bearcroft 1974). Storrar *et al*. (1977) estimated the numbers in Canada at that time at 5,000. This may be generous. According to a survey by the Canadian Wild Horse Society in 1972, Sable Island had about 270, Alberta 2,000 – 3,000, and British Columbia about 750 – 900 (Bearcroft 1974).

There is currently only one wild horse refuge in Canada despite efforts to create others.

Sable Island, Novia Scotia

Bearcroft (1974) suggests Sable Island horses may have originated from Spanish stock as early as the 1500's. Another source (Beson 1998) suggests they arrived in 1738.

After considerable controversy, Prime Minister Diefenbaker protected Sable Island under Federal Law in 1961. Since that time they have become the most studied horse herd in Canada.

Sable Island is located approximately 290 kilometers southeast of Halifax, Nova Scotia. It is 41 km long and up to 3 km wide. The best known component of its fauna is a population of feral horses, whose numbers now range between 150 and 400 individuals. The island supports numerous migrant, and small number of breeding bird species, and has status as a federal Migratory Bird Sanctuary administered by the Canadian Wildlife Service. It also has the world's largest congregation of breeding Grey Seals (Beson 1998. Towards a conservation strategy for Sable Island. Canadian Wildlife Service).

Today the Sable Island Preservation Trust manages the sanctuary. A more detailed study is underway to determine the interrelationships between the horses and vegetation (The Sable Island Preservation Trust Newsletter 2000).

Alberta

In 1974, Alberta moved to stop the slaughter of wild horses. Previously, an average of 225 – 250 were exterminated annually (Bearcroft 1974). At the time of completing my report, I was still trying to obtain a copy of this 1974 Alberta legislation.

Evans (1993) estimated 630 – 850 "*escaped or abandoned*" horses at that time in the "*Green*" or forested foothills area of Alberta. Counts by forest districts indicated a decline from 1977 when 1791 horses were estimated.

Alberta biologist Robert Ruttan provided this recent Alberta up-date for our report: Today there is a season for live-capture by permit in certain areas. In 2000, an aerial survey of wild horses by Don Livingstone (Forest and Land Use Officer at Rocky Mountain House) counted 187 horses west of Sundre and 100 near Nordegg. Smaller numbers were on the Clearwater. A large Wild Horse Permit Area includes the Sundre, Nordegg and Clearwater horse populations. Until recently, permittees were allowed to capture only by corral traps, and to take ratio of one female/three males of any age, with no limit as to numbers. Permittees are estimated to live-capture 30 - 40 per year. Outside of the permit area there are no regulations re: number, sex, age or capture method.

The Alberta permit area and rules appear to be a compromise between full protection and no protection (to satisfy cattle ranchers) and to stop protests re: snaring, running down or shooting horses (Robert Ruttan, pers. comm.).

Canadian Forces Base (CFB) – Suffield, Alberta

This is a military training area in Alberta managed by the Canadian Department of National Defense (DND). In 1992, the federal government announced protection of a portion of the military block as a National Wildlife Area (NWA) because it was a unique block of relatively intact mixed-grass prairie in the northern Great Central Plains of North America. Part of the proposed NWA had approximately 850 feral horses, which were reported to be causing range damage. In 1992, the DND formed a citizen's advisory committee, which, after reviewing a number of options (including maintaining a reduced herd), recommended humane removal of all the horses due to their perceived threats to the prairie ecosystem.

Information provided by the military concluded that the feral horses were not considered descendents of wild mustangs from Spanish incursions. DND claimed they originated from domestic stock, which was allowed on the range seasonally when CFB Suffield was established in the early 1940's. Some ranchers did not bother to recover their horses from the range (Boyde 1993). However, after our review of the DND-sponsored report I strongly felt that a more comprehensive historic review and genetic testing should have been done to validate the information provided by DND. The DND final decision to remove the horses stirred public controversy (Boyde 1993), but insofar as I have been able to determine all of the horses have now been removed.

British Columbia

"*They are nearly all gone from B.C. now, these wild horses of our quiet valleys and hills – the blacks, greys, whites, browns, sorrels, roans, duns, appaloosas, and palaminos – once seen in great herds described as 'a sight…. as beautiful and life-fraught as any the grass ever showed.*'" (McFadden 1965).

Our partial review indicates that wild horses in the province have not been given the public attention and conservation status that they have in the U.S. counterparts or in some other areas in Canada. There was some effort by the public to establish several wild horse refuges in British Columbia (Bearcroft 1974), but without success.

I also could not locate any formal status report by government on past and present numbers and distribution. In some respects, after a fairly detailed search and review I have concluded that B.C. government policy on management of wild horses in British Columbia is about where the U.S. government was prior to protective status in 1971.

The following review was by no means complete.

Past numbers

Wild horses in British Columbia were once far more numerous and widespread than today. Storrar *et al*. (1977) estimate that about 15,000 wild horses were killed in the 40 years following implementation of the bounty system in B.C. in 1924. Approximately 1,000-2,000 animals were estimated to remain in B.C. by the early 1960's, scattered along the Thompson and Upper Fraser River drainages (McKnight 1964). A mail-out survey by the Canadian Wild Horse Society in 1972 indicated that perhaps 750 – 900 head remained in British Columbia (Bearcroft 1974).

Proposed B.C. Horse refuges

As far back as 1965, the Canadian Wild Horse Society, a group originally based in Abbotsford, B.C., was actively lobbying for a number of wild horse refuges in the province. The initiative was supported by noted range ecologist Dr. Vance Brink and Members of Parliament Ron Basford and Barry Mather (McFadden 1965). While the Society was able to have the bounty eliminated (Bearcroft 1974), it was unsuccessful in seeing any sanctuaries established.

B.C. feral horse bounty system & market slaughter

From about 1924 to at least 1946, the B.C. government's policy on wild horses was one of a controlled season for purposes of elimination. Although there was no actual declared open season on horses, the Ministry of Lands and Forests closed ranges for "*roundup shooting*" between December 15 and March 15 of each year. Through livestock associations, appointed horse-hunters could obtain a license from local government agents to shoot feral horses. The bounty hunters were paid $3.00 per horse killed, except for stallions, which were $5.00. [The bounty was apparently paid for each pair of ears (McFadden 1965)].

One governmental source estimated that 7,000 - 9,000 horses were shot over a 22 year period although "*records were not accurately kept*" (Asst. Chief Forester C.C. Ternan letter. 1946.). Dan Weir, one of the bounty hunters, estimated the number killed could have been 10,000 (Weir 1946.).

An article on wild horses in B.C. (LeBourdais 1946) is exemplary of contemporary governmental and public attitudes that persisted at that time towards wild horses in B.C. Further research will likely show that the attitude persists in some quarters today:

"*In the past 22 years the Lands Department of the Provincial Government has paid out many thousands of dollars in an effort to rid the range of surplus horses – most of them wild. But, in spite of the fact that upwards of 10,000 horses have been shot, and hundreds of others captured by men on skis, on snowshoes and on horseback, the rangelands of British Columbia – particularly in the Cariboo country – are still horse-handicapped; the majority of these animals are small, inbred and more or less useless*."

According to McFadden (1965), an estimated 20,000 wild horses still existed in B.C. in 1939 despite these depletions. World War II created a new market for human consumption of horsemeat and "*The wild horses were flushed from every part of B.C., cornered, and shipped for butchering*". This was still continuing in 1965, with B.C. and prairie horses shipped to Alsask in Edmonton for slaughter and then sold in Europe, Japan and Canada. One of the few slaughterhouses in B.C., in Cloverdale, killed about 100 horses per week in the mid 1950's, but by 1965 much of the market was for pet food (McFadden 1965).

At the same time, the kill policy also continued. In 1962, a Ministry of Lands, Forest & Water Resources notice for the closure of crown range in a portion of the Nelson Grazing District stated that: "*During this period the Department will give consideration to applications of Livestock*

Associations, Farmer's Institutes, and others, to round up or shoot wild and useless horses" (Bearcroft 1974).

In 1974, wild horses were being administered under the B.C. Grazing Act, section 5(4) which states: "*The Minister of Lands and Forests may cause every horse found running at large upon a Crown Range in contravention of sub-section (3) to be killed, or to be seized and sold*….". Under section 5(6): "*The Minister of Lands and Forests may issue to any person a license, subject to such conditions as the Minister sees fit, authorizing that person to shoot or round up all horses found running at large*…" (Bearcroft 1974).

As noted previously, the Canadian Wild Horse Society was eventually successful in having the B.C. bounty on wild horses eliminated (Bearcroft 1974).

As noted further, the kill policy still appears to be practiced under some circumstances today, although not widely publicized. In a Royal B.C. museum review of hooved mammals in the province, Shackleton (1999) notes that: "*Feral horses are considered pests by some people, so they are hunted or rounded up*."

Chilcotin – Rainshadow Wild Horse Ecosystem area

According to LeBourdais (1946), at the turn of the century the wild horses, which thrived in the Chilcotin after escaping from the fur brigades, were captured by local ranchers and shipped by rail to Alberta to become domestic stock.

During the 1924 to 1946 period of the B.C. government's policy of wild horses liquidation, many Chilcotin horses were slaughtered on the range. According to LeBourdais (1946): "*In the winter of 1924 – 25, the winter of the first big drive for scalps – five selected horse hunters were employed in the Chilcotin area, west of Williams Lake…..When the season closed, in the early spring, they had accounted for 2,200 head*."

