POTENTIAL IMPACTS OF THE PROPOSED PACIFIC NORTHWEST NATIONAL SCENIC TRAIL ROUTE ON THREATENED GRIZZLY BEARS AND THEIR RECOVERY IN THE YAAK WATERSHED AREA, NW MONTANA

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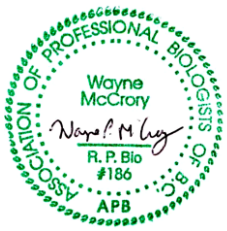

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Dr. Frank Lance Craighead

Frank Lance Craighead is a field ecologist, population geneticist, and GIS technician with over 20 years of experience in conservation planning. He grew up helping his father, Frank, and uncle, John, with their pioneering study of grizzly bears in Yellowstone National Park in the early 1960s. He recently completed a book as co-editor: "Conservation Planning: Shaping the Future" published in early 2013 by Esri Press. He graduated from Carleton College in Minnesota in 1969, completed a Master's degree at the University of Wisconsin in 1976, and completed his Ph.D. in Biological Sciences from Montana State University in 1994 studying grizzly bear genetics in the Alaskan Arctic.

He is currently a Research Affiliate in the Ecology Department at Montana State University, and a member of the IUCN World Committee on Protected Areas, the Society for Conservation Biology, the Society for Conservation GIS, and is a National Fellow with the Explorers Club. As the Executive Director of the Craighead Institute since 1994, he coordinates research and outreach, helping synthesize results and directing communications, fundraising, and development. The Craighead Institute and its scientific staff have developed and implemented conservation plans to protect wildlife and maintain biodiversity across multiple scales: regional to statewide to county-level. Conservation of grizzly bears and their habitat has always been a central focus.

Lance lived in Libby, Montana, for a year in 1976-77, where he directed a Bald Eagle study for the Army Corps of Engineers to study possible impacts of a second dam below the Libby Dam to re-regulate water flows out of Koocanusa Reservoir. Previous to this study, he has spent some time hiking and hunting in the Cabinet-Yaak Ecosystem.

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Bear biologist Wayne McCrory is a Registered Professional Biologist (RPBio) in the province of British Columbia with more than 40 years of professional experience. Beginning his career with the Canadian Wildlife Service, his extensive wildlife and bear work has been published in symposium proceedings, peer-reviewed journals, and government publications. He has produced 80 professional reports, some peer-reviewed, many involving environmental impact studies, cumulative effect reviews, bear habitat and bear hazard assessments of recreational facilities (trails and campsites) in numerous Canadian parks, and bear-people conflict prevention/management plans. He was also one of 11 biologists who served on the former BC government's Grizzly Bear Scientific Advisory Committee.

In his professional experience related to the Yaak Pacific National Trail (PNT) grizzly bear impact review, McCrory (including through his company McCrory Wildlife Services Ltd.) has carried out extensive bear habitat surveys on the BC side of the Selkirk and Purcell Mountains, including trail and campsite grizzly bear risk assessments for Parks Canada, BC Parks, and the BC Forest Service. As well, he directed an environmental impact assessment on grizzly bears of the proposed Jumbo Ski Resort in the central Purcells. He also did baseline grizzly bear potential habitat and trail/campsite risk assessments and a grizzly bear-people conflict prevention plan for BC's grizzly bear recovery plan for the North Cascades.

Wayne McCrory was also involved in a major three-year baseline habitat and grizzly bear travel corridor study for Parks Canada for Lake O'Hara in Yoho National Park that included being part of an expert panel of bear biologists that developed a GIS Grizzly Bear Encounter Risk Model to address grizzly bear mauling issues in a high intensity hiking area. He also

headed a 4-year research project in Kakwa Provincial Park in the Canadian Rockies that used non-invasive methods to relate grizzly bear movements and mark trees along park trails to grizzly bear encounter potential for people using the park's trail network. McCrory also teaches outdoor bear safety and bear-viewing guides courses. His curriculum vitae (CV) is available upon request.

Baden Cross, Applied Conservation GIS

Baden Cross is a mathematician and GIS analyst with extensive experience over the last 25 years working as an independent consultant on wildlife projects and conservation analyses in northwestern Canada and the U.S. His expertise includes working with GIS software, particularly the latest ArcGIS and associated habitat modeling software such as species Least Cost Paths, Corridors and Circuitscape analysis. His mathematical background has been a major asset in designing algorithms for different GIS models such as spirit bear and grizzly bear den habitat and Sitka deer winter range models for the BC central coast.

Baden has worked extensively with McCrory Wildlife Services Ltd. and many others for some 20 years on various consulting projects ranging from GIS map models for whitebark pine stands in the BC Chilcotin to GIS habitat hazard models for the BC Parks North Cascades grizzly bear recovery plan. He has also helped develop a GIS grizzly bear encounter risk model for a BC Parks study for Kakwa Provincial Park in the Canadian Rockies. Other projects have included preliminary GIS assessment for the Jumbo Ski Resort in the central Purcells mountains (north of the Yaak) as well as developing a Conservation Area Design (CAD) with the Craighead Institute for the Inland Temperate Rainforest (ITR) extending down into Idaho and northwestern Montana. This has included involvement with the Y2Y (Yellowstone-to-Yukon) Conservation Science and Planning Committee to help develop GIS strategies for the ITR, one of the seven Y2Y sub-regions. This included developing a fine-scale conservation analysis in the Robson Valley with Save The Cedar League and Selkirk Mountain Caribou Park Proposal in the Kootenay region of BC. He has also worked extensively with many scientists and different organizations in developing GIS map models for large landscape reserve networks.

DISCLAIMER

The findings contained in this report were compiled from an extensive literature review, interviews with a number of relevant personnel, and a short time-frame field investigation of grizzly bear habitat values related to the Pacific Northwest National Trail (PNT) in the Yaak area. The authors feel they have provided an accurate and authoritative analysis of the subject matter covered in this report. The independent conclusions and recommendations expressed are entirely their own. The authors take full responsibility for any errors or omissions on their part, but not on the part of errors or omissions extant in the data provided by outside sources. Where possible, they have identified where they have relied on their own professional opinions.

While best efforts have been made to ensure the validity of this review, no liability is assumed with respect to the use or application of the information contained herein.

Special Note: The Pacific Northwest National Scenic Trail is generally abbreviated in USFS and other documents as the PNNST or is shortened to Pacific Northwest Trail or PNT. PNT is also the abbreviation used for trail signage through the Yaak northern route. For simplicity we used PNT as the abbreviation throughout our report.

ABSTRACT

This study was done for the Yaak Valley Forest Council (YVFC) in 2017 by two independent consultants who are expert bear scientists. The study was commissioned by YVFC as a result of their concerns regarding the potential for negative effects of the northern Pacific National Trail (PNT) alternative on the threatened Yaak grizzly bear population and its recovery.

Our Yaak PNT study area was confined mainly to the Yaak watershed area. Presently, only the 2016 US Forest Service (USFS) northern PNT alternative has been mapped and available, which was a study constraint. One new northern PNT trail connector has already been built and PNT signage posted along the route. The study included interviews, a background scientific literature review, short duration field-level reconnaissance surveys of the northern Yaak PNT, review of the 1978 and current proposed PNT alternatives & environmental impact assessment, and coarse and fine filter GIS map analyses of select grizzly bear habitat parameters in the Yaak northern PNT alternative and potential alternate route options.

A long-term grizzly recovery plan has been ongoing in the Cabinet-Yaak Grizzly Bear Recovery Zone (CYGBRZ) with numbers (about 50) now about halfway to recovery, according to a 2015 genetic study. This study also concluded that comprehensive management was needed to support population growth, increased connectivity and gene flow due to small population size, isolation, and inbreeding, with the lowest density known to interior grizzly bears. Population augmentation and reduction of human-caused mortality, including defense-of-life kills, has helped recovery but this is still a precarious grizzly bear population without a lot of resilience from an increase in cumulative effects such as would occur from the PNT.

Over half of the length of the USFS northern PNT alternative would cross four of the six U.S. grizzly bear recovery zones, with about 7% of the total length crossing the Yaak portion of the CYGBRZ. Here, the northern alternative would cross two important grizzly bear core areas identified using Resource Selection Functions (RSF) and one important linkage zone; all three of the northernmost recovery CYGBRZ grizzly bear management units (BMUs) with proven female grizzly with young occupancy; and a high proportion of higher elevation areas where prime grizzly bear summer, fall, and denning habitats are found. Grizzly bear encounter risk and displacement from eventual high summer and shoulder season, and even winter recreation use would likely cause significant adverse effects to grizzly bears and their recovery along the Yaak northern PNT alternative. High levels of eventual PNT recreation use predicted for the summer will also affect USFS female core area non-motorized calculations and designations. A GIS map model of RSF core areas combined with a digital elevation model (DEM) of seasonal grizzly habitat zones was used to identify a number of potential lower impact alternative routes in the Yaak that would pass mostly through lower elevation grizzly bear spring range. This included the more southern 1978 Jonkel route.

Our results were similar to the 1978 USFS-NPS review of the PNT in the Yaak. We recommend that the proposed National Environmental Policy Act Environmental Impact Statement (NEPA-EIS) for the PNT avoid the northern alternative in the Yaak and carefully study a number of lower impact alternatives. Careful mitigation for whichever Yaak route is

chosen should include a PNT grizzly bear-people conflict reduction plan, including but not limited to public education for hiking in bear country, encouraging people to carry bear spray, careful siting and location of trails and associated campsites to avoid high quality seasonal habitats and travel routes, trail maintenance to improve good lines of sight, temporary closures of areas where bears are known to be active and provisions for alternate routes, and other standard methods. However, while grizzly-people conflicts and displacement impacts can be reduced by selecting a more southern route with careful conflict reduction measures, they cannot be totally eliminated. Overall, the Congress-approved PNT through the Yaak presents a significant planning and management challenge for the responsible agencies related to grizzly bears and their recovery.

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The Current Situation: Status of Past & Current PNT Proposed Routes in the Yaak Study Area

1. The PNT, originally proposed around 1974, underwent an extensive joint US Forest Service (USFS)-National Park Service (NPS) feasibility study authorized by Congress in 1977 that looked at four options, including a "no trail" option. The joint study was completed in 1980 and recommended the "no trail" option for a variety of reasons including, at the time, strong economic and environmental concerns. The study concluded that the PNT would have significant adverse environmental impacts on the grizzly bear and fragile high elevation areas, and that of all the alternatives, the northern scenic route would have the greatest adverse impact on environmental values.

2. In 2009, with the CYGBRZ recovery plan already well underway and a slowly increasing grizzly population in the Yaak, Congress approved the PNT and added it as one of 11 national trails. This meant that the previously approved 1978 "no trail" option was eliminated. Currently, the USFS is managing a review of the PNT and has formed a 23-member Federal Advisory Committee to help determine the location and management of the PNT, including alternatives. The agency has also formed an interdisciplinary team of Forest Service resource specialists with plans to start a Comprehensive Plan and an Environmental Impact Statement (EIS) under the National Environmental Policy Act (NEPA) to be completed by 2019. The task of the team is to develop and assess PNT trail alternatives and include a draft biological assessment in fall-winter 2017, followed by a public input process with a final ruling on location and management to be completed by 2019.

3. Despite the 1980 USFS-NPS study's conclusions that the northern scenic route would have the most adverse environmental impacts on grizzly bears and fragile high elevation habitats, the northern scenic route has been the only alternative intensively mapped by the USFS for planning purposes in the Yaak, with no other major alternatives identified. A number of possible alternatives should have been mapped based on proposed alternatives made in the past and on currently available information on grizzly bears. Therefore, much of our analysis involved a review of the potential effects of the 2016 northern PNT route shown on the USFS PNT website.

4. We discovered that the USFS official PNT website indicates that the regulatory agency has already allowed construction of a new trail from Eureka to Webb Mountain near the eastern border of the CYGBRZ. Field surveys confirmed that the new trail from Koocanusa Reservoir to Webb Mountain has already been constructed with PNT signage. Additionally, we observed and documented that other sections of the northern route in the Yaak were also marked with PNT signage. As a result, the northern PNT alternative, which goes through considerable critical grizzly bear habitat and was previously rejected in 1980 partly because of that, is being widely promoted by PNT advocates with some hiking and other use already occurring. This, in our professional opinion, could raise serious concerns regarding the

objectivity of the USFS obligation to impartially identify and evaluate alternatives as part of their EIS and NEPA process unless this is comprehensively addressed as the NEPA process proceeds.

5. The design of the location of current northern "scenic" PNT route in the northern Yaak appears to have been deliberately selected to include as many high elevation scenic mountainous peaks as feasible. This includes, from east to west: Webb Mountain, Thirsty Mountain, Boulder Mountain, Mount Henry, Garver Mountain, Mushroom Mountain, Black Top Mountain, Rock Candy Mountain, and Canuck Peak. One optional subroute on the west side loops north through the high elevation Northwest Peak Scenic Area. **(**As will be seen, this has a significant bearing for grizzly bears).

6. The northern PNT in the Yaak appears to be all within the jurisdiction of the Kootenai National Forest. While not quantified, other apparently lesser impact alternatives we identified, including the southern 1978 (Jonkel) route, would include some private land and possibly state land.

7. Types of trail sections and allowable outdoor recreation (motorized and non-motorized) uses can have an influence on grizzly bear encounter risk and degree of displacement caused to bears by human activities. Most of the 68 miles of the northern PNT route in our Yaak study area has been carefully designed to link up existing open roads (31.6 %) and established hiking trails (68%) with very little cross-country (0.4%). The amount of PNT roads in the Yaak is higher than for the overall PNT (23% paved and gravel roads). Of the 21.4 miles of Yaak roads, the majority (71.5%) is gravel suitable for passenger cars, while 15% is paved and 13.5% is unmaintained and not suitable for passenger cars. Hiking will be allowed on all of the PNT through the Yaak. Although the National Scenic Trails System Act (NSTSA) does not allow motorized use, Section 7(j) of the NSTSA allows motorized use on existing motorized routes. However, the USFS PNT website indicates they will be working towards a continuous non-motorized trail route that will include relocations. There are as yet no trail sections identified where bicycles and equestrian (pack-and-saddle) would be prohibited, although it appears that such uses along the whole Yaak PNT have not yet been decided.