Dan Weir was one of the licensed horse hunters in the Chilcotin and hunted the range between Redstone and Chilko Lake (which fringes the Brittany area). In 1924 - 25, he shot 430 horses in the area and claimed that 3 other hunters killed over 1500 head over the first 3 winters that they hunted this range. He stated that: "*Horses have been shot on the range periodically but not in any great numbers since 1930*." Weir estimated that in the same area in 1946 there were "*still about 300 head or more of real wild horses as well as 150 head of half gentle stuff still running with the wild ones…*" (Weir, B.C. Archives 1946)

After the WWII market opened up for horsemeat, wild horses were still being shipped from the Chilcotin for slaughter in 1965. McFadden (1965) indicates that the Cloverdale slaughterhouse received a shipment of 54 from Alexis Creek. I have it on good authority from a confidential interview in Williams Lake that this practice still continues today, but further verification is needed.

Also, as recently as ten years ago there was a government-sanctioned shoot-off of some of the wild horse herds on the east side of the Rainshadow Wild Horse Ecosystem to make way for a cattle grazing allotment (Lester Pierce, pers. comm.). This appears to have been successful. During field surveys, I saw evidence of deeply rutted but abandoned horse trails.

3.4 IMPLICATIONS OF CLEARCUT LOGGING

Extensive logging is planned in the near future for mature stands of the pine forest to the north and west of Nuntsi Provincial Park. It was not the intent of this report to conduct an in-depth impact analysis of proposed logging.

I did only a preliminary review of 1:30,000 logging plans proposed by one company (Riverside – Cariboo Woodlands Forest Development Plan, Forest License A54417, Brittany 2001). Apparently other companies also have logging plans.

A more in-depth impact analysis of all proposed logging should be a priority, for both the short-term and long term (100 + year rotation period).

Riverside's proposed "first pass" logging would include construction of a "Brittany Main" haul road approximately 40 km long. This would cross the Chilko River about 2.5 km upstream from its confluence with the Taseko. The road would extend across the middle of the entire Brittany Plateau to about Brittany Lake. There would also be an extensive network of branch roads and a large zone that would involve extensive clearcuts up to and along the western boundary of Nuntsi Provincial Park.

In my opinion, this proposed road system and cut-blocking would effectively bisect and thus fragment the large intact core wildland that comprises the Brittany Triangle. This would mean the loss of a major conservation opportunity for a viable foothills extension to the two B.C. protected areas. As well the opportunity to provide protection for an already existing wild horse refuge would be foregone (see next section).

I have based the following preliminary review on our own extensive analysis of the impacts of clearcut logging on the B.C. coast (McCrory *et al*. 2002), as well as a recent review for World Wildlife Fund Canada of impacts of human developments on large carnivores in the Rocky Mountains (Carroll *et al*. 1999).

The first impact will be the loss of a large enclave of security habitat that is necessary for survival of the population of grizzly bears, wolves and other carnivores. The isolation preferred by wild horse herds will also be diminished. Our limited observations indicate that horses in our study area were selecting available remote habitats to avoid human presence. A review of recent satellite imagery for the region shows that roading and clearcutting of the surrounding lodgepole forests is already extensive (pp. xiii and xiv). The Brittany Triangle appears to one of the last foothills area in the upper Chilcotin headwaters that remains unfragmented.

I am unfamiliar with the impacts of roading and clearcutting on wild horses. West of Sundre, Alberta wild horses have been reported to use clearcuts and have habituated to logging roads (Ian MacRae, film producer, pers. comm.). However, I suspect this would also make them vulnerable to increased mortality from traffic and bullets, as is the case with roadside bears.

On the positive side, I acknowledge that if logging proceeds in our study area, there will be some increase of forage availability for bears and wild horses resulting from creation of new openings. This would include an increase in pinegrass productivity for horses (B.C. Min. of Forests 1982), as well as some berry productivity for bears. However, I also believe the long-term net result of negative influences will far outweigh any short-term positive benefits for the following reasons.

Directly put, the extensive network of logging roads and large clearcuts will cause habitat fragmentation. I would expect the density of roads alone would exceed the threshold (0.4 km/ km^2) above which some large carnivores such as female grizzly bears start to abandon important habitats within at least a 0.5 – 1.0 km zone of influence (Z0I) of road development (Horejsi 1998). Many studies now show that most human-caused mortality to black and grizzly bears occurs within about 1.0 km of human developments, especially roads. (Horejsi 1998. Mattson 1990). This increased mortality rate of less wary bears often offsets any improved habitat values attributed to planted roadsides and clearcuts. Nevertheless, roadside bear foraging has never been considered to be a desirable occurrence, as such bears are a threat to vehicular safety.

Loss of travel corridors for bears to salmon rivers, increased mortality from poaching and hunting, conflicts between moose hunters and grizzly bears, loss of security cover by clearcutting around the numerous small and large meadows, would be only some of the more obvious impacts that need to be further quantified.

Logging would also be expected to increase the rate of natural die-off to moose and wild horse ungulates during deep snow winters. As previously observed during winter surveys on the Chilcotin military block, moose stop feeding in large clearcuts during periods of deeper snow except around the forested peripheries (McCrory 1995). I would expect the same with wild horses, which might use cut-blocks during easier winter periods. In addition, higher energy costs would have to be expended by horses in deep snow winters winter because of having to wade through cut-blocks where once existed the pine forests with sheltered trail networks.

These are only some obvious ecological consequences that warrant further study and consideration.

3.5 CONSERVATION RECOMMENDATION – PROTECT THE WILD HORSE REFUGE

As documented previously, the Rainshadow Wild Horse Ecosystem appears to represent one of the few enclaves of large, wilderness habitats in southern British Columbia where wild horses have managed to survive in a natural refuge. Because of this, Colonial Spanish Horse bloodlines may have some chance of still being present in the gene pool. The Rainshadow Ecosystem has also been shown to represent biologically productive habitats. This includes the wild occurs surviving in a complete predator-prey ecosystem. Overall, then, the area may be somewhat unique and for all intensive purposes, has already acted as a refuge.

Beyond the biology, there are the obvious First Nations cultural and heritage values of the horse herds, especially as the horses appear to have been established for several centuries. According the local Xeni Gwet'in chief Roger William (pers. comm.), their wild horse ways have always been part of the culture and the horses are something they do not want to lose. The 1989 Nemaiah Aboriginal Wilderness Preserve protects these values.

In terms of a rationale for heritage conservation of wild horses that goes beyond biology, Momatiuk (1997) perhaps summarizes it best for the protection achieved in the U.S.: "*Mustangs symbolize much that has been lost to "progress"- wide-open spaces, self-sufficiency, and a sense of unabridged freedom. They're a living lesson in social organization and animal psychology, unhampered by breeders' needs for conformation, color, and behavior. In their remote habitats, they undergo the laws of natural selection, form friendships and families, fight, play, and care for* *each other. Contrary to claims that they are inbreed, sickly, and ugly, most are stunningly handsome and robust.*"

A logical outcome of our field study and background research would be to strongly recommend that these natural refuge values be allowed to continue. By definition, the Xeni Gwet'in have already protected the area under the terms of the Nemaiah Aboriginal Preserve. Protection would also mean some formal designation of protection by the provincial and federal governments of the entire Rainshadow Wild Horse Ecosystem as western Canada's first wild horse refuge.

I could actually find no negative biological rationale (e.g. range damage) not to recommend this. I would caution, however, that some management issues need to be addressed as part of an overall protection package. One is that the B.C. Parks act appears to have no means to accommodate "feral" species in provincial parks such as Nuntsi. The wild horses appear to have been a part of the ecosystem long before the recent establishment of the park. I would suggest the policy be modified as in several U.S. National preserves with feral horses.

3.6 CONSERVATION ATTRIBUTES AND MANAGEMENT CONCERNS OF A WILD HORSE REFUGE

The following is a partial review only.

3.6.1 Competition of wild horses with bears, wild ungulates and domestic cattle

In considering maintenance of a formal horse refuge for our study area, an over-arching concern is the complex question of interspecific competition with other ungulates (and bears) by such a large, successful "grazer" as the feral horse. For example, the relationship between the horse bands and current cattle grazing allotments requires further research. I am aware that there is at least one (#128), which is held to the west of Nuntsi Creek by Joe and Calvin Schuk (Chilko Lake Study Team 1993). There is also some concern by the B.C. Wildlife Branch that wild horses may compete with California bighorn sheep on higher elevation ranges (Chris Schmidt, pers. comm. to Dave Williams). California bighorn appear to be resident in the higher country around the southwest side of the Brittany Triangle. Here they are also near the northern limit of their North American distribution (Chilko Lake Study Team 1993).

It is interesting to note, however, that the feral horse is now so far down the totem pole in the Cariboo – Chilcotin that a recent detailed "*problem*" analysis by B.C. Environment on grassland biodiversity in the region failed to acknowledge that the wild horses even exist and were once present in quite high numbers (Hooper and Pitt 1995). However, I concur with these authors that the inter-relationships between different ungulate species utilizing grassland ecosystems is complex, and that caution must be exercised in drawing any hard and fast conclusions concerning impacts caused by individual grazing species.