8. Current levels and projected recreation use levels by season resulting from the northern PNT route in the Yaak and potential alternative routes were not determined. We expect that after build-out the peak of recreation use of the PNT route selected for the Yaak will be in summer running into early-mid fall with some use in the spring. Some backcountry winter use can also be expected. We predict that summer and possibly shoulder season recreation use of a final PNT trail through the Yaak will at some point reach and exceed the IGBC (1998) task force standards for non-motorized levels of "high-intensity trail" use of 20 or more parties per week for core area grizzly bear calculations. By way of comparison, the Pacific Crest Trail issued 5,657 permits in 2016. Twenty parties of 5 people on the PNT would total 100 people per week or roughly 1200 per summer; any more would exceed standards for core grizzly areas.

Grizzly Bears: The Current Proposed PNT Northern Route in Relation to US Grizzly Bear Recovery Zones

Our analysis shows that some 51% of the 1156 mile route proposed in 2016 for the 2009 Congress-approved Pacific National Trail (PNT) will pass through four of the six U.S. Grizzly Bear Recovery Zones. Nearly 7% (76 miles) of the total length of the northern PNT will pass through the CYGBRZ, with about 6% (68 miles) through our Yaak grizzly bear-PNT study area.

Current and Predicted Grizzly Bear Numbers in the Yaak Grizzly Bear Recovery Zone

Assessment of grizzly bear encounter risk and impacts of the northern PNT and any alternative routes on grizzly bears is complex because it has to take into account the current population level and projected numbers at full recovery. A grizzly bear DNA-hair snagging study in the CYGBRZ concluded that in 2012 this threatened grizzly bear population had reached about half of the population recovery goal of approximately 100 bears. The Yaak was estimated to have only 18-22 grizzly bears, among the lowest density of interior North American populations. In the northern Yaak, some grizzly bears have home ranges shared with British Columbia.

The Northern PNT Route in Relation to CYGBRZ Recovery Bear Management Units (BMUs) in the Yaak

Recovery BMUs have been designated for grizzly bears in the CYGBRZ as part of recovery planning. Each BMU approximates the size of a female grizzly bear home range, including all seasonal (spring, summer, fall, winter den) habitat components. The northern PNT would pass through three BMUs with demonstrated occupancy by female grizzly with young. The northern Yaak BMUs have the most female grizzlies with young occupancy compared to the southern Yaak, likely reflective of higher value seasonal habitats and less human disturbance. Telemetry studies indicate some female grizzly bear home ranges have concentrated activities in the northern PNT area.

The Northern PNT Route in Relation to Resource Selection Function (RSF) Upon Grizzly Bear Core Areas and Linkage Zones in the Yaak

At the large landscape level, the northern PNT would cross two grizzly bear core habitat areas in the Yaak, including a large one on the west side. This does not mean that other quality grizzly habitats do not occur along the PNT route. The northern PNT also crosses an important north-south linkage zone on the east side of our Yaak study area.

The Northern PNT Route and Potential Alternatives in Relation to Seasonal Grizzly Bear Elevational Habitat Zones in the Yaak

At the time of this report, no grizzly bear habitat map had been completed for the Yaak recovery zone, although one is being done (Wayne Kasworm, pers. comm). We used available CYGBRZ habitat information derived from telemetry locations and other data to develop a GIS

Digital Elevation Model (DEM) to identify where seasonal grizzly habitats would most be expected to occur (spring, summer, fall, and winter denning). Our results show that because the proposed scenic PNT was deliberately routed to include as many higher elevation scenic mountains as possible in the northern Yaak, a higher degree of overlap with summer, fall, and den habitats occurs than if alternate routes were chosen at lower elevations where mostly spring habitats are found. It is noted again that summer will be the peak of PNT use.

We estimated 24 miles or 35% of the northern PNT in the Yaak will cross low elevation areas (below 4,590 feet) where spring habitat types would occur, while the balance (44 miles or 65%) of the total PNT length overlaps with other seasonal habitat elevation zones. All the non-spring habitat (44 miles or 65%) is considered a fall habitat zone (above 4,590 feet—except for some grizzly use of ungulate carcasses at lower elevations in November). A subset of that (37 miles or 54%) is considered summer habitat above 4,929 feet. At the highest elevations (26 miles or 38%), the route is in winter den habitat beginning at elevations above 5,580 feet.

We used an overlay map of core areas combined with our DEM grizzly bear elevation habitat model to identify that, besides the southern Jonkel route, a number of alternative east-west routes are available through the Yaak that would minimize the amount of higher elevation summer, fall, and den habitats crossed by a PNT trail while being largely where spring grizzly habitats would occur.

A PNT Route in Relation to the Seasonal Importance of Grizzly Bear Huckleberry (*Vaccinium*) Habitats in the Yaak

Various grizzly bear diet and habitat studies, including those done in the CYGBRZ, have demonstrated that during good berry years huckleberries are a critical high energy summer and fall food for bears to build fat deposits in readiness for winter hibernation. We found higher elevation *Vaccinium* habitats to be common along the PNT areas we ground-truthed in October. The transborder grizzly study team has developed a GIS huckleberry map model on the north side of the border that identifies where the most critical grizzly habitats occur. The model is still being field-tested and will be expanded to include the CYGBRZ. We suggest the huckleberry model be used as one of the tools to help the NEPA-EIS process evaluate the different lower impact PNT alternatives through the Yaak.

Grizzly Bear Encounter Risk Related to Yaak-Northern PNT and Potential Alternative Routes

For our Yaak-PNT route grizzly bear assessment, we focused on the potential for injurious-type encounters between grizzly bears and allowable PNT non-motorized recreationists on the trails and closed roads. Non-motorized would include hikers, bicycles, and equestrian-pack & saddle. We did not include PNT open roads where both motorized and non-motorized use would be allowed. The most likely type of potentially injurious grizzly bear-people encounter would involve the defensive behavior by mother grizzly bears with young encountered by surprise at close range on the PNT, followed by people encountering at close range a grizzly bear on an animal kill, and lastly a predaceous attack involving people traveling or camping. Use of

bicycles will increase the risk of sudden encounters with grizzly bears to that user group. We assume that tight controls for backcountry human food/garbage management (i. e., 100% of current standards) would be implemented and enforced by the Kootenai National Forest for a PNT trail and associated campsites and, therefore, we did not consider the food-conditioned type of encounter a serious risk.

Confrontations between PNT recreationists and grizzly bears would be additive to the present level of bear-people confrontations in the Yaak, some of which have led to defense-of-life mortality, which is an important threat to recovery of Yaak grizzly bears. This includes confrontations involving ungulate hunters. Encounter risk will increase over time if grizzly bear numbers, particularly females with young, increase towards the recovery goal and as the popularity of the PNT evolves towards "high intensity" use levels and beyond.

The northern PNT alternative route, due to its considerably higher elevation location compared to other lower elevation alternatives we identified, presents the highest encounter risk because of the highest overlap of the peak human recreation season (summer) with peak season grizzly bear summer habitat use. When compared to lower elevation alternatives that appear to be available, the northern route will create a higher risk of grizzly bear-people encounters over time, some possibly leading to human injury or death.

Occupancy by female grizzly bears with young in the three northern Bear Management Units (BMUs) that would be crossed by the northern PNT is already established. Use of these areas near the northern PNT route by grizzly bears is also higher than along the alternative routes, according to hair snare samples collected throughout the Yaak.

Displacement of Grizzly Bears Related to Yaak-Northern PNT and Potential Alternative Routes

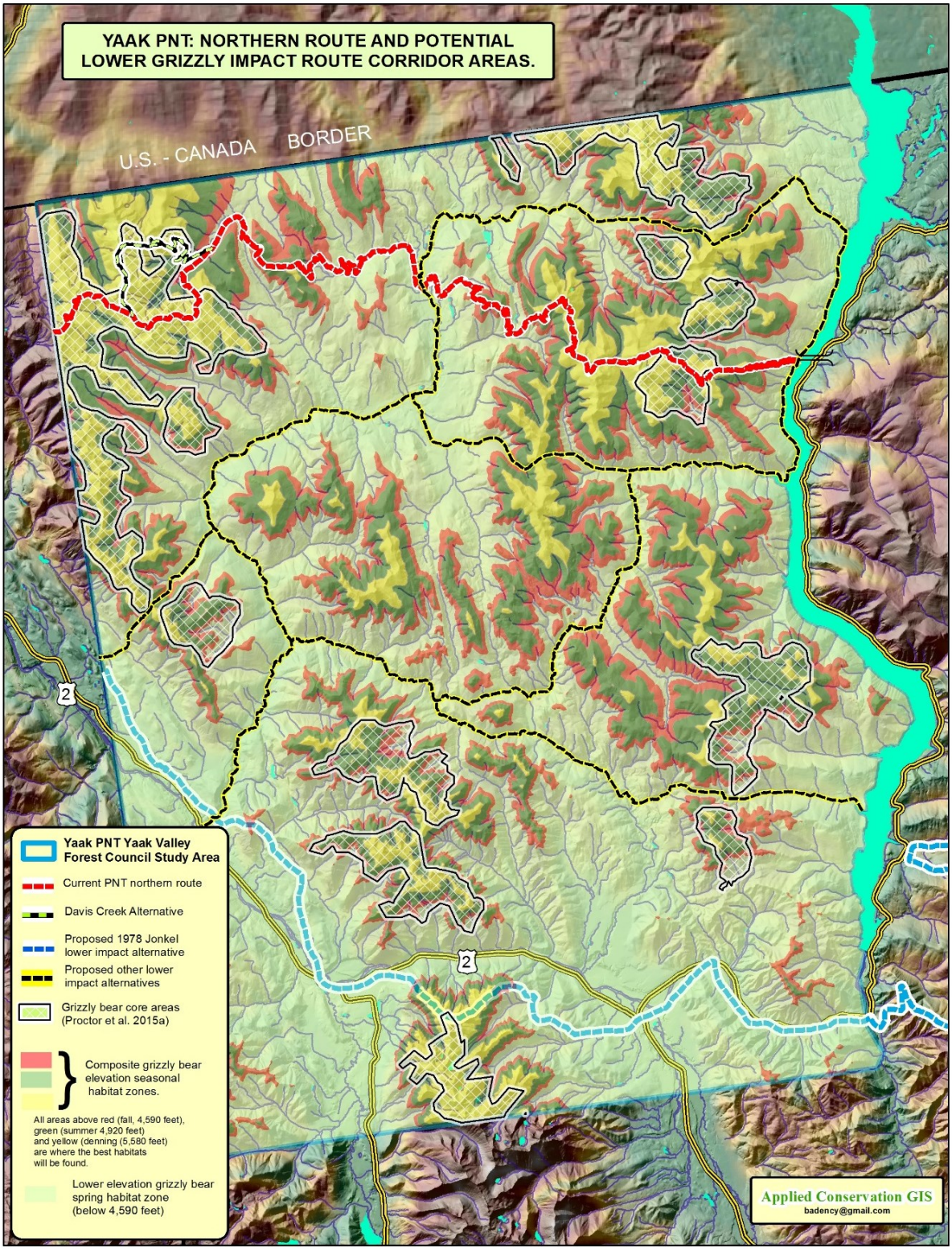
Our analysis concurs with the 1980 joint USFS-NPS feasibility study of the PNT that the northern route would have the most significant adverse impact on grizzly bears. While we acknowledge that some habituation of grizzly bears to a high human-use PNT trail may result, thereby reducing somewhat the negative effect on bears of displacement from critical habitats within a 500+ m Zone of Influence (ZOI) along the PNT, it is clear from our experience and review of the scientific literature that displacement of grizzly bears from critical habitats will occur, with a high potential for significant adverse effects on survival and population recovery of the threatened Yaak grizzly bears; although the full effects of human-caused displacement on bear bioenergetics has never been quantified. Habituation would also increase the likelihood of close bear-human encounters and increased risk to hikers. For the same reasons as in the above-mentioned encounter risk section, to minimize grizzly bear displacement from essential habitat, PNT alternative routes with lower overlap with summer, fall, and den habitats should be preferred over the northern scenic route.

RECOMMENDED KEY PLANNING AND MANAGEMENT ACTIONS

Although we concur with the 1980 PNT feasibility study conclusions that no PNT should be allowed, given that a PNT was subsequently approved by Congress, the following recommendations can be applied in the NEPA-EIS alternatives route planning process to mitigate adverse impacts on grizzly bears and their recovery, and minimize grizzly bear encounter risk for PNT user groups:

1. As a priority and as with the 1980 review, the northern PNT Yaak alternative should be rejected and a lower impact southern alternative be carefully studied.
2. Whatever PNT route is finally selected by the NEPA-EIS study, a bear-people conflict management plan should be developed for the Yaak PNT. This should include, but not just be limited to, the following commonly used procedures: careful route selection to avoid trail and campsite locations in or proximal to prime grizzly bear habitats; management and siting of trails to maintain good line-of-sight; management of warning signs and seasonal closures when bear hazard situations are identified; bear-proof food/storage facilities at PNT campsites; adequate public education including signage on safer travel in bear country (such as traveling in groups of four or more people); mandatory carrying and knowledge of the use of bear spray; restrictions or public education on the dangers of dogs-off-leash; consideration of a permit system similar to the Pacific Crest Trail including that it be mandatory that people carry bear spray and know how to use it; and other measures.

Figure 1. Garver Mountain Trail section of northern PNT alternative showing PNT signage already in place. There is a proposed PNT campsite at this point location adjacent to important spring wetland grizzly habitat (Pete Creek Meadow) and important huckleberry (*Vaccinium* spp.) areas along the trail to the east.



Map 1. Showing higher impact northern PNT alternative (red) and lower impact possible alternatives (yellow) identified using a GIS grizzly core area – habitat elevational map model. Also shows approximate 1980 low impact southern "Jonkel" route (blue).

1.0 INTRODUCTION, BACKGROUND, PROBLEM IDENTIFICATION, AND RATIONALE FOR THIS STUDY

The U.S. National Trail System was created by an Act of Congress in 1968 for a network of recreation, scenic, and historic trails across the country. The intent was to:

> *provide for outdoor recreation needs, promote the enjoyment, appreciation, and preservation of open-air, outdoor areas and historic resources, and encourage public access and citizen involvement* (https://www.nps.gov/nts/).

In the Yaak area of northwest Montana there is a lengthy historic context related to concerns of the potential impacts of a proposed Pacific National Trail (PNT) on grizzly bears. In 1974, Rep. Joel Pritchard introduced H.R.1529, a bill to authorize a study for the purpose of determining the feasibility and desirability of designating a proposed 1200-mile Pacific Northwest Trail (PNT) route from the Continental Divide in Glacier National Park to the Pacific Ocean beach of Olympic National Park. As a result, Congress authorized a study in 1977 to examine the feasibility and desirability of construction. The joint study was done by the U.S. Forest Service (USFS) and National Park Service (NPS) and examined a number of alternatives including the "most scenic," also known as the proposed northern route currently promoted by the Pacific Northwest Trail Association. The joint agency study was rigorous in that it involved numerous public meetings, consultations with other agencies including state and tribal agencies, and low-level aircraft reconnaissance flights.

During this previous 1977-1978 PNT review period, the few grizzly bears still surviving in the Yaak and Cabinet mountains in northwestern Montana were drawing some attention as part of a U.S. recovery plan for the species. In 1975, the surviving isolated grizzly bear subpopulations south of Canada were listed as Threatened under the terms of the Endangered Species Act (16 U.S.C. 1531-1543). A subsequent survey of the Yaak and adjacent regions by the Border Grizzly Project (Joslin et al. 1976) concluded that grizzly bear numbers appeared precarious in the Yaak drainage, including in the Mount Henry and Northwest Peaks area and the northern tip of Idaho and adjacent northeastern Washington. A survey of the Cabinet Mountains by Erickson (1978) determined that only 12 grizzlies may remain.

In 1978, as a result of concerns regarding the impact of the proposed PNT northern scenic route on grizzly bears in the Cabinet-Yaak ecosystem, Dr. Chuck Jonkel (head of the Border Grizzly Project) and a graduate student carried out an independent review which concluded that the eastern third of the proposed PNT trail was a complicated issue, in part because of its additive effect in areas of increasing human development, and because of the *precarious nature of the grizzly bear along portions of the route*. The study also concluded that the publicity from incorporating the proposed PNT into the National Scenic Trail System would *greatly increase human use of trails within grizzly country which have previously received minimal hiking pressure* and that *increased hiking of trail sections in grizzly bear range will be to the detriment of the bear.* The study stated that *Our strongest recommendation is that the trail swing far to the south to avoid both the prime and precarious grizzly range* (Jonkel and McMurray 1978). The Kootenai National Forest also recommended a more southern route.

The joint USFS-NPS assessment of the proposed PNT project was completed in 1980, at about the same time as the Jonkel and McMurray document. Although the study found the southern route to have the least environmental impact, instead of following the Kootenai National Forest and the Jonkel and McMurray recommendations for a more southern route, the joint agencies recommended that no PNT trail be constructed for a variety of reasons, including high economic costs. One of the other reasons they opted for the no-trail option was that *there would be significant adverse environmental impacts on the grizzly bear and on fragile and frequently over-utilized high elevation areas*. The authors also pointed out that trail systems already existed throughout much of the study area. They concluded (p. 57) that:

> *…the most scenic route is the one which would have the greatest adverse impact on environmental values. In order to accomplish the purpose of optimizing visual quality, the route stays at a high elevation wherever possible and, in so doing, crosses many miles of fragile high elevation meadows, balds, and ridgelines…Throughout most of the distance in Montana and to a lesser degree in Idaho, the route crosses grizzly range. Much of the range is rated by Dr. Charles Jonkel, head of the Border Grizzly Project at the University of Montana, as being critical to the bears' survival. Dr. Jonkel has determined that of 365 miles in Montana and Idaho, 280 miles are in critical grizzly range*.

At the time (40 years ago), this joint 1978 USFS-NPS study of the proposed PNT appeared to resolve once and for all any threat that the PNT proposal may have posed for grizzly bears and their possible recovery in the Cabinet and Yaak mountains of northwestern Montana and elsewhere. By 1993, a revised grizzly bear recovery plan (USFWS 1993) was adopted to aid the recovery of this species within the six U.S. grizzly bear ecosystems, including the Cabinet-Yaak Grizzly Bear Recovery Zone (CYGBRZ). The Cabinet-Yaak recovery plan is still ongoing with at least 15 grizzly bears now occupying each of the two subzones, largely as a result of augmentation by grizzly bears transplanted from other areas combined with positive efforts to reduce the density of access roads and associated human-caused mortality to bears. So far, the CYGBRZ recovery plan is about one-third to half-way toward meeting a total recovered target population of 100 grizzly bears.

By 2009, with the CYGBRZ grizzly bear recovery plan well underway, the PNT was endorsed by Congress as a national trail in spite of opposition from the public and federal and state wildlife agencies. It had undergone a sudden revival when Congress added it to the 2009 National Trails Act when it passed in Section 5205 of H.R. 146 of the Omnibus Public Land Management Act (Grossman 2016). This meant that the previous “no trail” option was no longer an option and the trail was a go-ahead. The PNT then became officially listed on the federal government’s website as *Designated by Congress in 2009 as one of America’s 11 National Trails* (https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3855327.pdf).

A detailed PNT review is now being implemented by the USFS, including by federal law, completing an eventual Environmental Impact Statement (EIS) under the National Environmental Policy Act (NEPA). This second federal government review of the PNT project is being coordinated under the direction of the USFS Pacific Northwest National Scenic Trail

Manager in Portland, Oregon. The USFS has initiated a 23-member federal advisory committee to help determine the location and management of the PNT, including alternatives. In spring 2016, the agency also formed an interdisciplinary team of Forest Service resource specialists to start a Comprehensive Plan and an EIS to be completed by 2019. The task of this inter-disciplinary team is to develop and assess PNT trail alternatives, including a draft biological assessment in fall-winter 2017, followed by a public input process (https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3855327.pdf). A final ruling on location and management is to be completed by 2019.

The Yaak Valley Forest Council (YVFC) is one of the 23 groups sitting on the PNT advisory committee. Despite the promised planning process to look at PNT alternatives and carry out a detailed EIS, the YVFC found that the USFS website for the PNT currently shows only one route. This route appears to follow the originally proposed northern scenic route that was rejected in 1977-1978. They also found that some new trail construction had already taken place and that PNT trail signs had been posted along part of the route where it passes through northern Yaak known grizzly bear core habitats. The northern PNT route, including through the Yaak, was also being widely publicized resulting in a subsequent increase in hiker use over the past few summers along the proposed PNT northern route. These PNT developments without major PNT alternatives having been mapped by the USFS continued to raise serious concerns with YVFC about the potential impacts of the northern PNT route through the Yaak on grizzly bears and their recovery. Subsequently in 2016, YVFC conducted their own preliminary review (Grossman 2016) of the potential harm the northern PNT trail could have on grizzly bears and questioned why other routes are not yet being recommended or analyzed, such as that proposed much earlier by Jonkel and McMurray (1978). YVFC consulted on the matter with a number of North American grizzly bear experts. As a result, in June 2017, YVFC commissioned the Montana-based Craighead Institute (ChI) to carry out a preliminary independent review of the potential effects of the PNT through the Yaak area on grizzly bears and their recovery.

2.0 STUDY APPROACH & METHODS

1. Carry out a background review of all relevant scientific literature and any other information, and conduct some interviews.
2. Define the main Yaak study area after background review, including current and past PNT routes, coarse filter analysis of grizzly bear core areas/linkage zones, interviews, and reconnaissance-level field surveys.
3. Review PNT project and associated background studies, including history of PNT and prior impact study.
    - Research northern Yaak PNT alternative and availability of GIS shapefiles and quantify: open roads, closed roads, existing trails, cross-country, etc.
    - Research allowable/non-allowable uses on current PNT route in Yaak study area. Quantify with table showing miles and percentages.
    - Research existing and potential future recreational use of PNT route in the Yaak.

4. Grizzly bears: Coarse filter review
    - Examine overall map of northern PNT alternative in relation to the six U.S. grizzly bear recovery zones, including CYGBRZ.
    - GIS map analysis of PNT northern alternative in relation to CYGBRZ Bear Management Units (BMUs) (Kasworm et al. 2015).
    - GIS map analysis of northern PNT alternative with Resource Selection Function (RSF) determined core grizzly habitat and linkage areas (Proctor et al. 2015a).
    - Review PNT route in relation to mapped grizzly bear home ranges (Kasworm et al. 2015).
5. Grizzly bears: Fine filter review
    - Field reconnaissance and ground-truthing of habitat values of select northern PNT trail sections.
    - Background research on grizzly bear habitat and diet information for the Yaak and design of GIS digital elevation model (DEM) for grizzly bear habitat values for spring, summer, fall, and denning seasons and overlay with northern PNT alternative. Then assess lineal extent of different habitat zones crossed by PNT for each season.
    - Assess Yaak PNT route issues in relation to importance of huckleberries and their habitat for grizzly bears based on an ongoing huckleberry modeling study on the Yahk-Purcell-Selkirk BC side (Proctor et al. 2015b).
    - Develop a GIS combined core area/elevational habitat model map overlay to assess degree of overlap with northern PNT alternative and identify lower impact alternatives; include southern 1978 Jonkel route.
6. Grizzly bears: Encounter risk
    - Carry out a literature review of factors related to grizzly bear-people encounters, including those that are injurious and apply to northern PNT alternative.
    - Assess other alternatives identified at a coarse-scale level.
7. Grizzly bears: Impact assessment of a Yaak PNT
    - Literature review of effects of motorized (road) and non-motorized (trail) human use on grizzly bears.
    - Use all available information to provide an analysis of the potential effects of the northern PNT (and alternatives identified) on grizzly bears and their recovery in the Yaak study area.
8. Bear-people conflict reduction and displacement reduction recommendations
    - Examine standardized means to minimize potential grizzly bear-people conflicts and habitat displacement along the PNT that includes the option of locating alternatives to the current northern route.
    - Develop a Yaak PNT grizzly bear-people conflict management plan.

Study constraints and limitations

The study was constrained by a short time frame and limited budget. The lack of identification by the USFS of other PNT route alternatives besides the northern one in the Yaak study area and their considerations was a major constraint. Our study would have benefitted from a detailed map of grizzly bear habitats for the Yaak area of the CYGBRZ, as well as more field time to adequately ground truth habitat values and their use along key sections of the northern route. Due to these factors, our results must be considered preliminary in nature.

3.0 RESULTS & DISCUSSION

3.1 The Proposed Pacific Northwest National Scenic Trail Through the Yaak Watershed

3.1.1 Current status of proposed PNT through the Yaak study area

We used the 2016 version of the proposed northern PNT alternative available online at: https://usfs.maps.arcgis.com/apps/MapJournal/index.html?appid=4eec2364964340f6abca53609e2bd4fd. According to the map legend:

> *This set of maps is put together for the members of the PNNST Advisory Council to help describe some of the current land management along the trail. The data shown in these maps are a snapshot based on agency databases and publicly available information as of September 2016 on which uses are allowed/prohibited. We are working with local trail managers to verify the accuracy of the data, and errors may exist. Allowed/ prohibited uses and restrictions are subject to change at the discretion of the local managing agency or landowner. This map does* not *reflect current trail or road conditions or the safety of a particular activity…*

For our detailed analysis, we were also able to obtain the current GIS shapefiles for the 2016 PNT northern route, thanks to David Fothergill, MLA Acting Pacific Northwest National Scenic Trail Program manager.

The total length of the proposed PNT from the east side of Glacier National Park to the Pacific coast is 1156 miles (438 miles on existing roads, 701 miles on existing trails, and 17 miles cross-country/beach walking).

The PNT portion in the Yaak grizzly bear study area is approximately 68 miles.

The current (2016) northern alternative through the Yaak appears to more or less follow the same 1977-1978 PNT northern route, also known as the scenic option. No other major alternatives have been mapped for the present government review process although, in our professional opinion, this should have been investigated and done using available resources at hand.

On the west side of our Yaak grizzly bear-PNT study area, there are two higher elevation trail alternatives: one going northwest up Davis Creek and through the Northwest Peak Scenic Area and the other going southwest via Midge Creek and then Rock Candy Mountain.

3.1.2 Jurisdiction of the northern PNT trail route and possible alternative routes through the Yaak study area

The USFS map shows ownership within 10 miles of the current route. With the exception of several small areas of private land, the route passes through USFS federal jurisdiction in the Kootenai National Forest. Although we did not attempt to quantify different land jurisdictions for the other possible Yaak PNT alternatives, we identified they would also pass mostly through the Kootenai National Forest and what appears to be some private land. The southern 1978 Jonkel route appears to cross more private land and some state land, but again, it was not our role to quantify how much.

3.1.3 Amount of open roads, existing trails, and cross-country of proposed northern PNT alternative through the Yaak study area

Table 1 on the following page indicates that most of the 68 miles of the proposed northern PNT route in our Yaak grizzly bear study area has been designed to link up existing open roads (31.6%) and established hiking trails (68%) with very little cross-country (0.4%). (These segment types are shown on the Yaak core area/linkage zone PNT Map 6 further on in this report.) Note that the existing hiking trail component includes the new PNT section that was recently built from the highway on the west side of the Koocanusa Reservoir up to Webb Mountain, with numerous switchbacks.

Of the 21.4 miles of roads used for the PNT route, the majority (71.4%) is gravel suitable for passenger cars, while 15% is paved and 13.5% is unmaintained and not suitable for passenger cars. Note, too, that the amount of roads (31.6%) for the proposed northern PNT in the Yaak is a higher proportion than for the length of roads of the overall PNT (23% paved and gravel roads). Of the 21.4 miles of Yaak roads, the majority (71.5%) is gravel suitable for passenger cars while 15% is paved and 13.5% is unmaintained and not suitable for passenger cars. Hiking will be allowed on all of the PNT through the Yaak.

Although the National Scenic Trails System Act (NSTSA) does not allow motorized use, Section 7(j) of the NSTSA allows motorized use on existing motorized routes. However, the USFS PNT website indicates they will be working towards a continuous PNT non-motorized trail route that will include relocations.

3.1.4 Yaak PNT route where bicycle and equestrian uses will be permitted

Hiking will be allowed on all of the Yaak PNT route. It would appear from the USFS interactive PNT map that there are yet no sections identified where bicycles and equestrian (pack-and-saddle) would be prohibited although we calculated from the map that for bicycles, about 39% of the route will be on-road, cross-country, or where there is a question about uses, and for equestrian (pack-and-saddle), it would be 48% (Table 1).

Table 1. Amount in miles of different PNT trail types and allowable non-motorized uses through the Yaak PNT grizzly bear study area. Most of the road sections are open to motorized use. Information derived from: https://usfs.maps.arcgis.com/apps/MapJournal/index.html?appid=4eec2364964340f6abca53609e2bd4fd.