As noted by Hooper and Pitt (1995), separation of feeding niches by wild ungulates is well documented on the Serengeti Plains of East Africa and that positive interactions among herbivores are commonly believed to occur in many grassland ecosystems. However, in the Green Mountain Wild Horse Herd Management Area of southcentral Wyoming, a study of habitat selection patterns of wild horses cautioned that their numbers must be managed to mitigate the potential for detrimental impacts to habitats and other large herbivores (Crane *et al*. 1997).

Basically, the wild horses of the Rainshadow Wild Horse Ecosystem share spring to fall range with two native Cervid species (moose and mule deer), possibly one native Bovid species (California bighorn sheep), and some domestic cattle. Elk apparently died off in the Chilcotin in the 1830's for undetermined reasons (McCrory 1995).

Moose appear to be the only other ungulate besides the wild horse that ekes out an existence during the long, cold Chilcotin winters on the Brittany Plateau. The mule deer migrate to more low-lying areas for winter survival. Some deer move as far east as the Fraser River (Chilko Lake Study Team 1993). I am unsure what range overlap occurs, if any, between bighorn sheep and wild horses.

While detailed research is needed to more carefully quantify possible over-grazing competition between feral horses, wild ungulates and domestic cattle, I saw limited evidence of over-grazing during our field surveys. The most damage I observed was being caused by cattle to riparian habitats on private land holdings in Elkin Creek.

Field sign observed from the winter (pellet groups, plant cropping) suggested fair numbers of moose and horses winter in Nuntsi Provincial Park but I saw little evidence of vegetation damage other than over-grazing in a few small riparian areas.

While acknowledging that more detailed research is required, our limited observations are consistent with an in-depth study on wild horse ecology near Tatla Lake, about 50 km north of our study area. Storrer *et al*. (1977) found significant ecological separation between moose and feral horses. They believed this was due to differing food habits. Horses showed preferential use of sedge meadows and upland pine forests, while moose preferred ecotonal areas.

Other studies also suggest some co-existence may be possible between feral horses and other ungulates, including cattle, provided horse numbers are reasonably controlled and cattle use if carefully managed. In a study in the lodgepole pine foothills near Sundre, Alberta, Salter and Hudson (1980) found that there was a general ecological separation of wild horses from deer and moose. While horses shared 90% of sites used by moose over the year, this decreased to 25% during late winter. This was because moose mostly browsed on shrubs while horses fed mostly on grasses and sedges. In one instance in winter, an adult moose and five horses fed within 25 m of each other in a mixed shrub meadow. The moose browsed on shrubs while the horses pawed for graminoids. The potential for competition appeared highest between horses and cattle but grazing relationships were considered complex. During spring, horses used some areas later preferred by cattle but range use was not excessive prior to cattle being turned out. There was little overlap of horses and cattle in summer even though they fed on similar plants.

Interestingly, in a study of 4 wild ungulates on winter range in north central New Mexico, it was found that common use was advantageous because wild horses and elk used a greater proportion of grasses, which received little use by mule deer and pronghorn antelope (*Antilocapra americana*). Empirical observations showed the 4 wild ungulates used different areas, depending on location of water, topography, presence of livestock, and adjacent plant communities (Stephenson *et al*. 1985).

As part of conservation plan for the Brittany, site-specific studies should be made where concerns appear legitimate for competition between feral horses and other ungulates such as cattle and bighorn.

3.6.2 Population control issues - natural self-regulation factors in Rainshadow wild horses

The wild horse of North America is characterized by a high reproductive potential and a long life span (Gross 2000). In the western United States, they have exhibited growth rates that frequently exceed 15% annually, rapidly achieving population sizes that raise concerns about long-term habitat damage (Garrott *et al*. 1991).

Because of their high reproductive potential, many wild horse bands in U.S. protected areas or BLM federal lands with limited carrying capacity are managed to maintain numbers within acceptable limits. For example, the horse population in the Pryor Mountain Wild Horse Range in Montana is carefully controlled because it has the reproductive potential to double in size every 4 - 5 years, attaining a size that presents risks to habitats and to populations of deer and mountain sheep (Garrott and Taylor 1990).

Perceived problems associated with the potential for over-population and over-grazing by feral horses in the Chilcotin appears to be a persistent concern that has received little documentation and study. The draft management plan for Ts'il?os Provincial Park (next to the Brittany) mentions that feral horses may be affecting grasslands communities (p. 39, B.C. Parks 1996). Perceived but undocumented competition with cattle is likely the underlying reason they were shot off about ten years ago from the east side of the Rainshadow Wild Horse Ecosystem.

A careful review of ecological factors indicates that the Rainshadow wild horse population is essentially dissimilar to many "*controlled*" populations in the U.S. Unlike the U.S. populations, the presence of 4 large, top carnivores combined with periodic severe winters would be a dominant factor in natural self-regulation. Secondly, the local Xeni Gwet'in also help control numbers through an annual round up for domestic purposes.

It therefore unlikely that Rainshadow horses over-extend their numbers to the point of causing excessive range damage.

Brittany horses and top predators

Our research shows that the Brittany ecosystem has the full guild of the larger North American carnivore species (grey wolf, mountain lion, grizzly bear and black bear). This is unlike the wild horse areas in the United States in which some or all of these species have been extirpated, particularly the grizzly bear and wolf.

I postulate that predation (along with severe winters) likely plays a stronger role in natural regulation (and natural selection) of the Brittany horse herds than has been reported in the U.S. wild horses. Many of the wild horse populations in the U.S. that require population control are in areas where large predators never existed (i.e. East coast islands) or where most or all of the top predators have been extirpated over the last century or so through aggressive predator control programs designed to protect rancher interests.

The mountain lion is one effective top predator. Large ungulates such as deer and elk can constitute its most common prey (Iriarte *et al*. 1990). Our remote cameras documented one very large mountain lion traveling at night on a horse trail. Although mountain lions still inhabit some U.S. wild horse ranges, Berger (1986) considered mountain lion predation on feral horses as incidental or uncommon. However, in the Montgomery Pass Wild Horse Territory on the central California – Nevada border, mountain lion predation on horse foals was shown to effectively regulate population size (Turner *et al*. 1992). Foal survival rate was one-third less than reported for other feral horse populations. At least four adult mountain lions inhabited the area between May and October. Of 28 foal carcasses located from May to mid-July, 82% were the result of mountain lion kills. No older horses were killed by mountain lions. These predators exhibited "*prey-switching*" with May to October foals as their primary prey, and mule deer serving as the most important winter prey.

At least one wolf pack and their numerous sign were documented in our study area. Wolf scat was more commonly recorded than any other carnivore scat. Analysis is needed to document how much the wild horses are part of their annual diet but I suspect it could be periodically significant. One long-term U.S. horse researcher (Kirkpatrick 1994) stated that: "*the wolf has been driven from the wild horses range. Still, there are some interesting behaviors displayed by wild horses that suggest there is an ancient conflict between the two species*". Anecdotal evidence by several writers (Dobie 1934, Ryden 1978) suggest that feral horses derived from the Spanish types formed circles to protect their offspring from attacking wolves. Ryden (1978) quotes one first-hand incident on the prairies from about 1842 (reported in the New York Times in 1882).

Kirkpatrick (1994) does not believe that bears, where they share their range with wild horses, play any role in predation. He noted that wild horses grazed in the Pryor Mountains within 100 metres of a black bear and displayed little alarm or obvious concern. The same author also noted that the bears didn't pay much attention to the horses either.

Unfortunately, no studies appear to have been done to test the relationship between bears and horses. However, given the predatory and scavenging behaviour documented in both bear species, [which are largely vegetarian (Herrero 1985)]; I suspect that they would opportunistically feed on wild horses in our study area, such as on weakened animals or on foals.

Several authors (Hechtel 1978, Archibald 1983) hypothesize that grizzly bears move in a random search pattern to increase the probability of finding high-energy animal food sources.

Both bear species have been known to prey on calf and adult moose and elk, which are almost as large as the wild horse foals. In Banff National Park, Hamer and Herrero (1983) concluded that: "*Hunting for elk calves appeared to be a major activity for grizzly bears during the elk calf season*." They also reported feeding on the carcass of a dead bull elk. In central Idaho, there is currently a proposal to experimentally limit black bear numbers because of a high predation rate on elk calves (Steve Nadeau, Idaho Fish and Game Dept., pers. comm.). I have personally observed grizzly bears feeding on bison carcasses in Yellowstone National Park, defending the meat source from wolves and coyotes.

Also noteworthy would be that Rainshadow wild horses would constitute an important alternative prey species for top predators. This would likely decrease predation pressures on other ungulate species in the ecosystem.

Natural regulation by starvation winters

As noted in Salter and Hudson (1979), horses can survive exceptionally hardy climates, including sub Arctic conditions, and are able to utilize low quality forages by cratering beneath snow up 60 cm depth. However, they do experience weight loss over the winter and nutritionally stressed animals are predisposed to widespread starvation with prolonged deep snow and extreme weather conditions.

In the Pryor Mountain Wild Horse Range, Garrott and Taylor (1990) reported that small numbers of horses died in most winters but in 1977-78, severe winter conditions caused a 51% loss of the population. There were alternating periods of heavy snow accumulations followed by warm temperatures that caused icing within the deep snow, which made foraging very difficult. During above-normal snowfall (without icing) in 1983-84, 13% of the population also died

Salter and Hudson (1979) report that large die-offs have been documented by Forest Service personnel along the Alberta foothills and in the interior of British Columbia. However, they felt that, because of absence of long-term data in their Alberta foothills study, they could not determine the importance of nutritional stress in regulating population levels of wild horses.

In the Brittany Triangle, periodic prolonged winters with deep snowfall and cold weather extremes would be a strong factor in periodic population declines as has been reported elsewhere. The presence of healthy numbers of top predators would interplay with this, but even in mild winters, predation on weakened animals would maintain some self-regulation. Long-term studies are needed.

3.6.3 Horse removals and control

Our review suggests that current control of numbers of the Rainshadow wild horses by severe winters; large predators and live-capture by local First Nations may preclude any artificial control measures being necessary.

However, it is still worth touching on some of the artificial control methods employed in the U.S. One concern that emerged from our review was that horse controls through excessive removals may pose a threat to the genetic viability of small, isolated horse herds. Because of this, in some U.S. areas, infertility treatments have been suggested as a better alternative to removal through periodic round-ups.

In the U.S., most management strategies on BLM lands involve round-ups that remove about 8,000 horses annually as part of their Adopt-A-Horse program (Gillis 1994). For the Pryor Mountain Wild Horse Range, BLM personnel removed 143 horses from the population between 1976 and 1986. The highest number removed in any year was 48, representing about 25% of the population. Although the annual growth rate of the herd is 18%, by removing animals, the population was maintained at 120 - 150 individuals (Garrott and Taylor 1990). Originally, horse capture was achieved by capture and immobilizing drugs but this was changed in favour of corral trapping. Men on horseback drive small groups of horses into permanent corral traps erected in advantageous locations throughout the Wild Horse Range. Experienced wranglers also rope horses eluding the corrals or those of particular interest. Once trapped, horses are restrained by roping the head and hind legs in a procedure known as “*heading and heeling*” (Garrott and Taylor 1990).

In other BLM areas, helicopters are used to round up feral horses. A detailed study of the effects of such roundups on behaviour and reproduction was done on two BLM areas, one in central Idaho and the other in central Wyoming. The researchers found no evidence that roundups were having deleterious effects on feral horses (Hansen and Mosley 2000).

However, despite these results, there is now concern that such control removals from small, isolated horse populations such as the 150 horses inhabiting the Pryor Mountain Wild Horse

Range could be deleterious to genetic viability (Gross 2000). Genetic diversity rapidly disappears in small populations (Wright 1931). A review by Gross (2000) concluded that management strategies for wild horse control that relied less on removal of the animals and more on infertility treatments would help reduce threats of long-term loss of genetic variation. Short-duration contraceptives have been used to successfully control growth of horses on Cumberland Island (Georgia) and Assateague Island (Maryland) off the east coast of the U.S. (Gross 2000).

(Gross 2000) also pointed out the general lack of appreciation among wildlife managers and biologists of the important roles of generation time and effective population size in maintaining genetic variation in long-lived species subject to management control.

3.6.4 Wild horses as possible disease vectors

There are recent concerns from local livestock owners in the Chilcotin that feral horses may be infected with Equine Infectious Anemia (EIA) or "swamp fever" (Dave Williams, pers. comm.). The concern is that feral horses may transit the disease to domestic horses. As noted by the Canadian Food Inspection Agency: "*The significance of Canada's feral horses with respect to disease transmission and surveillance is uncertain. It is possible that feral populations could serve as EIA carriers and sources of infection via vector spread to domestic horses. They could also serve as a reservoirs of disease after being infected from domestic horses…While the immediate risk of feral animals serving as effective disease reservoirs or vectors in Canada seems low, we must recognize the potential for change.*" (Fisher 1999).

Bearcroft (1974) reported on a major outbreak of EIA (gleet or glanders) in Alberta from 1899 – 1903 which almost exterminated valuable imported horses, but which hardly affected the hardy native range-bred horses.

EIA is caused by a virus, which reproduces in the red blood cells. When the immune system of an infected horse tries to fight the virus it also destroys the healthy red blood cells. This causes anemia, which makes the horse vulnerable to other infections and diseases. Some horses can have an acute form and some are carriers. EIA is usually spread by blood (shared veterinarian needles, horseflies, etc.) or through breeding (10% of the time). Stallions may transmit to mares and mares may transmit to foals. EIA is considered an infectious disease by Canadian Food & Inspection Agency. It is tested with a Coggins test and a horse with a positive result will be retested by another lab. If both tests are positive, the horse must be euthanized or permanently quarantined. It has been reported in the Smithers/Houston area, the Kispiox Valley, and the Cariboo (McCrindle 2001).

In Montana, EIA is considered a vector borne disease with insects that feed on blood (primarily horse flies) being the main transmitters; although common needles are also recognized. Infected equines are quarantined 200 m from any other equines since transmission beyond this via insects has not been documented. It has been diagnosed in Montana for years but there has been a recent outbreak in seven horses (Gertonson 2000). Further review also suggests the whole epidemiology, threat and testing for the disease is now being questioned by a variety of interests (Online: See http://www3.sk.sympatico.ca/brown7/RC-EIA.html).

Certainly, in terms of considering a wild horse refuge to the Brittany, the concerns for EIA transmission needs to be more adequately researched and addressed.

3.6.5. Compensation fund for rancher losses from predators

The Brittany Wild Horse Ecosystem exists along the eastern fringes of the Coast Mountains. To the east is the Chilcotin zone of extirpation of wolves and grizzly bears due to conflicts or perceived conflicts with extensive cattle ranching interests. For example, few wolves appear to presently exist in the nearby Taseko Management Area (Sopuck *et al*. 1997). McCrory (1995) reported little evidence of grizzly bears still existing on the Chilcotin Military Block about 80 km to the east. A wolf pack was evident but being subject to poisoned baits (Compound 1080) due to apparent conflicts with cattle ranching interests (see photos, above). Most livestock losses to predators in the region are attributed to wolves and 1080 was considered the most effective (Hooper and Pitt 1995) despite its known lethality to other animals. It has been used in the Chilcotin since 1978, but a moratorium was implemented in B.C. in 1999 (Hooper and Pitt 1995).

As reported in a previous section, 3 grizzly bears were recently killed near the Brittany due to conflicts with ranchers. Interestingly, in the Yellowstone Ecosystem, a study showed that only a few adult males of a grizzly population became cattle predators and accounted for 39% of calf mortalities and 12% of adult cattle mortalities (Anderson *et al*. 2001).

There is currently no program in the Chilcotin to compensate ranchers for livestock losses proven to be incurred by predators. Problem wildlife has generally been handled by conservation officers using poison baits in winter and trapping at other times (Hooper and Pitt 1995); or by the ranchers themselves (W. McCrory, personal observations).

Compensation programs have proven to be partially successful in the U.S. in reducing control kills of wolf and grizzly bears related to livestock operations (Marty Smith, Defenders of Wildlife, pers. comm.). A survey of grassland problems by Hooper and Pitt (1995) indicated that ranchers in the Cariboo - Chilcotin were reluctant to become involved with compensation programs, which they view as creating more government bureaucracy.

Hand in hand with proposed protection of the Rainshadow Wild Horse Ecosystem, the pros and cons of establishing a rancher compensation program should be seriously reviewed with respect to a large adjacent buffer zone; especially since overall protection, including Nuntsi and Tsy?los Provincial Parks, will help maintain viable populations of large predators whose home territories will just not be confined to the preserve.

"***Clearly, if carnivore conservation is impeded by a problem between local communities and carnivore behaviour, problem resolution must involve not only carnivore that is the problem, but also the humans who are having the problem***." (Sillero-Zubiri and Laurenson 2001).

Grizzly bears, wolves and other large carnivores that travel from the isolation and security of core habitats in the mountains such as the Brittany Triangle to more developed lands to the east likely have low survival rates due to conflicts and perceived conflicts with ranchers and others. The author photographed this dead cow set out as poisoned bait for a pack of wolves near Riske Creek in the winter of 1994. The Conservation Officers had laced it with 1080, a poison that is also lethal to birds and other animals. In 1999, a moratorium was placed on the use of 1080. (Photos by W. McCrory).

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APPENDIX I. Summary of habitat transects from field surveys in June, 2001.
Brittany Triangle study area.

Topographic maps which accompany these transect lines and stations are still "*in file*" and have not yet been drafted for inclusion. August habitat transects are typed up as field notes but were not tabularized. Habitat unit codes were for field classification and have since been modified.

Table 6. Results of bear habitat transect results of Rainshadow Wild Horse Ecosystem - Brittany Triangle. June 2001. Bear food density ratings and observations.