	Amount (miles)	% of total	
1**. Road/trail types**			
PNT on road	21.43	31.6	
PNT on trail	46.19	68.0	
PNT cross country	0.27	0.4	
Total	**67.89**		
2. **Road types**			
Highways or other roads with high speed limit	0.00	0.00	
Paved roads with moderate speed limit	3.23	15.0	
Dirt or gravel suitable for passenger cars	15.30	71.4	
Not maintained for passenger cars	2.89	13.5	
3. **Bicycle**			
Biking allowed on trail	41.32	60.9	
Prohibited or prohibited for part of section	0	0	
Road, XC or question about uses	26.58	39.1	
3. **Off Highway Vehicles (OHV)**	0	0	
4. **Equestrian (pack-and-saddle)**			
Allowed	44.6	65.7	
Prohibited	0		
Road, XC or question about uses	32.4	47.7	
Roads and areas where allowed uses are unknown	0	0	
All the above values are for the current US Forest Service PNT trail routes in our Yaak study area, the total length of which is an estimated 68 miles using only the Midge Creek alternative not the longer Davis Creek route.			

3.1.5 Projected seasons and levels of PNT recreational use of the Yaak PNT

It was beyond the scope of our study to attempt to ascertain existing and projected people and motorized use of the existing roads and trails of the northern PNT route or any alternatives through the Yaak, although the Kootenai National Forest may have some information. For the northern route, this is also complex since a number of different "open" motorized access roads are used for a portion of the PNT through the Yaak or provide separate motorized access up different valleys that intersect with different waypoints along the PNT route at higher elevations, such as near Canuck Peak.

In terms of projected PNT recreation use, we made a number of what we considered to be reasonable assumptions:

1. We expect that after build-out, the peak of recreation use of the PNT route selected for the Yaak will be in the summer running into early-mid fall with some use in spring.

2. Allowing that given the increase in winter outdoor backcountry recreation in Canada and the US, including high country ski, snowshoe, and snowmobile traverses, some winter use of the Yaak PNT route can be expected.
3. We predict that summer and possibly shoulder season recreation use of a final PNT trail through the Yaak will at some point reach and exceed the IGBC (1998) task force standards for non-motorized levels of "high-intensity trail" use of 20 or more parties per week (Anonymous 1990). Lyndaker (2011) discusses the complexities of quantifying high-intensity human use of hiking trails in the Idaho Panhandle National Forest to meet the IGBC definition.

If the large recent increase of permits for long-distance hikers and horseback riders of the Pacific Crest Trail (which passes through the North Cascades grizzly bear recovery zone in the north) is any indication of future PNT use, once a route is officially finalized, it is not difficult to project that the PNT through the Yaak will become a "high-intensity trail." Permits for long-distance (500+ miles) hikers and horseback riders for the Pacific Crest Trail increased by over 300% in just four years from 1,879 in 2013 to 5,657 in 2016 (Pacific Crest Trail Association, www.pcta.org/visitor-use-statistics). In 2016, over 700 people self-reported completing the trail, but this is just a portion since others did not bother to report and there is no measure of day-use only recreation. As to how many people use this national trail each year, the PCT Association states:

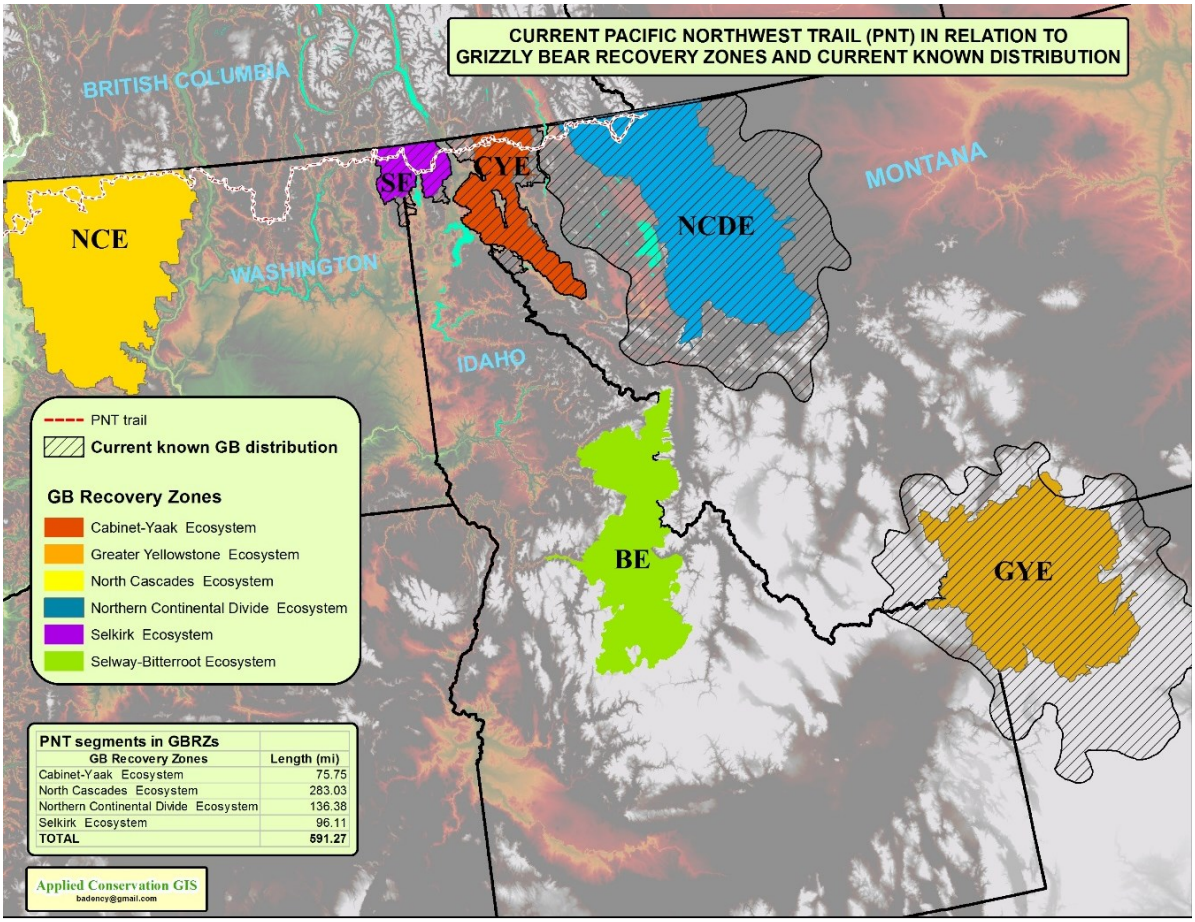
> *We'd love to know exactly how many people use the Pacific Crest Trail. Probably hundreds of thousands or more than a million people use the PCT each year—if we were to count every person who steps on to some section of the trail. We just don't know and there's no feasible way to count them all*.

3.2 Assessment of the Yaak PNT and Grizzly Bears

3.2.1 US grizzly bear recovery ecosystems crossed by the proposed (2016) northern PNT route

We developed Map 2 to show that the proposed PNT route traverses four of the six US grizzly bear recovery zones, including the North Cascades (NCE), where few or no grizzlies currently occur but a proposed long-term recovery plan is now being seriously considered. Given the extensively documented scientific database for North American grizzly bears concerning the risks of bear-people encounters and associated human injury or fatality on recreational trails (and associated campsites), as well the phenomenon of grizzly habitat displacement from trails and other outdoor recreation sites such as campgrounds, we were surprised to find that the USFS 2016 proposed PNT route widely advertized on its website presents no major alternative routes; it still follows approximately the most scenic northern route that the 1980 USFS-NPS study concluded would have the most adverse environmental impacts on grizzly bears and fragile high elevation habitats.

Of the current total length of the PNT current route (1156 miles), we estimate 591 miles, or 51%, of the length passes through the four designated US grizzly bear recovery zones. Nearly 7% (76 miles) of the total length of the PNT passes through the Cabinet-Yaak grizzly bear recovery zone, and 6% (68 miles) passes through our Yaak PNT grizzly bear study area.



Map 2. Proposed northern PNT alternative (2016) in relation to designated US grizzly bear recovery zones.

3.2.2 Current status and predicted grizzly bear numbers in the Yaak grizzly bear recovery zone

Assessment of the grizzly bear encounter risk and impacts of the northern PNT and any alternative routes on threatened Yaak grizzly bears is complex because it has to take into account the current population estimates and numbers targeted for full recovery. A grizzly bear DNA-hair snagging study that also used telemetry locations in the CYGBRZ (Kendall et al. 2015) concluded that in 2012 the grizzly bear population had reached 48-50 animals, about half of the population recovery goal of approximately 100 bears. In the northern Yaak, some grizzly bears have home ranges shared with British Columbia. In 2012, the Yaak was estimated to have 18-22 grizzly bears (Kendall et al. 2015). The grizzly bear density of 4.3-4.5 grizzly bears/1,000 km^2 in the Cabinet-Yaak was considered among the lowest of the interior North American grizzly populations. According to the same source: *the small size, isolation, and in-breeding documented by this study demonstrate the need for comprehensive management designed to support CYE population growth and increased connectivity and gene flow with other populations…*

It should also be noted that demographic recovery targets from the grizzly bear recovery plan (USFW 1993) criteria are for females with cubs over a 6-year average, with a distribution of females with young of 18 of 22. Currently, the levels in 2014 were at 2.5 females with cubs (15/6) with a distribution of females with young of 11 of 22 (Kasworm et al. 2015, p. 20).

According to Kasworm et al. (2015), the numbers of females with cubs in the CYGBRZ from 2009-2014 averaged 2.5 per year, with a variance of 1-4 per year. Mortality caused by people during this same period averaged 1.5 bears per year amounting to a death rate of 0.3 females per year. Of the nine known or probable grizzly bear deaths caused by people (in or within 10 miles of the CYGBRZ in the U.S.) during the same 2009-2014 period, two were adult females (one self-defense and one under investigation), four were adult males (two were illegal kills under investigation, one was a grizzly bear mistaken as a black bear, and one was in self-defense), two were subadult males (one mistaken species identity and one self-defense), and one was a male cub (under investigation). Of these nine, it is to be noted that three were killed in known self-defense situations while others were still under investigation. Such human-caused mortality appears high for such a small population.

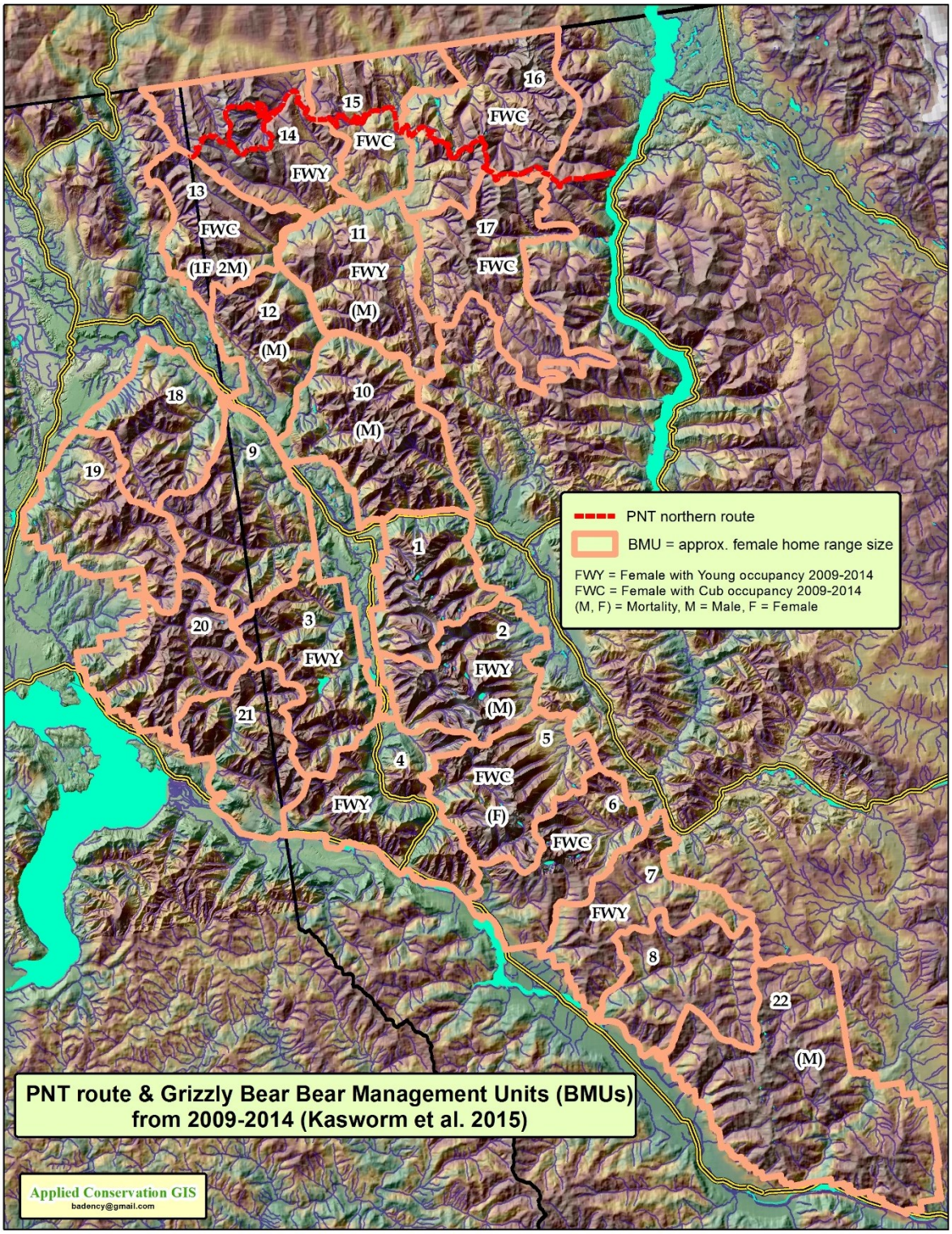
3.2.3 PNT & Kootenai National Forest Bear Management Units (BMUs) with Female with Cub and Young (FWC, FWY) Occupancy from Kasworm et al. (2015)

One measure we used to evaluate the relationship of the current PNT route in the Yaak to grizzly bear habitats and their recovery was to overlay the route on a copy version of the grizzly bear management Unit (BMU) map for the CYGBRZ from Kasworm et al. (2015. p. 21, Fig. 4). We created our own version (Map 3) of the BMU map by digitizing the boundaries from the Kasworm et al. map to a topographic type map that showed drainages (and thus there could be some small boundary errors as a result).