Loc-ation	Transect # & date& air photo polygon	Dist.	Bear habitat unit	Code	Elev-asp-ect	Bear foods	Seas-Pot	Sign & comments
June 15-Far Mead. Cabin-Brit. Cr.	June 15, B1-2, old road west	1 km	Pine-bearb-soop-grasses	PBbSo	1350 m	Bearb(M/L) Soop(L) Grass(L) Ants(M)	Spr(L) Sum(L) Fall(M)	Low prod. bearb of last fall's fruits, horse sign
	June 15, B2-3, old road west 1350	300 m	Grass-sedge meadow	Gr-Sedge	1350 m	Gr(H) Sedge(H)	Spr(H) Sum (H)	Horse use (H), no bear sign
	June 15, B3-4, old road west	1 km	Pine-bearb-soop-grasses	PBbSo, 41-60yr. burn	1350 m	Bearb(M/L) Soop(M) Grass(M) Ants(M)	Spr(L) Sum(L) Fall(M)	1 last fall's bearb. Scat, horse sign
	June 15, B4-5, old road west 1350	500 m	Grass-sedge meadow	Gr-Sedge	1350 m	Grass(H) Sedge(L)	Spr(H) Sum (H)	Horse use (H), no bear sign
	June 15, B5-6, old road west	3 km	Pine-bearb-soop-grasses	PSoBb, 41-60 yr. burn	1300 m	Bearb(L) Soop (L/M) Grass(M) Ants(M)	Spr(L) Sum(L) Fall(M)	West slope Mod beetle kill '75-'89 To log.
	June 15, B6-7 old road west	300 m	Grass-sedge meadow	Gr-Sedge	1300 m	Grass(H) Sedge(L)	Spr(H) Sum (H)	Horse use (H), no bear sign
	June 15, B7-8, old road west	1.5 km	Pine-bearb-soop-grasses	PSoBb, 41-60 yr. burn	1300 m	Bearb(M/L) Soop(M) Grass(M) Ants(M)	Spr(L) Sum(L) Fall(M)	Gb hair coll off rub tree on road closer to B7
	June 15, B8-9, Brit Cr Meadow	1 km, loop	Large, grass-sedge meadow. Old homestead	Gr-Sedge	1300 m	Grass(H) Sedge(H)	Spr(H) Sum (H)	Horse/Moos use (H), High prod. and extens. No bear sign
	Adjacent west side		Semi-open pine-Bearb			Bearb(H), Grasses(M)		Old trail, horse, wildlife

Location	**Transect # & date& air photo polygon**	**Dist.**	**Bear habitat unit**	**Code**	**Elev-aspect**	**Bear foods**	**Seas-Pot**	**Sign & comments**
June 16-Far Mead. Cabin-North Tr. Area	June 16, B3-B10, North Tr. Area	1 km	Large, grass-sedge meadow s linked by narrow pine corridor	Gr-Sedge	1350 m	Grass(H) Sedge(L)	Spr(H) Su(H)	Horse use(H); Wolf scat on adjacent horse trail
	June16, B10-B11, North Tr. Area	500 m	Pine-bearb-soop-grasses	PSoBb; 41-60 yr	1350m	Bearb(L) Soop(M) Grass(M) Ants(M)	Spr(L) Su(L) Fall(M)	Horse use (H); no bear sign.
	June 16, B11-B12, North Tr. Area	500 m	Large, grass meadow	Grass	1350 m	Gr(H) Dandel(M)	Spr(H) Su(H)	Horse use(H); no bear sign
	June16, B12-B13, North Tr. Area	500 m	Pine-bearb-soop-grasses	PSoBb; 41-60 yr	1350m	Bearb(L) Soop(L)	Spr(L) Su(L) Fall(M)	Horse use(H); 11 horses(2 colts) in meadow
	June 16, B13-B14, North Tr. Area	500 m	Large, grass meadow	Gr-Sedge	1350 m	Grass(H) Sedge(L) Dandel(M) Ants(L)	Spr(H) Su(H)	Horse use(H); no bear sign
	June16, B14-B15, North Tr. Area	500 m	Pine-bearb-soop-grasses	PBbSo; 41-60 yr	1350m	Bearb(M) Soop(L) Grass(H) Ants(L)	Spr(L) Su(L) Fall(M)	Un-even aged burn; lush,hairy wild rye grass
	June16, B15-B16, North Tr. Area	1 km	Pine-bearb-soop-grasses	PBbSo; open, mixed age	1350m	Bearb(L) Soop(M) Grass(M)	Spr(L) Su(L) Fall(M)	Un-even aged burn; lush,hairy wild rye grass
	June 16, B16-B17, North Tr. Area	100 m	Large, grass meadow; same as B13-B14; but N-S Transect.	Gr-Sedge	1350 m	Grass(H) Sedge(L) Dandel(M) Ants(L)	Spr(H) Su(H)	Horse use(H); 2 bear scats in SE corner; one Bb and other Veg.< 1 week
	June16, B17-B18, North Tr. Area	750 m	Pine-bearb-soop-grasses	PBbSo; open, mixed age	1350m	Bearb(L) Soop(L) Grass(M)	Spr(L) Su(L) Fall(L)	
Lower Nuntsi/Elkin Creek	June 17, B19-B20, Trapper trail	2 km	Willow/bog birch/ Wet meadow	Mead/Sa/ Bet/Gram	1300 m	Grass(M/H) Sedge(L) Ants(H) Bb(L)	Spr(H) Su(H) Fall(L)	Wolf scat <2 weeks; fine hair

	June17, B20-B21, Trapper trail	2 km	Pine-bearb-soop-grasses	PBbSo; open, mixed age class	1350m	Bearb(L/M) Soop(Tr) Grass(L/M) Sedge (L) Ants (L) Vetch (Tr)	Spr(L) Su(L) Fall(L)	Horse sign; old wolf scat; sedges/grasses at lake margin (B21)
	June17, B21-B22, Bush walk on compass bearing	3 km	Pine-bearb-soop-grasses	PBbSo; mostly open mosaic; mixed age class	1350m	Bearb(L) Soop(L/Tr) Grass(M/H) Ants (Tr) Rose(Tr) Dandel(M) Med rue(L)	Spr(L) Su(L) Fall(L)	2 bear scat < 4 days; couple horse meadows; dandelion/ meadow rue
	June17, B22-B23, Bush walk on compass bearing	3.5 km	Doug fir-bearb-soop-grasses	DfPark BbSo; mostly open mosaic; mixed age class	1350m	Bearb(L) Soop(Tr) Grass(H) Rose(Tr) Vetch(Tr)	Spr(L) Su(L) Fall(L)	Cougar sign; Wolf scat; Bear scat
	June 17, B23-B24, Bush walk on compass bearing	300 m	Large, grass meadow	Grass	1300m	Gr(H) Dandel(Tr)	Spr(H) Su(H)	Horse use(H); no bear sign
	June17, B24-B25, Bush walk on compass bearing	500 m	Pine-bearb-soop-grasses	PBbSo; 1-20yr	1300m	Bearb(L) Grass(H) Rose(Tr) Vetch(Tr)	Spr(L) Su(L) Fall(L)	Horse use(H); no bear sign
	June17, B25-B19, On road	1 km	Pine-bearb-soop-grasses	PBbSo; 40-60yr	1300m	Bearb(M) Grass(M) Soop(M) Ants(L)	Spr(M) Su(M) Fall(M)	Large wolf track on road
Far Meadow cabin to upper Nuntsi Creek mead	June18, B26-B27, On Ho Tr Sw of Cam site #1	2 km	Pine-bearb-soop-grasses	PSoBb; Mixed age;	1300m	Bearb(L) Grass(L/M) Soop(M) Rose(Tr)	Spr(L) Su(M) Fall(M)	On horse trail
	June 18, B27-B28, Upper Nuntsi Cr	100 m	Grass-sedge meadow	Gr-sedge	1300m	Gr(H) Sedge(L) Ants(L)	Spr(H) Su(H)	Horse/ Moose use(H); no bear sign

	June18, B28-B29, Upper Nuntsi Cr	500 m	Pine-bearb-soop-grasses	PBbSo; Mixed age;	1300m	Bearb(L) Grass(L) Soop(L) Rose(Tr)	Spr(L) Su(L) Fall(L)	On horse trail; old burn
	June 18, B29-B30, Upper Nuntsi Cr	100 m	Grass-sedge / Shrub meadow NE lake	Gr-sedge/ shrub	1300m	Gr(H) Sedge(M) Ants(L)	Spr(H) Su(H)	Horse/Moos use(H); no bear sign; old wolf scat
	June18, B30-B31, Upper Nuntsi Cr	500 m	Pine-bearb-soop-grasses	PSoBb; 40-60yr	1300m	Bearb(L) Grass(L) Soop(M) Rose(Tr)	Spr(L) Su(L) Fall(M)	On horse trail
	June 18, B-B31-B32, Upper Nuntsi Cr	1km	Grass-sedge / Shrub meadow	Gr-sedge/ shrub	1300m	Gr(H) Sedge(M) Ants(L)	Spr(H) Su(H)	Horse/Moos use(H); no bear sign; old wolf scat
	June 18, B-B32-B33, Upper Nuntsi Cr	500 m	Grass-sedge / Shrub meadow	Gr-sedge/ shrub	1300m	Gr(H) Sedge(M) Ants(L)	Spr(H) Su(H)	Horse/Moos use(H); no bear sign; old wolf scat
	June18, B33-B35A, Upper Nuntsi Cr	1km	Pine-bearb-soop-grasses	PSoBb; Mixed age	1300m	Bearb(L) Grass(L) Soop(M) Rose(Tr)	Spr(L) Su(L) Fall(M)	Bushwack;High Moose sign;Grouse(H);coyote grouse kill
	June18, B35A-B36A, Upper Nuntsi Cr	1.5km	Pine-bearb-soop-grasses	PSoBb; Mixed age	1300m	Bearb(L) Grass(L) Soop(M) Rose(Tr)	Spr(L) Su(L) Fall(M)	Bushwack; High Moose sign
	June18, B36A-B34, Upper Nuntsi Cr	500 m	Pine-bearb-soop-grasses	PBbSo; Mixed age	1300m	Bearb(L) Grass(L) Soop(L) Rose(Tr)	Spr(L) Su(L) Fall(L)	Bushwack;High Moose sign
	June18, B32-B32A, South meadow	1.5km	Pine-bearb-soop-grasses	PBbSo; Mixed age	1300m	Bearb(L) Grass(L) Soop(L) Rose(Tr)	Spr(L) Su(L) Fall(L)	ATV Road/HoTr;2 fresh wolf meat scats; 1 old coyote; High Moo/Ho use
	June 18, B-B32A-B33A, South meadow	500 m	Grass-sedge / Shrub meadow	Gr-sedge/ shrub	1300m	Gr(H) Sedge(L) Ants(L)	Spr(H) Su(H)	Horse/Moos use(H); no bear sign
	June18, B33A-B34A,	1.km	Pine-bearb-soop-grasses	PBbSo; Mixed age	1300m	Bearb(L) Grass(L) Soop(L) Rose(Tr)	Spr(L) Su(L) Fall(L)	ATV Road/HoTr;; High Moo/Ho use