According to the Kootenai National Forest web link on BMUs:

> *This layer was originally developed by a team of FS and FWS biologists. Their delineations were based on the grizzly bear home range sizes from the Cabinet-Yaak Grizzly Bear ecology study (Kasworm and Manley 1988). Each BMU was to approximate the size of a female grizzly bear home range and include all seasonal (spring, summer, fall, winter den) habitat components. Boundaries were to be easily identifiable on the ground so they follow hydrologic boundary to the extent possible. Boundary adjustments were last made in 1997 to match adjusted watershed boundaries.* (https://www.fs.usda.gov/main/kootenai/landmanagement/gis#wild).

Map 3 (on next page) shows that the northern PNT would pass through three BMUs (14, 15, and 16) with demonstrated female with young (FWY) or female with cub (FYC) occupancy from 2009-2014. While no mortalities (sex M or F in brackets) were documented for these, BMU #13, which would be crossed by the PNT just to the west of our study area in Idaho, showed one female and two male mortalities over this period. It is noteworthy that the northern Yaak BMUs have the most FWY/FWC occupancy compared to the southern Yaak, likely reflective of higher seasonal habitat values and less human disturbance.



Map 3. Showing CYGBRZ designated bear management units (BMUs) including those with female with young occupancy crossed by the northern PNT alternative.

Although it was beyond the scope of our study to show the home ranges of various grizzly bears crossed by the northern PNT alternative from Kasworm et al. (2015), the following maps (4 and 5) demonstrate how some adult female grizzly bears concentrate some of their annual use in the vicinity of the current PNT corridor.

3.2.4 PNT & resource selection function (RSF)-derived GIS grizzly bear core habitat and linkage areas

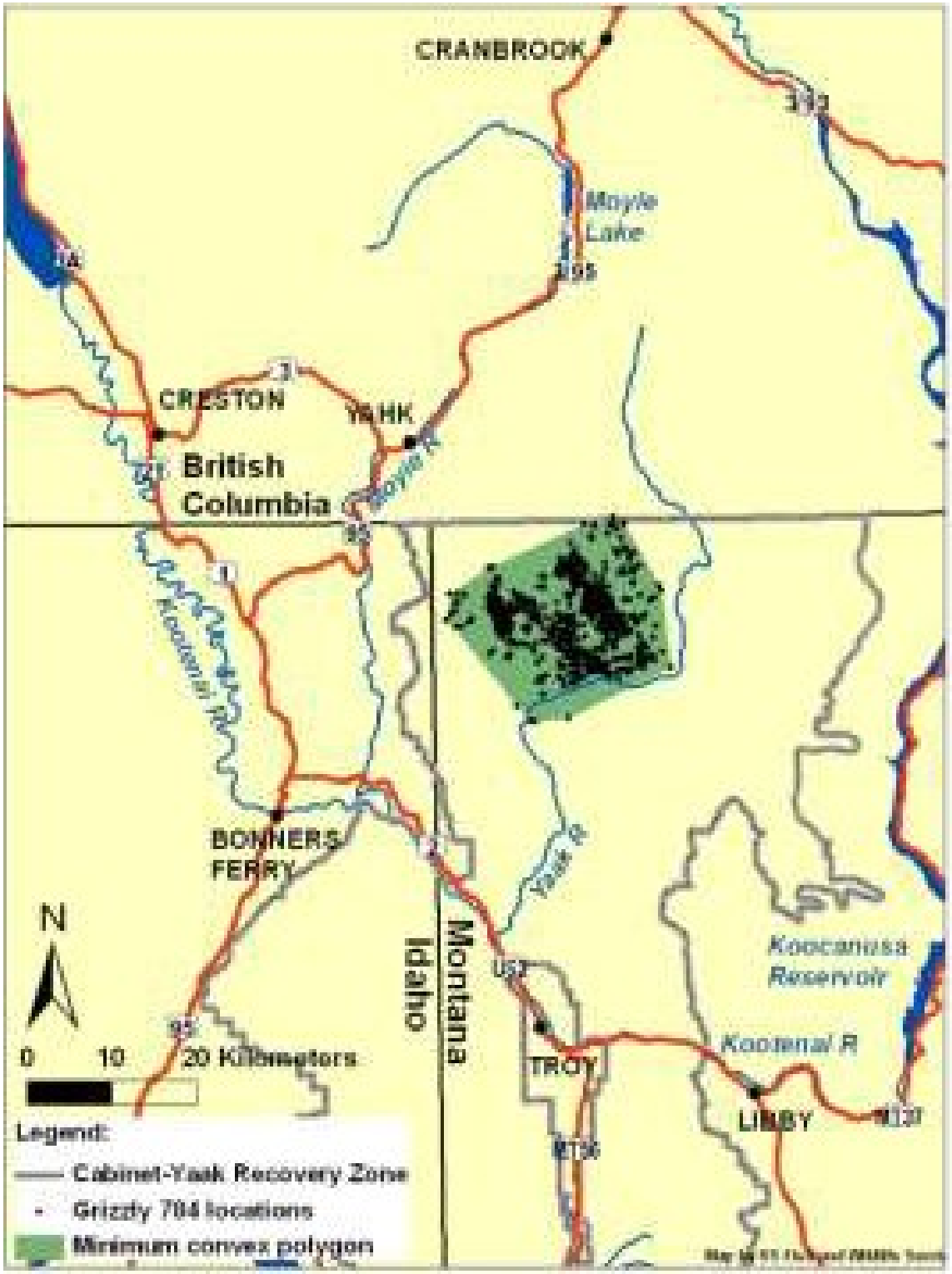
Proctor et al. (2015a) used a resource selection function (RSF) approach to predict backcountry areas of high quality grizzly bear habitats and frontcountry linkage zones through human-settled zones in the Canada-USA transborder grizzly bear recovery area, including the CYGBRZ. They used data collected from 2004-2014, including grizzly bear telemetry locations.

We were able to obtain GIS map shapefiles for the highest value core areas (dark green) and linkage zones (yellow) and then overlay Map 6 with the current northern PNT alternative. The map shows that the PNT crosses two grizzly bear core areas in the Yaak, including the largest one on the west side. This does not mean that other quality grizzly habitats do not occur in the non-core areas, which they do, but core areas reflect what is apparently the best.

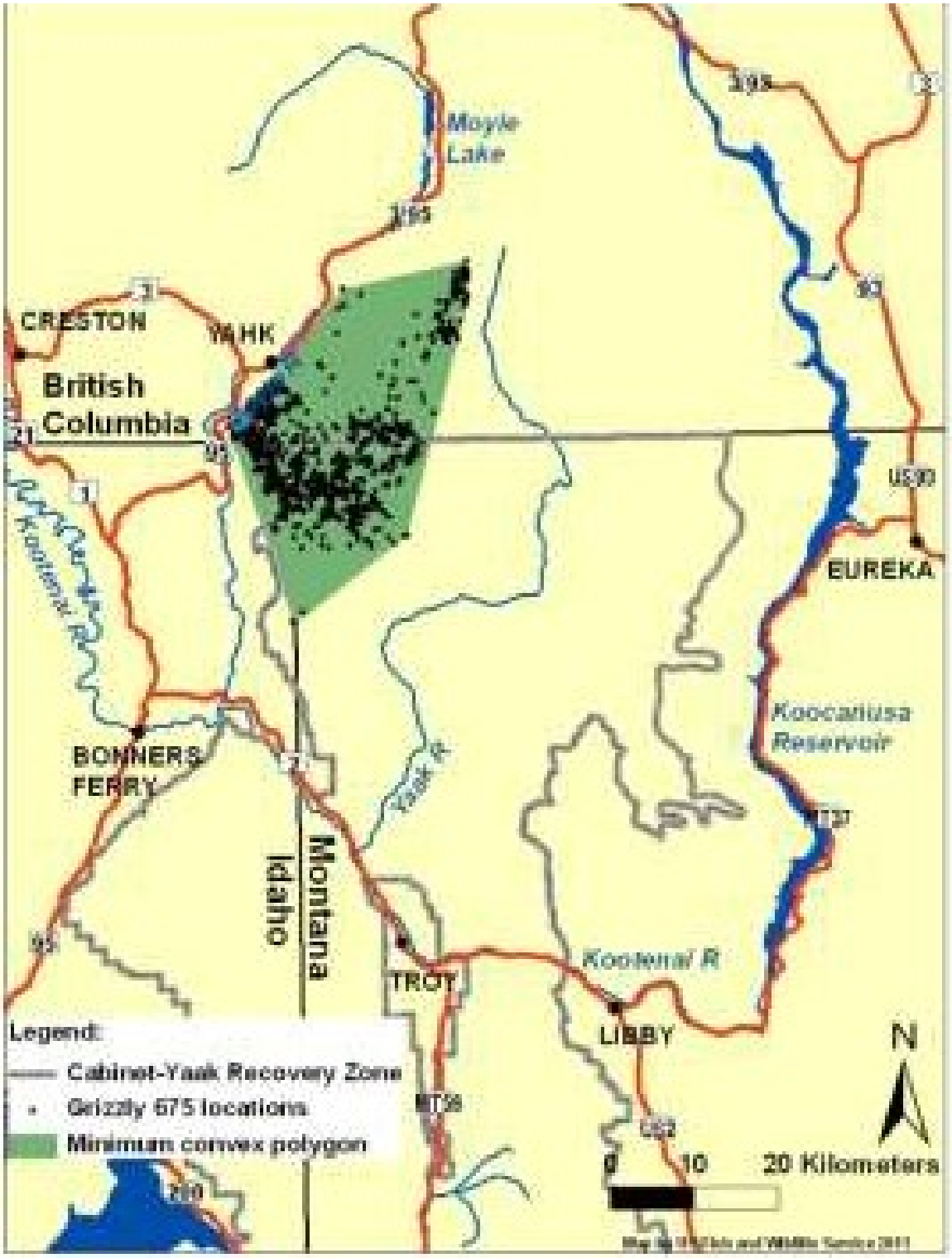
In terms of high value linkage areas (yellow), the PNT crosses an important north-south one on the east side of the Yaak study area. The linkage map can be somewhat misleading since, although not shown as a high linkage area, most of the entire Canada-USA border area is suitable for grizzly bear movements back and forth (W. Kasworm, pers. comm.) due to little or no human settlement. This is demonstrated by some of the Yaak grizzly bear home ranges encompassing large areas on the Canadian side (Kasworm et al. 2015). As will be discussed later in our comments on other PNT alternatives through the CYGBRZ, Kasworm's biggest concern regarding linkage and grizzly bears is more in the south where narrow or "pinched" linkage zones have been mapped across Highway 2 between the Yaak and Cabinet grizzly bear recovery areas. Only recently have telemetry studies shown that three grizzlies have crossed between the two formerly isolated grizzly bear recovery zones (W. Kasworm, pers. comm.).

3.2.5 Assessment of grizzly bear habitat areas and their seasonal importance along the northern PNT route in the Yaak study area

Development of a detailed ground-truthed map of grizzly bear habitat potential, ranked in importance values for the three grizzly bear seasons, was considered essential to assessing grizzly-people encounter risk and human disturbance potential of trail and campsite facilities for the BC North Cascades grizzly bear recovery plan (McCrory 2003a). As well, an accurate grizzly bear seasonal habitat map was considered essential for designing a grizzly bear hazard reduction program for the recovery plan, such as by relocating some trails and campgrounds out of high quality potential grizzly bear habitat (McCrory 2002). In Yoho National Park, an expert panel of grizzly bear biologists working for Parks Canada on an assessment of grizzly bear mauling incidents related to a popular subalpine hiking trail network endorsed the value of accurate fine-scale ground-truthed mapping of grizzly bear habitats to the micro-habitat level over coarse scale conceptual mapping for making reliable grizzly bear encounter reduction management decisions for recreational trail networks and campgrounds (Donelon and Paquet 1997).



Map 4. Radio locations and minimum convex (shaded) life range of female grizzly bear 784 in the Yaak River, 2007-09. (Figure 83, p. 87. Kasworm et al. 2015).



Map 5. Radio locations and minimum convex (shaded) life range of female grizzly bear 675 in the Yaak River, 2004-10. Figure 65. p. 83. Kasworm et al. 2015). Note this bear not only spent considerable time in the vicinity of the northern PNT route in Montana and Idaho, but her home range extended well into Canada.

Unfortunately, we found no detailed grizzly bear habitat maps that included denning available for the Yaak that would have assisted us with a finer-detailed assessment. According to Wayne Kasworm (email dated Sept. 5, 2017), the 19 habitat components he references in his annual grizzly bear reports are based on a mapping system that the US Forest Service used in the 1980s to map grizzly bear habitat around the Cabinet-Yaak. He feels that these components are not as accurate today but he uses them for his grizzly bear aerial radiotelemetry locations. These components are described in greater detail by Kasworm and Manley (1988) in their report on grizzly (and black bear) food habitats and habitat characteristics from scats and radio-collar information from three grizzly bears in their Cabinet Mountains study. More recently, Kasworm et al. (2015) provide an update on the seasonal grizzly bear habitat components of the Cabinet-Yaak ecosystem. Apparently, an updated grizzly bear habitat map is now being prepared for the CYGBRZ.

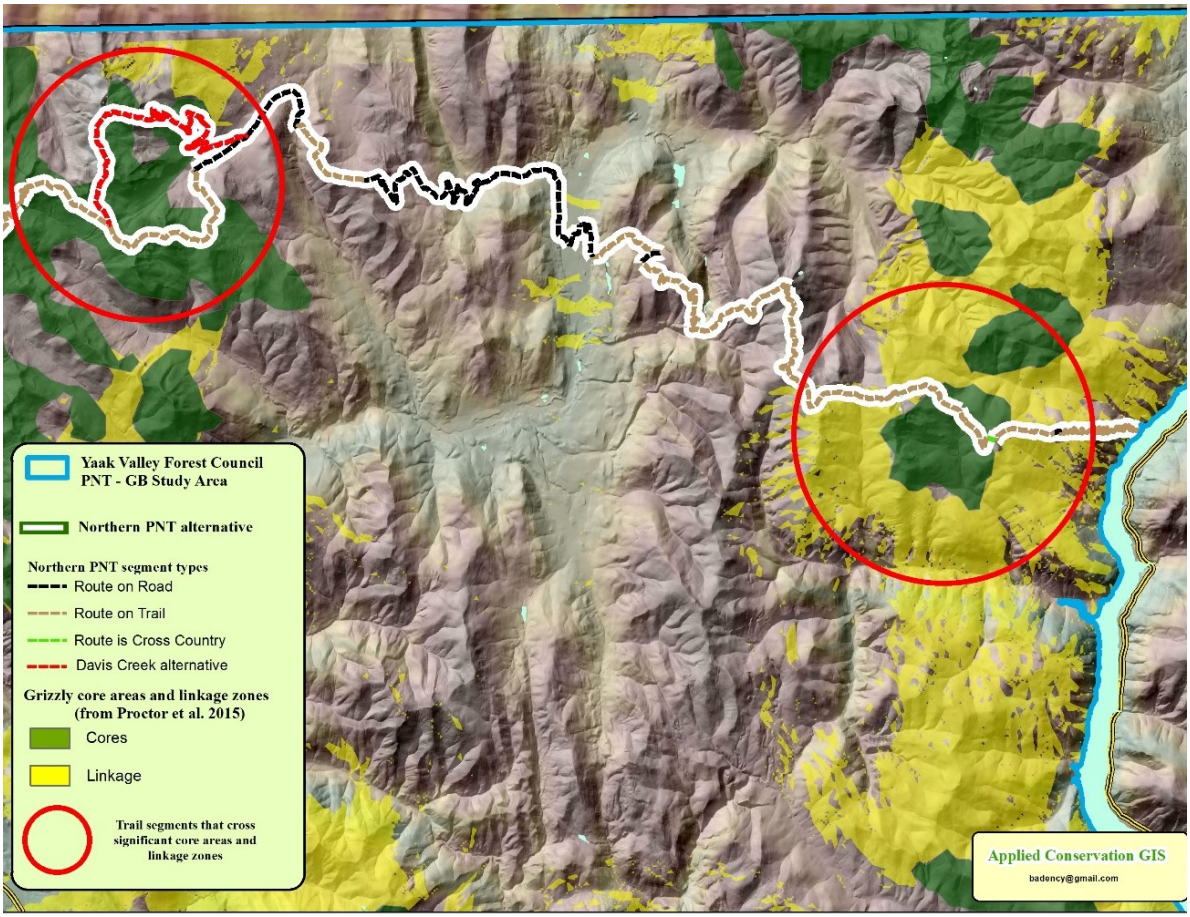
For the Kootenai National Forest, Johnson and Gautreaux (2008) provide a comprehensive summary of seasonal grizzly habitats in the Yaak for vegetation management prescriptions for grizzly bear habitat enhancement or restoration for the C-Y ecosystem based on the Kasworm et al. studies. Since no grizzly bear habitat map was available, we used a GIS Digital Elevation Model (DEM) approach to map the elevation zones for the different seasonal grizzly bear habitats summarized by Johnson and Gautreaux (2008). We used these as a surrogate to identify where important grizzly bear habitats by season would most likely be found (see Table 2). This included elevation zones for spring, summer, fall, and winter den habitats. We then overlaid the map with the northern PNT route.

We then used the DEM habitat predictive model and PNT overlay to estimate the amount of each seasonal habitat zone that would be crossed by the PNT (Table 3, Appendix), which are summarized in Table 2 on p. 32.

The results (Map 7) show summer, fall, and winter den habitat all overlap in varying degrees at higher elevations (but with different low elevation demarcation zones) at lower elevations while spring habitat is found at lower elevations. We estimated 24 miles or 35% of the northern PNT in the Yaak will cross areas where spring habitats types would occur at lower elevations (below 4,590 feet), while the balance (44 miles or 65%) of the total Yaak PNT length overlaps with other seasonal habitat elevation zones, including 44 miles or 65% of trail length of fall habitat zone (above 4,590 feet, except for some grizzly use of ungulate remains at lower elevations in November), 37 miles or 54% of total trail length of summer above 4,929 feet, and 26 miles or 38% of the total route in winter den habitat starting at elevations above 5,580 feet.

3.2.6 Seasonal importance of grizzly bear huckleberry habitats related to the current PNT in the Yaak study area

Currently, an important 3-year grizzly bear-huckleberry (*Vaccinium* spp.) habitat model study is underway for the Canada-USA transborder area headed by Dr. M. Proctor of the transborder grizzly bear study team. The project is based on developing and testing a reliable predictive GIS map model for huckleberry habitat because various studies have demonstrated that huckleberries are a critical summer food for bears (Proctor et al. 2015b).



Map 6. Shows northern PNT alternative in relation to RSF-defined grizzly bear core areas (dark green) and linkage areas (yellow) from Proctor et al. (2015a). Other important grizzly habitats would also be found along the PNT route outside of the core areas.

The first year results demonstrated considerable success of the map model, which included the Purcell and Yahk areas in BC just north of our PNT Yaak grizzly bear study area. According to Dr. Proctor (pers. comm.), the model, when completed and fully tested, will be useful for predicting the most critical habitats for grizzly bears since there is a correlation between huckleberry habitats and other seasonal habitats of importance during the non-huckleberry season. It is expected the study will be expanded to include the CYGBRZ (M. Proctor pers. comm.).

Kasworm et al. (2015) found that huckleberries were an important food item in summer and fall in the CYGBRZ, particularly in September. We found higher elevation *Vaccinium* habitats to be common along the PNT areas we ground-truthed in mid-October, 2017 (Mt. Henry, Canuck Peak, Garver Mountain to Pete Creek Meadows). Based on this background huckleberry study just north of the border and our preliminary assessment, we suggest that higher elevation *Vaccinium* areas could represent significant grizzly bear encounter and habitat displacement issues for grizzly bears. However, this requires more in-depth evaluation including assessment of the occurrence of high value *Vaccinium* areas along the current route and any other alternative routes studied during the PNT NEPA-EIA process. We suggest that the Proctor et al.

study *Vaccinium* habitat model mapping, if expanded to include the Yaak, be included in the PNT EIA evaluation alternative routes.

Table 2. Summary of grizzly bear important habitat components by season for the Yaak from Johnson and Gautreaux (2008) as derived from various CYGBRZ grizzly bear reports.

Season	Most used habitat components	Preferred aspects	Elevation	Important food items	Amt. in miles crossed by PNT
Spring (April 1, den exit-June 15)	Closed timber, Timbered shrubfield, Graminoid side hill, Mixed shrub/cutting unit	All	Below 4,590 feet	Grasses, Sedges, Succulent forbs, Corms of glacier lily and biscuit root	24.0
Summer (June 16-Sept. 15)	Timbered shrubfield, Mixed shrub/cutting unit, Closed timber	All	Above 4,920 feet	Succulent forbs, Insects, Berries (mostly huckleberry)	37.0
Fall (Sept. 16-Nov. 30, den entry)	Timbered shrubfield, Closed timber, Mixed shrub/snow chute	All	Mostly above 4,590 feet	Revert back to green-up grasses & sedges with late rains, Berries incl. huckleberries mtn. ash	44.0
November			Low, can be down to 3,300 feet		May be related to ungulate hunter carrion
Den use (Dec. 1-March 31)	Timbered shrubfield, Closed timber,	S. aspects avoided, all others used	5,580 feet		26.0
All the above values are for the current US Forest Service PNT trail route in our Yaak study area, the total length which is an estimated 68 miles, using only the Midge Creek alternative, not the longer Davis Creek route.					

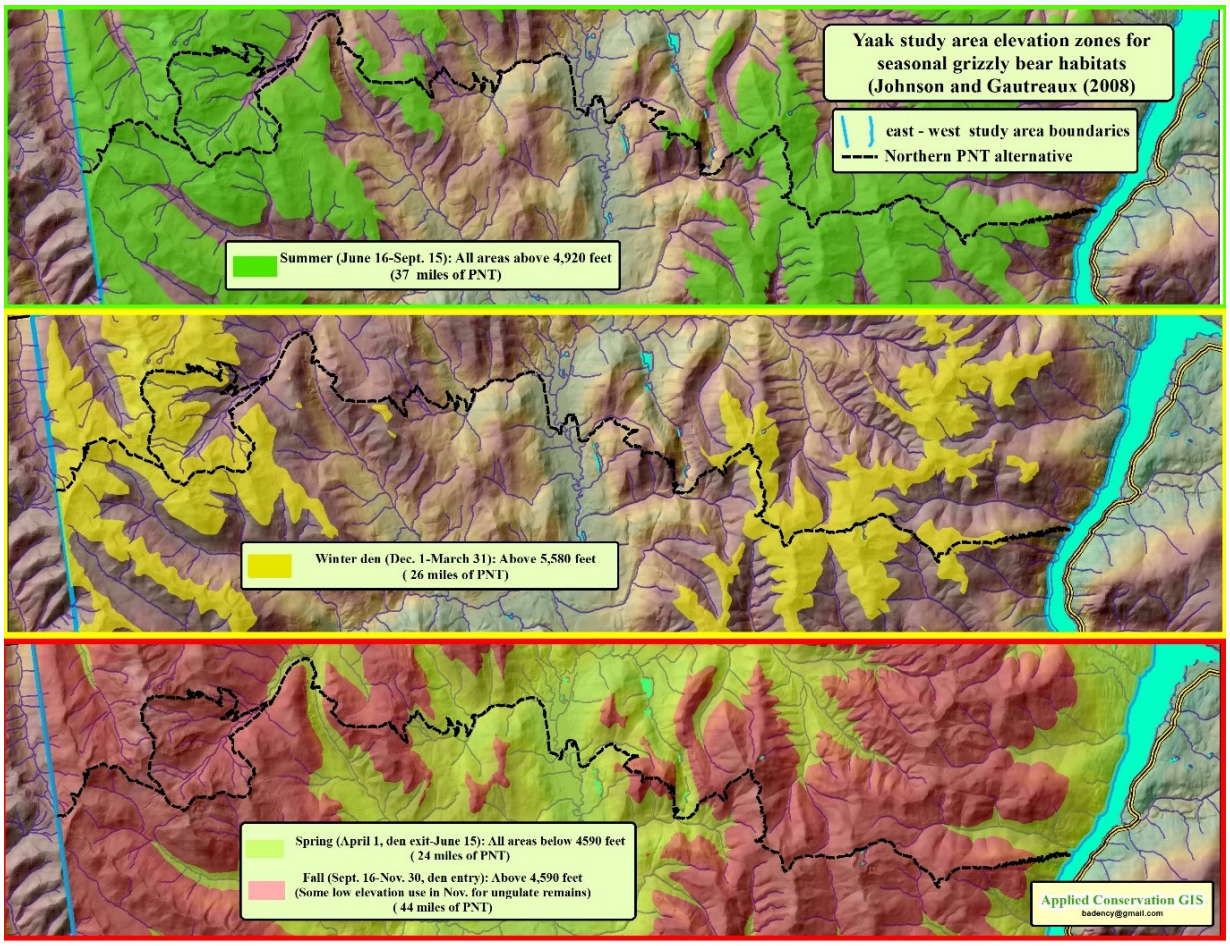
3.3 Assessment of the 2016 Proposed Northern PNT in the Yaak and Grizzly Bear Encounter Risk

3.3.1 Projected seasons and levels of recreational use of the Yaak PNT route in relation to seasonal grizzly bear habitat elevation zones

The timing, amount and types of human recreational use on hiking trails and roads has a strong bearing on the risk of grizzly bear-people encounters (as well as displacement of grizzly bears), just as would the estimated number of grizzly bears in the Yaak at full recovery magnify the encounter risk (and displacement) effect.

The following assessment is based on our assumptions of seasonal recreation use of a Yaak PNT at build-out and over time, made in the PNT section of our report.

The peak of PNT recreation use after build-out would coincide mostly with the Yaak grizzly bear summer season (June 16-Sept. 15) and to a lessor extent with the grizzly bear spring season (April 1-June 15) and the fall season (Sept. 16-Nov. 30). This is relevant in terms of the overlap of PNT seasonal recreation use with grizzly bear seasonal habitats and travel corridors and their relationship to grizzly bear encounter risk and habitat displacement. Allowing that given the increase in winter outdoor backcountry recreation in Canada and the U.S., including high country ski, snowshoe, and snowmobile traverses, some winter use of the Yaak PNT route can be expected. This has the potential to interfere with high elevation grizzly bear hibernation (and wolverine natal/maternal) winter denning areas.



Map 7. Showing northern PNT alternative and extent to which it crosses spring habitat elevation zone (light green) and higher elevation summer, fall and den habitats that have different lower elevation demarcation zones but overlap higher on the mountains.

Summer and possibly other season recreation use of a final PNT trail through the Yaak will at some point exceed the IGBC (1998) task force standards for non-motorized levels of "high-intensity trail" use of 20 or more parties per week (Anonymous 1990), thereby affecting Kootenai National Forest grizzly bear BMU calculations and designations for core areas. According to Wayne Kasworm (pers. comm.), this could have repercussions on current levels of access management worked out with the local (and regional and national access management considerations) community for grizzly bear core areas and existing road access and availability.

3.3.2 Grizzly bear risk encounter risk potential related to the northern Yaak PNT route and alternatives

In this section, we examine the potential for grizzly bear encounters related to the current northern PNT route and for consideration for other possible PNT alternatives through the Yaak as part of the proposed NEPA–EIA process being planned for this national trail.

Although we cannot say with precision, our review suggests that at more advanced stages of recovery of grizzly bear numbers in the Yaak and with final development and predicted high-intensity backcountry use, the current northern PNT route will cause an increase in grizzly bear-human encounters that over time may involve human injury. This is primarily because the current northern route passes through two identified grizzly bear core areas with 44 miles, or about 65%, of its 68-mile length passing through higher elevation summer and fall habitat zones where most of the grizzly activity is expected to overlap with eventual high levels of hiking use. Use of bicycles on some sections of the trail may increase the risk of encounters with grizzly bears to that user group. We also suggest that potential confrontations between PNT recreationists and grizzly bears would be additive to what appears to a current low level of bear-people confrontations in the Yaak, some of which involve ungulate hunters, which have lead to a small number of grizzly bear mortalities in defense-of-life kills (Kasworm et al. 2015). We did not attempt to determine if data exists on backcountry hikers-grizzly bear encounters in the northern part of the Yaak.