Location	Transect # & date& air photo polygon	Dist.	Bear habitat unit	Code	Elev-aspect	Bear foods	Seas-Pot	Sign & comments
Lower Elkin Cr	June 19, B34-B35, Downstream	3 km	Willow/bog birch/ Wet riparian meadow	Mead/Sa/ Bet/Gram	1000 m	Grass(L) Sedge(L) Ants(L))	Spr(L) Su(L) Fall(L)	Cattle trail
	June19; B35-B36, Downstream	1.km	Pine-aspen-spruce riparian zone	P/A/SBb So	1000m	Bearb(L/M) Grass(H) Soop(Tr) Ants(L) Rose(Tr) W.Straw (Tr) Vetch(Tr) Clover (Tr)	Spr(H) Su(L) Fall(L)	Potential spawn ground
	June19; B36-B37, Downstream	750 m	Spruce riparian zone	Spru Rip	1000m	Soop(Tr) Bunb(Tr) Rose(Tr)	Spr(L) Su(L) Fall(L)	2 Mark trees; Classic bear trail; fishingsite;moose sign
	June19; B37-B38, Downstream	1km	Pine-aspen-spruce riparian zone	P/A/SBb So	1000m	Bearb(Tr) Grass(H) Soop(Tr) Currant (Tr) Rose(L) Horsetail (L)	Spr(M) Su(L) Fall(L)	Mark tree Classic bear trail;spruce cambium feeding; moose sign
	June19; B38-B39, Up east slope	500 m	Pine-aspen Park land	P/A/BbSo	1300m	Bearb(L) Grass(H) Soop(L) Ants(L) Vetch(Tr) Rose(Tr)	Spr(H) Su(M) Fall(L)	Pine/aspen mosaic ; upslope; mule deer sign
	June17, B39-B40, East ridge	3 km	Pine-Douglas fir Park	PDfBbSo; Predom. mixed age Pine; scattered Doug. fir	1600m	Bearb(L) Soop(L) Grass(H) Ants(Tr) Rose(Tr) Vetch(Tr)	Spr(H) Su(M) Fall(L)	Much more xeric than west side ridge; far fewer fir stands; lack of game trails; much beetle kill
	June19; B40-B41, Down east slope	500 m	Pine-aspen Park land	P/A/BbSo	1300m	Bearb(L) Grass(M) Soop(L) Ants(L) Vetch(Tr) Rose(Tr)	Spr(M) Su(M) Fall(L)	Pine/aspen mosaic ; downslope; steeper slope

	June 19, B41-B34, Valley bottom	2 km	Willow/bog birch/ Wet riparian meadow	Mead/Sa/ Bet/Gram	1000 m	Grass(H) Sedge(H)	Spr(H) Su(H) Fall(L)	Very lush wet meadow On private L7381; cattle use
Location	**Transect # & date& air photo polygon**	**Dist.**	**Bear habitat unit**	**Code**	**Elev-aspect**	**Bear foods**	**Seas-Pot**	**Sign & comments**
Old rd., 2 km e. of Far Meadows. Rd. is cut out (Lester P)	June 21, B42-43	200 m	Meadow			Dandelion(L), Grasses (H)	Spr-Early summer (L)	-fresh & winter horse. -1 lppine, camb.feed
	B43-44	0.5 km	Pine-bearb-soop-grasses	PBbSo; Mixed age	1300m	Bearb(L) Grass(L) Soop(L)	Spr(L) Su(L) Fall(L)	-Fresh horse tracks -1 winter wolf scat (hair, meat)
Old rd. on n. side of lake. Lake has quicksand all around edge	B44-45	0.5 km	Meadow-quicksand lake, danelion meadow @ e. end. Stoney shore, limited grasses	Mead/Grass/ dandelion	1300m	Dandelion(L), Grasses (L)	Spr-Early summer (L)	-fresh & winter horse. -4 bear scats (Green veg-<1 wk), 2 Bb tr, 1 Gb tr, 1 dig
	B45-46	2 km	Pine-bearb-soop-grasses	PBbSo; Mixed age	1300m	Bearb(L) Soop(L) Grass(L)	Spr(L) Su(L) Fall(L)	-Fresh horse tracks
	B46-47, June 18 & 21	0.3 km	Large meadow-danelion meadow , 4 small ponds/lakes	Mead/Grass/ dandelion	1300m	Dandelion(L), Grasses (H), sedges L)	Spr-Early summer (H)	-fresh & winter horse. -no bear sign
Cut trail to e.end of Far Mead. Lk. & rd.	Near B45-48	2 km	Pine-bearb-soop-grasses, small meadows @ e. end of Far Meadows Lake	PBbSo; Mixed age	1300m	Bearb(L) Soop(L) Grass(L)	Spr(L) Su(L) Fall(L)	-Fresh horse tracks, several trails -1 last yr. veg scat, 1 3-day veg scat
Location	**Transect # & date& air photo polygon**	**Dist.**	**Bear habitat unit**	**Code**	**Elev-aspect**	**Bear foods**	**Seas-Pot**	**Sign & comments**

Lower Nuntsi Cr. NE drainage from Far Meadow Rd	June 21, B49-B50,	1 km	Spruce/willow/ birch riparian zone	Spru Rip	1300 m	Grass(H) Sedge(M) Soop(L) Bb(L) Vetch(Tr) Ants(L) Rose(L)	Spr(H) Su(H) Fall(L)	Creek is pond-like; Mark tree w/brown hair; 4 bear scats <5m apart moose/ horse sign
	June 21, B50-B51	0.2km	Grass-Sedge meadow	Gr-sedge	1300m	Grass(H) Sedge(H) Soop(L) Bb(L) Ants(L) Rose(Tr)	Spr(H) Su(H) Fall(L)	Very large wet meadow; log torn open
	June 21; B51-B52	0.5 km	Spruce/aspen/ willow	SpruRip	1300m	Grass(H) Sedge(L) Bb(L) Soop(L) Rose(L)	Spr(H) Su(H) Fall(L)	More mesic than B49-B50; moose sign; more aspen stands
	June 21; B52-B53	0.1 km	Lake/Willow/ birch/Gr-sedge	Lentic Rip	1300m	Grass(H) Sedge(H) Bb(L) Soop(L) Rose(L) Ants(L)	Spr(H) Su(H) Fall(L)	Bear scat < 1 month; Horse sign
	June 21; B53-B54	0.2 km	Pine-bearb-soop-grasses	PBbSo; Mixed age	1300m	Bearb(L) Soop(L) Grass(L)	Spr(L) Su(L) Fall(L)	2 bear scats; 1 Gb at edge off meadow in timber
	June 21; B54-B55,	0.1km	Grass meadow	Mead-Gr	1300m	Gr(H) Dandel(H) Wstraw(L)	Spr(H) Su(H)	3 bear scats; horse sign
	June 21; B55-B56	0.5 km	Pine-bearb-soop-grasses	PBbSo; Mixed age Mod. beetle kill	1300m	Bearb(L) Soop(L) Grass(M) Ants (Tr)	Spr(M) Su(L) Fall(L)	Bear scat similar to B54-B55; horse trail disperses
	June 21; B56-B57	1 km	Pine-bearb-soop-grasses	PBbSo; Mixed age Mod. beetle kill	1300m	Bearb(L) Soop(L) Grass(M) Ants (Tr)	Spr(M) Su(L) Fall(L)	
	June 21, B57-B58,	0.5 km	Spruce/aspen/ Shrub riparian	Spru Rip To Lake inlet	1300 m	Grass(H) Sedge(H) Soop(L) Rose(L)	Spr(H) Su(H) Fall(L)	Gr-sedge; narrow margin on creek
	June 21; B58-B59	0.1km	Lake inlet/Gr-sedge	Gr-sedge	1300m	Grass(H) Sedge(H)	Spr(H) Su(H)	200m wide Gr-sedge meadow at inlet

	June 21; B59-B60	1.5 km	Lake/Willow/ birch/Gr-sedge	Lentic Rip	1300m	Grass(M) Sedge(L) Bb(L) Soop(L) Rose(L) Currant(Tr) Wstraw (Tr) Ants(L)	Spr(M) Su(M) Fall(L)	Mark tree on N shore margin trail; old horse sign, winter in spruce; sedge margin; eagle
	June 21; B60-B61	0.5km	Lake/Willow/ birch/Gr-sedge	Lentic Rip	1300m	Grass(H) Sedge(H)	Spr(H) Su(H)	Gr-sedge marsh; moose/horse sign
	June 21; B61-B62	0.5 km	Pine-bearb-soop-grasses	PBbSo; Mixed age Beetle kill(H); down timber	1300m	BearbM) Soop(L) Grass(L)	Spr(L) Su(L) Fall(L)	Heavy down timber Disperses horse movement
	June 21; B62-B63	1.5 km	Lake/Willow/ birch/Gr-sedge	Lentic Rip	1300m	Grass(M) Sedge(L) Bb(L) Soop(L) Rose(L) Currant (Tr) Wstraw (Tr) Ants(L)	Spr(L) Su(L) Fall(L)	Similar habitat to B59-B60 but not extensive Gr-sedge marsh; horse sign
	June 21; B63-B64	1 km	Pine-bearb-soop-grasses	PBbSo; Mixed age Beetle kill(M); down timber	1300m	Bearb(L) Soop(L) Grass(M) Rose(L)	Spr(L) Su(L) Fall(L)	Moderate down timber Disperses horse movement
	June 21, B64-B65	1 km	Grass-Sedge meadow	Gr-sedge	1300m	Grass(H) Sedge(L) Dandel(L) Potentilla(L) Ants(L)	Spr(H) Su(H) Fall(L)	Horse sign;
	June 21; B65-B66	0.5 km	Pine-bearb-soop-grasses	PBbSo; Mixed age Beetle kill(L); down timber	1300m	Bearb(L) Soop(L) Grass(M)	Spr(L) Su(L) Fall(L)	Horse trail disperses
	June 21; B66-B67,	0.1km	Grass-sedge meadow	Gr-sedge	1300m	Gr(H) Sedge(L) Bb(L) Ants(L) Dande (L/M) Potentilla (L)	Spr(M) Su(M)	Horse/moos sign

	June 21; B67-B68	0.5 km	Pine-bearb-soop-grasses	PBbSo; Mixed age Beetle kill(L/M); down timber	1300m	Bearb(L) Soop(L) Grass(M)	Spr(L) Su(L) Fall(L)	Horse trail disperses
	June 21; B668-B69,	0.1k m	Pine-grass parkland	Pine-Gr	1300m	Gr(M)	Spr(L) Su(L)	Meadow nearly lost to pine
	June 21; B69-B70	1 km	Pine-bearb-soop-grasses	PBbSo; Mixed age Beetle kill(M/H); down timber	1300m	Bearb(L) Soop(L) Grass(M) Rose (Tr)	Spr(L) Su(L) Fall(L)	Horse trail disperses
	June 21; B70-B71,	0.1k m	Grass-meadow	Mead-Gr	1300m	Gr(H) Dande (M) Potentill (H)	Spr(H) Su(M)	8 horses; 1 stallion, 4 mares, 2 yearlings, 1 foal

APPENDIX II. Results of remote camera set-ups #1 to #9, Brittany Triangle Study area, 2001

Table = Cam.#1. Results of remote camera #1 set up on primitive road, about 1 km west of Far Meadows research station.

Date- June	**Species & classn.**	**Photo/ sign**	**Date of use/ Time**	**Comments**	**Cam. days**
CAM # 1 June 18/01:				set-up	
June 21/01	Mule deer & 2 newborn fawns		9:20 a.m.	Travel & sniff @ trail	
June 24/01	Mule deer, male		19:59	Travel n. on horse trail & sniff	
June 26/01	Adult wolf		3:39 a.m. Dark	Tail only. Looks like large grey. Travel w. on road	
June 29/01	Adult wolf? (Same)		2:11 a.m. Dark	Back only. At cam. & rec..	
Summary	**4 deer, 2 wolf**				**12**
July 10/01	Cow moose	Large, no bell	2:24 – 2:26 a.m.	Travel on rd. & sniff @ trail	
July 10/01	Cow moose-smaller	Diff.?	19:08	Travel n. on horse trail	
July 12/01	Bay mare & foal (+ 2 ad.? in back-ground	Rear feet-founder	7:34	Travel s. on horse trail	Wx - sunny
July 12/01	Black stallion (1 in back-ground)		7:36	Travel s., sniff trail	
July 13/01	Coyote (Ad.)		12:45	Travel n. on trail	
July 13/01	Mule deer, female		22:58 (Dark)	Travel n. on trail	
July 15/01	Ad. wolf	Lge. & gray	11:34	Travel n. on main trail	
July 26/01	Mule deer, doe		6:55 (Light)	Travel s. on horse trail	
July 27/01	Bay mare, foundered. Others in back-ground	No colt	6:42 (Light)	Travel s. on horse trail	
July 27/01	2 Bay mares (1-small white face patch)		6:43	Approach from n.	
July 27/01	Lge. dark mare, colt & mares		6:43	Travel s.	
July 27/01	Bl. Stal.		6:43	Travel s.	
July 27/01	Dapple grey mare-white rear socks & 2 more behind		6:44	Travel s.	
July 27/01	Smaller mare, bay	2-year	6:44	Travel s.	
July 30/01	Mule deer doe		9:06	On road, travel w.	
Summary	2 horse move-ments,	2 moose, 3 mule deer 1 coyote 1 wolf			30 cam. days
Aug 1/01	Mule deer, buck	Antlers in photos	0:01 (Dark)	Near camera	
Aug 4/01	Mule deer, 2 does	Strange scars on side	8:42-8:43	Travel s. on horse tr.	

Aug. 10/01	scarred mule deer doe with fawn (spots)		9:04	walking s. on horse-trail	
Summary	**5 diff. mule deer**			**Sev. have strange scars-lynx attacks?**	**30? Cam.** days
Sept. 10/01	coyote		17:01	walking n. near horse-trail	
Sept 15/01	moose, Ad.		1:32 Dark	walking w. on road	
Sept. 15/01	cow moose		4:20 Dark	walking w. on road	
Sept. 16/01	Red squirrel		19:36	base of tree	
Sept. 20/01	Ad. moose	rear end	18:04	going w. on road	
Sept. 22/01	Ad. moose	back	20:16 (Dark)	facing w. on road	
Summary	**1 coy., 4 moose**			Forest fire	**23 days**

Table = Cam. #2. Results of remote camera #2 set up on primitive road about 2 km west of Far Meadows research station.

CAM # 2 Aug 20/01 Set-up					
Date	**Species & classn**	**Photo/ Sign**	**Date of use/Time**	**Comments**	**Cam. days**
Sep 01/01	grey wolf		23:59 (Dark)	travel e.	
02/01	2 grey wolves (immature)		00:00 (Dark)	facing camera	
02/01	2 grey wolves		00:00	sniffing ground; facing e. & w.	
02/01	grey wolf		00:01	sniffing flag on mark tree	
02/01	grey wolf		00:01	Approach-ing mark tree from e.	
02/01	grey wolf		00:01	Approach-ing mark tree from e.	
Sep 02/01	2 grey wolves		00:01	1 wkg e; other app 1st	
02/01	grey wolf	back to camera	00:02	looking west	
02/01	grey wolf		00:02	sniffing ground behind mark tree	
05/01	grey wolf (same immat.)		20:13 (Dark)	trotting w.	
05/01	grey wolf		20:13	looking at camera	
05/01	grey wolf		20:14	sniffing @ mark tree, flagging	
05/01	grey wolf		20:15	facing flagging; looking w.	
05/01	grey wolf (same)		20:35	walking e.	Lost day?
24/01	large bull moose		4:23 (Dark)	walking w.	
24/01	cow moose		21:05	walking e.	

			(Dark)		
24/01	cow moose		21:05	walking e.	
24/01	young bull moose		21:13	walking w.	
24/01	cow moose		21:56 (Dark)	walking e.	
30/01	coyote		18:07	walking e.	
Summary	-3 wolf events (2) **-4 moose events -1 coy.**				**29 cam.-days**
Oct 02/01	Pierces	with rifles	12:06	waving at camera	
08/01	red squirrel		9:39	sniffing transmitter	
Summary	**-1 red sq.**	**-1 hunter**			**12 days**

Table = Cam. #3. Results of remote camera #3 set up on access road about 2 km east of Far Meadows research station.

Date	**Species & classn**	**Photo/Sign**	**Date of use/Time**	**Comments**	**Cam. Days**
CAM #3 Aug 27/01 Set-up					
26/01	Pierces	on ATV	14:41	driving N.	
26/01	Pierces	with Marty's antlers	18:35	walking S.	
26/01	Rosie Pierce		18:35	walking S.	
26/01	Lester P.		18:36	looking at camera	
29/01	5 light grey wolves-Ad.		6:46	walking S.	
29/01	2+ wolves-Ad.		6:47	1 walking S.; others noses to ground to N.	
29/01	6 wolves-pups?		6:47	moving S.	
29/01	6 wolves-pups?		6:48	4 noses to gr to N; 2 walking S.	
29/01	3 wolves-pups?		6:48	S. to camera	
29/01	wolf pup		6:48	facing S. nose to gr. near mark tree	
29/01	wolf pup		6:48	looking S. from mark tree	
30/01	Lester P	pack & rifle	7:28	walking N.	
30/01	Lester P	ATV	11:52	going S.	
Summary	**-1 wolf pack (11?)**	**-4 ATV passes**			**3 Cam. nights**
Sep 04/01	Am. Red squirrel		14:19	On mark tree	
05/01	Am. Red squirrel		11:30	on transmitter	
06/01	wolf ????	eyes only	23:08 (Dark)	facing S.	
09/01	Am. Red squirrel		9:14	base of tree	
09/01	black horse		13:08	facing E.	