We developed a grizzly bear encounter profile for the proposed Yaak PNT based on a number of studies done elsewhere. In developing a profile of potentially injurious bear-people encounters for the grizzly bear recovery plan for the BC North Cascades, McCrory (2002) identified six general categories. There are many complex and poorly understood interacting variables related to the potential occurrence for each grizzly bear encounter type that has the potential to cause human injury or fatality. Bear species, population size, overlap of feeding habitats and travel corridors with recreation facilities, degree of habituation and/or food conditioning, and other factors have to be taken into consideration. The six categories were based on extensive bear risk assessment research by the author in provincial and national parks in Canada combined with a review of relevant studies by McArthur Jope (1982), Nadeau (1987), Jope (1985), Herrero (1985, 2002), Herrero and Fleck (1990), Herrero and Higgins (1995,1999), Herrero and Higgins (1999), McCrory et al. (1999), and others.

The six bear-people incident categories are:

1. food/garbage incident
2. chance encounter with a defensive mother bear
3. chance encounter with a defensive subadult or adult grizzly
4. bear feeding on a large mammal carcass
5. predaceous attack by either bear species where a person(s) is treated as prey
6. unexplained attack

Of these six types, grizzly bears are generally more dangerous than black bears in all categories except for predaceous attacks. Even adult and subadult grizzlies on their own have been known to attack humans in chance encounters without the motivation being scientifically understood (Herrero 2002). According to a review by Ciarnello (1997), even though there are about 12 times more black bears than grizzly bears in British Columbia, grizzly bears accounted for three human deaths and 32 injuries between 1985-1996 and black bears accounted for four human deaths and 30 injuries during the same period. According to Herrero (2002), about 10% of black bear inflicted injuries are major (hospitalization for 24 hours or more), whereas about

50% of grizzly inflicted injuries are major. Studies also show that black bears are seldom aggressive towards humans. In an intensive study of 992 interactions between black bears and visitors in the backcountry of Yosemite National Park (1978-1979), bear aggression was observed in less than 6% of the interactions and less than 2% of the total bear behavior recorded (Hastings et al. 1981). Even if black bears exhibit "aggressive" behavior when cornered, defending a food source, or defending young, this is normally a ritualized display [within the species] that rarely leads to human injury.

For our Yaak-northern PNT route grizzly bear assessment, we focused on the potential for injurious type encounters between grizzly bears and allowable PNT recreationists (hikers, bicycles, and pack-and-saddle). We did not include the sections of the northern PNT alternative where motorized use also occurs. Although black bears also inhabit the study area, they were not part of our review.

In the case of the PNT route in the Yaak, the following background review suggests that the most likely type of dangerous grizzly bear-people encounter would involve defensive behavior by mother grizzly bears with young encountered by surprise at close range on a trail, followed by people encountering at close range a grizzly bear on an animal kill, and lastly by a predaceous attack involving people traveling or camping. We assumed that tight controls for backcountry human food/garbage management (i.e., 100% of current standards) would be implemented and enforced by the Kootenai National Forest for a PNT trail and associated campsites and, therefore, we did not consider the food-conditioned type of encounter a serious risk. The Kootenay National Forest is included in USFS Special Orders designed to minimize grizzly bear/human conflicts in national forests. Storage of food, garbage and other attractants is restricted during occupancy (www.fs.usda.gov/detail/flathead/home/?cid=stelprdb5347448).

According to Jope (1982), females with young were involved in at least 74% of the 38 injuries to hikers in North American national parks prior to 1974, even though they comprise only 16-20% of grizzly bear population. Prior to 1974, females with young were involved in ten of 11 injuries to hikers in Glacier National Park (US). Sudden surprise was an important factor in these incidents, and in all of the attacks, the hikers were not actively making noise. In a later publication, Jope (1985) also noted that in more recent incidents in Glacier National Park, single adult and subadult grizzly bears were also involved in injurious encounters. Only hikers that did not wear bear bells were charged. The author suggested that habituation of grizzly bears to hikers reduces the rate of fear-induced charges and subsequent injuries. A later analysis by Gniadek and Kendall (1996) for Glacier National Park indicated that in the 1980s there were 28 people injured in 21 incidents, with 26 injuries caused by grizzly bears and two by unknown. From 1990-1994, there were 16 people injured with ten known to be caused by grizzlies and the others unknown. Since 1974, the more recent incidents involved surprise encounters with grizzly bears. Their data since 1984 suggested that for every grizzly bear-caused human injury (N=22) or fatality (N=2) there were at least 50 close encounters that did not result in human injury.

In a study of human injuries in Yellowstone National Park from 1970-1994, Gunther and Hoekstra (1995) found that with implementation of a new bear management program in 1970,

bear-inflicted injuries to park visitors decreased significantly. After 1980, most injuries from grizzly bears happened in the backcountry and tended to be more severe than the majority of previous roadside injuries in the frontcountry that were largely caused by black bears. From 1970 to 1994, 34 people were injured in the backcountry, with 26 of these caused by grizzly bears. Of all of the bear-caused injuries in the backcountry, 91% involved people who were hiking while the remainder occurred in campsites. Of the backcountry injuries, 68% were caused by female grizzly bears with young and 18% by yearlings. Most involved surprise encounters while hiking.

In a later study for Yellowstone Park, Gunther (2015) found that during the 35 years between 1980 and 2014, there were 33 human injuries caused by grizzly bears in the backcountry of Yellowstone. Most of these involved mother grizzly bears being aggressive in defense of their young while people were hiking. Only one bear attack occurred at a backcountry campsite. The author concluded that the risk to park visitors from being attacked by a grizzly bear were significantly higher for those hiking in the backcountry than for visitors who remain in the developed areas of the park. He estimated that the chances of being injured while on a multi-day overnight trip in the park was about 1 in 200,000 overnight stays, but the chances of being attacked by a grizzly while just day-hiking could not be determined.

Kokanee Glacier Provincial Park in BC is a high-elevation protected area in the South Selkirk Mountains and is more ecologically similar and proximal to the Yaak than Yellowstone. Surveys by McCrory (1985; 2000) indicated Kokanee Glacier Park has very productive grizzly bear habitats with healthy grizzly and black bear numbers combined with relatively high backcountry visitor use. By 2000, hiking and camping during the active spring-fall bear season had increased to an average of 68 park visitors per day, having doubled since 1985. Several bear habitat/hazard studies in the park beginning in 1985 resulted in some seasonal and permanent trail and campsite closures and improved food/garbage management in high quality grizzly bear habitats. One valley with highly productive grizzly bear habitats was closed to a proposed trail development and has since been managed as a grizzly bear security area. Between 1985 and 2000, park rangers recorded 26 non-injurious bear close encounters with people. The majority (81%) involved grizzlies (N=21), 15% black bears (N=4), and 4% unidentified (N=1). Of these, the majority (73%, N=19) involved non-aggressive encounters where most of the bears moved off in reaction to the presence of people. Some 27% (N=7) involved aggressive behavior, two involved a food-conditioned black bear just outside the park, one involved a female grizzly that made one bluff charge after being surprised at close range, and four involved a subadult grizzly that appeared to be exhibiting what was interpreted to be predaceous-interest behavior towards people. There were no encounters involving defensive behavior by a grizzly guarding a large mammal carcass. All encounters involved bears on a trail or at a hut, road, or campsite. No encounters were reported off-trail. The area of greatest conflict was at a higher elevation recreation trail and hut network in the Kokanee Uplands. Nearly half (n=11) of the 26 encounters since 1985 occurred here, all involving grizzlies: four involved mother grizzlies and seven involved subadults; at least five of the reported closer encounters were considered potentially serious enough that human injury or death could have easily resulted. All of the more serious encounters were caused by three grizzly bear groups

that appeared to have become habituated to humans. Despite the relatively high and increasing backcountry visitor use, the lack of injurious grizzly bear incidents from 1985-2000, even with a doubling of visitor use, was attributed to improved food/garbage control, better public education, closures of some trails and campsites in high quality bear habitat, and managing one productive valley as core grizzly bear security habitat with no trail access. Habituation was an indeterminate factor (McCrory 2000).

In terms of defensive attacks by bears on people while grizzly bears are feeding on a large mammal carcass or remains, this type of situation is considered more rare than injuries sustained from, say, mother grizzlies in defense of their young (Herrero 2002). In some areas of North America, especially where ungulates are abundant, both black and grizzly bears enhance their largely vegetarian diet through predatory and/or scavenging behavior. Often this involves hunting and killing young and/or weakened ungulates or locating carcasses, including those left by hunters overnight for subsequent retrieval. As a rule of thumb, grizzly bears become far more dangerous than normal when defending a large animal carcass. There is fair evidence that black bears are less dangerous than grizzlies in similar circumstances (Herrero 2002). In their review of human injuries inflicted by bears in BC from 1960-1997, Herrero and Higgins (1999) found that 19% of grizzly attacks involved ungulate carcasses whereas none were involved in black bear attacks.

Predatory attacks by either bear species along the Yaak PNT, however rare such incidents may be, are also of concern. Unlike attacks from bears related to artificial food conditioning or mother bears defending their young, predaceous attacks are more likely to be fatal. Black bears are more involved in predatory attacks on people than are grizzly bears. For example, an analysis by Herrero and Higgins (2003) of bear attacks in Alberta from 1960-1998, including in national parks, found that only 18% of grizzly bear incidents were predatory, whereas 58% of black bear incidents were predatory. For fatal black bear attacks in BC from 1960-1997, Herrero and Higgins (1999) found that 83% involved possible predation where motivation could be inferred. This is consistent with records for North America. Of 20 records of fatal attacks by black bears on the continent between 1900 and 1980, 80% involved the bear acting as a predator (Herrero 2002).

3.3.3 Grizzly bear encounter risk related to hikers, mountain bikers and equestrian (pack-and-saddle)

As noted previously, the 2016 northern PNT in the Yaak would allow hiking for all of the route but use of bikes and pack-and-saddle for only parts. Of the three user groups, people using horses and mules would be the least vulnerable to encounters with grizzly bears (see Herrero 2002), although we have some question about alpacas being used as pack animals. A review in 2010 by the Miistakis Institute in Canada (Quinn and Chernoff 2010) found that all trail use has environmental effects. The most detrimental environmental effects (especially to soils and vegetation) occur when a trail is first constructed. Effects on soil and vegetation are difficult to evaluate regarding hiking versus horseback versus wheels. Effects on wildlife are generally more pronounced with mountain bikes than with either hiking or horseback, generally due to the "sudden encounter" effect (Quinn and Chernoff 2010). According to the researchers:

*The sudden encounter is the most common situation associated with grizzly bear-inflicted injury (Herrero 1989). Mountain bikers are at particular risk of this type of encounter because the potential speed and relative silence of a biker may facilitate closer proximity to bears before being detected. Schmor (1999) interviewed 41 mountain bikers in the Calgary region who cycled in the Rocky Mountains. The responses indicated that 84% of survey participants had come within 50m of a bear while mountain biking and 66% of the encounters clearly startled the bear. Herrero & Herrero (2000) studied incidence of conflict/interaction between humans and grizzly bears (*Ursus arctos horribilis*) along the Moraine Lake Highline Trail in Banff National Park. They found that, though intensity of use was much lower for mountain bikers than for hikers along this trail, mountain bikers accounted for a disproportionately high incidence of conflict with bears. Herrero and Herrero (2000) suggest that grizzly bears are more likely to attack if a human is closer than 50m before being detected. The speed and relative silence of mountain bikes, especially when combined with environmental factors (e.g., dense vegetation, hilly terrain, sound of running water), likely contributed to mountain bikers approaching bears closer than 50m before being detected by the bear. Parks Canada instituted a requirement to travel in tight groups of at least six, which has reduced human-bear conflict in the area (Simic 2007).*

A more recent review of interactions between mountain bikers and bears (MacHutchon 2015) provides further evidence of the higher risk of using bikes in grizzly occupied areas.

It is worth mentioning that while many backcountry users now carry cell phones for both safety and general communication reasons, cell coverage is limited or non-existent in the northern Yaak and other areas (Jessie Grossman, pers. comm.).

3.3.4 The relationship of grizzly bear encounter risk to high quality habitats

The following background review of case history studies strongly indicates that the selection of a PNT alternative through the Yaak that avoids as much overlap as possible with higher elevation summer-fall-winter den habitat areas will provide for the highest level of public safety (and the least disruption to grizzly bears using core habitats). In the case of the northern PNT alternative, we suggest from our elevation habitat map potential that the northern scenic PNT would have the highest projected risk of grizzly encounters for PNT users at full recovery and high visitor levels (and the highest displacement of grizzly bears) of the different potential alternatives we identified through the Yaak (Map 7).

The basis for this is the extensive background research on grizzly bear interactions with people and hiking trail developments in North America that have demonstrated in most, but not all, instances a direct correlation between negative human-bear encounters and high quality bear habitat, primarily in areas with seasonally rich foods (Holcroft 1986, Nadeau 1987, Mattson and Knight 1991, Ciarnello 1997, and others). In some instances, grizzly bear travel corridors are also implicated as places for a higher risk of encounters (McCrory et al. 1999. McCrory 2003. McCrory et al. 2004).

Closures or avoidance of hiking trails and campsites in high quality grizzly habitat has been a management approach that has been implemented in certain situations since the early 1980s. However, the results have seldom been quantified by follow-up studies. In 1981, after a study of grizzly bears that congregate to feed on aggregations of ladybird beetles and army cutworm moths in a hiking/climbing area on McDonald Peak in the Mission Mountains of Montana, the Confederated Salish and Kootenai Tribal Council permanently closed the area for human safety and to protect a site critical to the Mission Mountain grizzly bear subpopulation (Klaver et al. 1985).

In 1982, Yellowstone National Park implemented a zoning program to further protect threatened grizzly bears and improve public safety. Sixteen bear management areas (BMAs) were created in the park that allowed for backcountry recreation to be seasonally restricted in areas of the park with high seasonal concentrations of grizzly bears and bear foods. Overall, the BMA program was intended to provide security habitat for grizzly bears away from human influence, decrease habituation, and provide safety for backcountry users. In a follow-up study of BMA effectiveness by Coleman et al. (2013), researchers from 2007-2009 contrasted human and grizzly bear global positioning system location data in six BMAs during restricted (limited human access) and unrestricted (open human access) periods. The results suggested human presence can displace grizzly bears if people were allowed unrestricted access to the six BMAs and confirmed the utility of management closures to protect grizzly bears in a well-visited park.