09/01	black horse		13:08	facing S to cam; sniffing ground	
14/01	Canada jay		12:29	sitting on transmitter	
19/01	coyote		4:17 (Dark)	walking N.	
21/01	large bull moose		2:41 (Dark)	walking N.	
21/01	red 4 x 4		9:31	driving N.	
Sep 21/01	Am. Red squirrel		12:33	base of tree	
21/01	coyote		20:33 (Dark)	looking S.	
24/01	blue 4 x 4		7:34	driving N.	
24/01	red 4 x 4		7:45	driving S.	
24/01	Lester P	on ATV	12:46	driving N.	
24/01	Lester P	on ATV	12:50	driving S.	
24/01	Lester P	on ATV	1:25	driving N.	
26/01	rider & dog	rear end	10:46	walking S.	
26/01	pack horse	rear end	11:42	walking S.	
26/01	3 riders		12:35	walking S.	
26/01	3 riders		12:35	walking S.	
26/01	Chief Roger/horse		12:35	walking S.	
26/01	D&P	"Tuffy"	12:46	driving S.	
26/01	2 riders leading 2 horses		13:25	walking N.	
26/01	3 riders leading horses		13:25	walking N.	
29/01	Am. red squirrel		15:10	base of tree	
29/01	blue Forerunner		9:24	heading S.	
30/01	Lester P	on ATV	15:38	going N.	
30/01	Lester P	on ATV	15: ?	going S.	
Summary	**-1 wild horse, 2 coy., 1 unid. –wolf?, 1 moose**	**-4 veh. passes & 2 more (res.), -4 ATV passes, -3 horse group passes**			**28? Cam. days**
Oct 01/01	young bull moose		16:50	walking N.	
13/01	coyote		00:59 (Dark)	walking N.	
Summary	**-1 moose -1 coy.**				**13 cam. nights**

Table = Cam. # 4 & 5. Results of remote cameras # 4 and # 5 set up in areas to the west of the Far Meadows research station.

CAM #4 Aug 22/01 Set-up					
Date	**Species & classn**	**Photo/Sign**	**Date of use/Time**	**Comments**	**Cam. Days**
Sep 10/01		*Noted silver tip hairs on carpet nails			Lost since Aug. 22 as rec. off
Sep18/01	coyote		23:11 (Dark)	trotting e. on trail	

20/01	mule deer doe & 2nd deer		8:25	facing e; facing w.	
21/01	coyote		4:06 (Dark)	walking 2.	
21/01	Am. red squirrel		7:07	leaping from transmitter	Forest fire. Pulled on Sept. 25
Summary	-2 coy. events (same) **-2 mdeer** **-1 redsquir**				**14 days**
Date	**Species & classn**	**Photo/Sign**	**Date of use/Time**	**Comments**	**Cam. Days**
CAM # 5 Aug 22/01 Set-up					Lost time?
Sept. 15/01	coyote		13:34	facing e. on trail	
25/01	Raphael on horse		18:00	riding w.	
Summary	**-1 coy.**	**-1 man on horse**			**Est. 32 days**

Table = Cam. # 6 & 8. Results of remote cameras # 6 and # 8 set up in areas to the south of the Far Meadows research station.

Date	**Species & classn**	**Photo/ Sign**	**Date of use/Time**	**Comments**	**Cam. Days**
CAM #6 Aug 23/01 Set-up					No time on photos
Sep 06/01	dark brown horse, Lge.		night	walking w.	Timer Off?
06/01	cow moose w/bell		8:48?	facing w.	
10/01	coyote		19:37 ??	facing s.	
11/01	Foal?; bay horse		7:19 ?? (Dark)	walking e.	
11/01	bay horse, mare		7:19 ??	standing, facing n.	
12/01	coyote		Night ??	walking w.	
14/01	lynx		18:36 ?? (Dusk)	walking w. @ stump, scent-marked?	
Sep16/01	br & 2 dk horses		5:01 ?? (Light)	walking e.	
16/01	4 dk horses		5:01 ??	walking e., sniff by stump	
16/01	3 dk horses		5:01 ??	2 looking at transmitter; 1 behind	
16/01	2 dk horse		5:02 ??	walking e., sniff ground	
16/01	2 dk horses	thin dk brown; heavier black	5:02 ??	walking e.	
16/01	solid dk br.		5:02 daytime	walking e., nose	

	Horse, stallion			to ground	
25/01	4 riders		17:03	heading e.	
25/01	2 riders & pack horse & dog		17:04	heading w.	
25/01	2 dogs	following pack horse	17:04	heading w.	
Summary	**-3 horse move.** **-1 moose** **-1 coy.** **-1 lynx**	**-film crew & horses**			**30 days Guess at times**
Oct 02/01	Cougar, lge.		19:45 (Night)	walking w.	
04/01	black bear, adult		20:54 (Night)	walking W.	
Summary	**-1 cougar** **-1 bk. bear**				Pulled on 13th. 12 days

Date	**Species & classn**	**Photo/ Sign**	**Date of use/Time**	**Comments**	**Cam. Days**
CAM # 8 Aug 26/01 Set-up	**Cheewit Lake**				
Sep 02/01	2 mule deer does		23:51 (Dark)	walking e.	
06/01	Am. red squirrel		9:08	at base of tree	
07/01	coyote		3:40 (Dark)	walking e.	
10/01	lynx		5:17 (Dark)	walking e.	
12/01	HUGE black bear	brownish tinges	18:34	walking w.	
18/01	young bull moose		7:37	walking W.	
23/01	Subad. Wolf?		8:33	facing camera	
Summary	**-2 mule deer** **-1 moose** **-1 bk. Bear** **-1 coy.** **-Subad. Wolf?** **-1 lynx**				**33 nites (include. Aug.)**
Oct 03/01	large cougar		6:16 (Dark)	walking w.	
05/01	lynx		23:43 (Dark)	walking w.	
08/01	bird in flight ????	unident. blur	7:18		
13/01	Subad. Wolf?		6:32	sniffing gr; facing w.	
Summary	**-1 cougar** **-1 lynx** **-Subad. wolf?**				**Pulled on 13th. 12 nites**

Table #7. Results of remote camera #7 set up on horse trail near Alkali Lake, south east of the Far Meadows research station. Camera along horse trail.

Date	Species & classn	Photo/ Sign	Date of use/Time	Comments	Cam. Days
CAM # 7 Aug 23/01 Set-up	**Horse trail, Alkali Lk.**				
Sep 05/01	mule deer doe		20:20 (Dark)	facing w.	
06/01	coyote		23:03 (Dark)	walking twds cam from w.	
12/01	mule deer doe		3:46-3:47 (Dark)	walking w.	
13/01	3 dk horses	fat	11:19	coming from w.	
13/01	3 dk horses	-bay with small white spot	11:20	from w.	
13/01	3 dk horses		11:20	from w.	
17/01	lynx		5:35-5:36 (Dark)		
18/01	bay horse	fat rear end	20:08 (Dark)	walking w.	
Summary	**-1 mule d. -1 coy. -l lynx -2 horse movement**				**Oct.-not work. Est. 34 days**

Table # 9. Results of remote camera # 9 set-up on the access trail near homestead at Elkin Creek.

Date	Species & classn.	Photo/ Sign	Date of use/Time	Comments	Cam. Days
CAM # 9 Sep 12/01 Set-up					
Sep 13/01	coyote		20:52 (Dark)	Run from cam.	
14/01	ruffed grouse		18:42	on rock by transmitter	
18/01	young bull moose		5:52	walking n.	
19/01	2 Hereford X cows		8:48	grazing	
Sep 19/01	4 cows		8:48	grazing	
19/01	cow & calf	no tails	8:48	walking	
19/01	cow & calf and horned cow		8:49	facing s.	
21/01	red 4 x 4		8:48	driving n.	
23/01	Lester’s big truck		18:15	driving n.	
23/01	blue 4 x 4		18:44	driving n.	
24/01	red 4 x 4		8:18	driving s.	
24/01	green Explorer		13:39	driving n.	
26/01	mule deer	hind end only	10:23	walking n.	
26/01	black Ford		17:30	driving s.	
29/01	blue 4 x 4		9:49	driving s.	
30/01	ruffed grouse		10:37	on rock	
30/01	Lester’s ATV		13:45	driving N.	
Summary	**-1 coy.**	**-7 veh. events**			**17 cam. days**

	-1 moose **-2 cow events** **-1 ruffed grouse**	**rec.** **+2 more?**			
Oct 01/01	ruffed grouse		7:23	on rock	
11/01	Rosie on ATV with trailer		13:04	driving s.	
11/01	Lester's big truck		13;12	driving s.	
13/01	coyote		3:17 Dark	facing n.	
13/01	snowstorm to end of roll		23:41		
Summary	**-1 ruffed grouse** **-1 coy.**	-2 veh. events rec. **+1 more?**			**12 days?**