Nadeau (1987) studied the direct relationship of grizzly bear encounters and seasonal bear habitat parameters in Glacier National Park (U.S.). He found that of the nearly 2,000 backcountry grizzly observations reported in Glacier Park from 1980 through 1984, 205 (10%) involved sudden encounters. About 5% (N=10) of these encounters resulted in human injury. He also found that if a hiker confronted a grizzly bear on a trail in the park in September, there was a high probability of being injured than at any other period. The author concluded that decreasing the chances of sudden encounters was an important management concern. Nadeau then used confrontation data and habitat information to test the hypothesis proposed by Herrero et al. (1983) and others for Banff National Park that avoiding key grizzly bear habitats would lead to a reduction of bear-people encounters and human injuries. He found a strong correlation between seasonally important grizzly bear habitats and confrontation sites along hiking trails, as well several other factors near grizzly bear feeding habitats, such as sight distance and proximity to water. Nadeau concluded that bear management can be enhanced through identification of seasonally important grizzly feeding areas and travel routes, then rerouting visitor use or redesigning trails in dangerous areas. These management actions would thereby reduce sites of grizzly bear-human confrontations in the future.

More recent research involving a four-year case history study of a higher than average grizzly bear attack site in Canada's Yoho National Park concluded that injurious bear encounters can also occur in areas of low grizzly bear vegetation feeding habitat potential but where bear travel corridors occur that include sites where bears opportunistically prey on ungulates near hiking trails, in this instance mountain goats (McCrory et al. 1999). As a result of final recommendations from an expert grizzly bear panel, Parks Canada implemented a permanent site closure on one hazardous trail network and a guideline for groups of only five or more

people and daylight travel only through another hazardous trail system. An adjacent high habitat valley was also permanently closed to hiking other than for groups of five or more with an experienced bear guide. These management measures appear to have worked since there have been no injurious confrontations over the past 18 years.

3.4 Potential Impacts of the Proposed Northern PNT Route in the Yaak to Grizzly Bears and Their Recovery

3.4.1 Habitat displacement & implications of northern PNT route to Yaak grizzly bears and the recovery plan: Grizzly bears, roads, and trails

From the following review, we suggest that recreational use of the 2016 PNT northern route in the Yaak—passing as it does for much of the way through higher elevation summer, fall, and winter den habitat—will have a serious negative effect on grizzly bears through displacement from high quality habitats during hyperphagia and even during winter denning, with the potential for reduced survival that could impact the grizzly bear recovery program. Again, this is still a precarious grizzly bear population without satisfactory resilience to increased negative human impacts. According to the hair-snagging DNA study that included the Yaak (Kendall et al. 2015):

> *…the small size, isolation, and in-breeding documented by this study demonstrate the need for comprehensive management designed to support CYE population growth, and increased connectivity and gene flow with other populations.*

There is a large body of scientific research on the effects of various forms of recreation on wildlife, habitat, and other environmental components. This includes the impacts of roads, trails, and other developments on grizzly bears.

The first review of recreation impacts literature was done in 1985 by Boyle and Samson (1985), who found 536 references concerning the effects of nonconsumptive outdoor recreation on wildlife. The variety and magnitude of recreational impacts has increased greatly since then. In 1997, a review of scientific literature on the effects of linear developments on wildlife, including grizzly bears, amounted to thousands of documents (Jalkotzy et al. 1997). A subsequent review by the Montana Chapter of the Wildlife Society in 1999 summarized 403 papers related to effects on carnivores alone (Claar et al. 1999). A bibliography compiled for the Bridger-Teton National Forest in 2002 included 607 scientific papers, reports, articles, and documents written with respect to the effects of roads on wildlife and the montane ecosystem (Nietvelt 2002).

A *Synthesis of the Literature and State of the Practice* about conflicts on multiple-use trails was compiled by the Federal Highway Administration at the request of the National Recreational Trails Advisory Committee (Moore 1994). This document looked at the challenges faced by trail managers to protect natural resources while maintaining user safety and providing high-quality user experiences. As might be expected from a highway agency, the document focuses primarily on trail construction types and users, and avoiding conflicts among users. It does however state that: *All trail use, regardless of travel mode, impacts natural resources*.

Resource damage depends on many factors, including the type of ecosystem, type of wildlife, elevation, type of vehicle, and level of use, among others (Moore 1994).

Effects of human activities on grizzly bears are complicated by the relationship between the habitat type, the spatial distribution of habitat and disturbance, population numbers and social structure of the bear population, the type of disturbance or mortality, and other factors. Despite the variation in habitat and disturbance factors, there are consistent effects of human activities on bears at the local level. Although bears in Yellowstone and Montana were fully protected, human-caused mortality comprised 86-91% of adult bear mortality up to 1995 (Weaver et al. 1996). Female mortality is particularly critical to population viability so that even small incremental increases in mortality risk or disturbance are a threat within occupied habitat (Mattson and Reid 1991, Mattson and Craighead 1994).

Grizzly bears and roads

Roads have been shown to be the most important variable correlating human influence on grizzly habitats and their use by bears. Trails with motorized traffic, such as all-terrain vehicles, have effects on wildlife that are similar to roads. Almost all studies have shown negative impacts, such as displacement from quality seasonal habitats and increased risk of mortality (Elgmork 1978, Zager 1980, Zager et al. 1983, Archibald et al. 1987, Mattson et al. 1987, McLellan and Shackleton 1988, Kasworm and Manley 1990).

Illegal killing and management control (removal of habituated bears) are the two main sources of adult bear mortality in the Greater Yellowstone Ecosystem (GYE) (Mattson et al. 1987, Weaver et al. 1996), and both are associated with roads. Road use by humans may also disrupt bear behavior and social structure, reduce the availability of adjacent foraging habitats, and create barriers to movement (Archibald et al. 1987, McLellan and Shackleton 1988, McLellan 1990). These effects may extend up to 3 km from primary roads and 1-1.5 km from secondary roads (Kasworm and Manley 1990, Mattson and Knight 1991). In the GYE, roads with buffer areas represented 32.9% of the area, but accounted for 70.3% of bear mortalities (Mattson and Knight 1991), therefore the mortality risk is almost five times higher near roads (Doak 1995).

Craighead et al. (1995) concluded that habitats in areas with road densities higher than 1 km/6.4 km^2 (one-third the threshold set by agencies at the time) are suboptimal for bears. Waller and Servheen (2005) used GPS collars to record grizzly bear movement data every hour in Glacier Park for 4 years. They found that the barrier effect of Highway 2 along the southern boundary of Glacier National Park depended upon traffic volume, particularly at night when most bears tried to cross. Roads were complete barriers to grizzly movement when traffic volume exceeded 100 vehicles per hour. They found that the only reason grizzlies could cross highways at all was due to very low traffic volume during evening and night hours (Waller and Servheen 2005). A follow-up study from 2012-2013 found that traffic volumes had increased to the point where bears were unable to cross at least 12 hours out of the day, but even lower traffic volumes caused strong avoidance of the highway by bears (Waller and Miller 2015). In southwestern Alberta, Northrup et al. (2012) related telemetry data from 16 global positioning system (GPS) collared grizzly bears to traffic volumes and selection of areas within 500 m of

roads. They found a strong behavioral shift occurred in grizzly bears in response to traffic patterns. When traffic was low, there was an increased use of areas near roads and to movement across roads during the night. Grizzly bears selected areas near roads used by fewer than 20 vehicles/day and were more likely to cross these roads. Moderate traffic levels caused bears to generally avoid roads and they strongly avoided high use roads (>100 vehicles/day) at all times.

One exception to the rule that motorized use is more disruptive than foot traffic appears to be when the motorized use is predictable and routine and traffic does not stop but continues moving. McLellan and Shackleton (1988) indicated that grizzly bears reacted more strongly to people on foot in remote areas than to motorized equipment in more developed areas. Grizzly bears that encountered people on foot in remote areas left the creek drainage, while those grizzly bears that encountered logging equipment and motor vehicles in roaded areas moved to cover but remained in the area. Weilgus et al. (2002) found that grizzly bears did not select against (avoid) restricted roads with only logging traffic.

Extensive road networks can act as population sinks with high rates of human-caused bear mortality due to legal and illegal hunting and defense-of-life shooting (Ciarniello et al. 2007). Ciarniello et al. (2007) compared two study areas in central British Columbia. The plateau study area (Parsnip) had resource development (12% logged) with an extensive road network, while the mountain study area (Hart Mountains) was relatively pristine (2% logged). Six of nine bears shot by hunters were within 100 m of a secondary or decommissioned logging road. Five grizzly bears were killed illegally in the more roaded plateau area (four not reported to authorities), while there were no illegal kills detected in the less developed mountain study area.

The most recent published study on roads and grizzly bear recovery tested the effects of habitat quality and road density on management actions to recover a threatened grizzly bear population in the Kettle-Granby ecosystem in south-central British Columbia (just north of the Canada-U.S. border). The study demonstrated that a policy target to reduce human access by managing road density below 0.6 km/km^2 and also ensuring roadless areas of high habitat quality with no roads was a reasonable compromise between the need for road access and population recovery goals. Spatial configuration of roads must also be considered. **They concluded that targeting closures to areas of highest habitat quality would benefit grizzly bear population recovery the most (Lamb et al. 2018)**.

Grizzly bears and trails

In terms of the impacts of trails, grizzlies and other animals can be displaced from needed resources by human activities on trails, often without the knowledge of recreationists. Cole and Knight (1990) referred to this as *unintentional harassment of animals* and noted that *entry into grizzly bear habitat can displace bears or, where bears habituate to humans, lead to encounters that eventually result in destruction of the bear*.

As noted previously, research by Coleman et al. (2013) in Yellowstone National Park found that human presence can displace grizzly bears if people were allowed unrestricted access to the six bear management areas (BMAs) in formerly restricted areas. They reported on other

concerns that the associated loss of foraging opportunities or increased energetic demand may pose a risk to a bear population.

For Banff National Park, Gibeau and Stevens (2005) report on an earlier study, which found that although the sample size was small, grizzly bears in areas of restricted human access used higher quality habitat and travelled less than bears in unregulated areas even though there was less high quality habitat in the restricted area. They also found that both wary and habituated adult female grizzly bears were affected by the presence of people. Without people around, wary bears made more efficient use of higher quality habitats with less movement. They found that this habitat optimization was eroded by the presence of people to a point where habituated bears traveled further in sub-optimal habitats. They also pointed out from research by others that female grizzly bears that have access to predictable and high value natural foods have greater body size, mature earlier, and have larger litters than those with access to foods with low nutritional value. In terms of trails, Gibeau et al. (2002) found that grizzly bears frequented areas closer to trails during the human inactive period when in high quality habitat and further from trails when distant from high quality habitat.

Although Kasworm and Manley (1990) found that grizzly bears were displaced less in the Cabinet-Yaak ecosystem by trails than by roads, Gibeau et al. (2002) found the opposite for Banff National Park, with bears avoiding high use trails when distant from high quality habitat. They concluded from their observations and the scientific literature that there were significant differences in the response of grizzly bears to roads, trails, and major developments depending on sex, age, time of day, and proximity of high quality habitats.

Non-motorized trails may be avoided by grizzly bears to a distance of 300m (Kasworm and Manley 1990, Mace et al. 1996). Mace and Waller (1998) found in the Jewel Basin hiking area east of Kalispell, Montana, that bear use increased with greater distance from trails and lakes with campsites. As with all animals living in habitat that is near the carrying capacity for the species, displacement can also lead to death. If a bear is displaced from an area needed for its survival, it is forced to move into other already occupied habitat. If it encounters a more dominant bear in the new place, it may be killed or displaced further into areas occupied by other bears. If the new bear kills or displaces the bear that was occupying the habitat, the result is the same: one less bear in the population.

In Glacier National Park (U.S.), Nadeau (1987) found that female with young grizzly bears were more likely than adults and subadults to avoid human use areas and at the time of his study showed little habituation to people.

In a comprehensive review of the impacts of human recreation on brown bears, Fortin et al. (2016) used empirical studies and expert knowledge to suggest that human displacement is the primary mechanism by which bears are impacted. They note that displacement from concentrated food resources often occurs during hyperphagia and this may affect the health, reproduction, and survival of bears because of a loss of nutritional intake and increased energetic costs. This is at a time when bears dramatically increase food intake in preparation for hibernation. However, they note that there have been no empirical studies on energy costs to

bears from recreation but caution that decisions that managers make in regulating human recreation spatially and temporally may have important consequences for bear populations.

3.4.2 Northern PNT alternative in relation to elevational grizzly bear den potential habitat along the route

Our Yaak GIS grizzly bear elevation habitat model shows that 26 miles or 38% of the northern scenic PNT alternative would pass through high elevation mountain ranges that have the highest potential for grizzly bear dens. With the increasing trend towards backcountry high elevation winter ski-touring, snowshoeing, and snowmobiling, including long-distance traverses, we strongly suggest that PNT winter recreation may impact grizzly bears (as well as wolverine natal/maternal dens) at their winter den sites. We did not investigate the current amount of allowable winter recreation activity in the vicinity of the northern PNT alternative, but that type of recreation varies according to the road/trail type.

A study in Sweden (Evans et al. 2016) of 15 subadult brown bears during the winters of 2011-2015, found that both body temperature and heart rate increased during capture and returned to hibernation levels after 15–20 days. The study showed that bears required 2-3 weeks to return to hibernation levels after winter captures. This suggested high metabolic costs during this period. As well, there are also indications that the winter captures delayed den emergence in the spring.

In a literature review of the impacts of winter recreation and other disturbances on grizzly bears (and wolverine) in areas of winter den habitats, McCrory and Cross (2005) concluded that there was enough evidence related to den abandonment documented for brown bears in Europe that they used habitat parameters from studies for both species in BC to develop a GIS den habitat prediction model for Kakwa Provincial Park in the central Rockies of BC. The study led to BC Parks restricting high elevation snowmobile use in potential den habitats for both species.

<u>We strongly recommend that serious consideration be given to a review of PNT alternatives through the Yaak that avoid high elevation potential and/or known grizzly bear winter den habitat areas (as well as wolverine natal/maternal den areas).</u>

3.4.3 Yaak PNT in relation to CYGBRZ grizzly bear female core area designations for bear management units (BMUs)

Once higher levels of recreation use of a Yaak PNT are reached, it will have an impact on access management criteria related to “high use motorized trails” used in Kootenai National Forest for designation of female core areas in bear management units (BMAs). According to bear biologist Wayne Kasworm (pers. comm.), this would then affect and alter some of the allowable limits of local motorized access currently worked out with input from the Yaak community.

According to a review of forest plan amendments for access management within the Selkirk and Cabinet-Yaak grizzly bear recovery zones (USDA 2011, p. 10), a core area is defined as follows:

An area of secure habitat within a BMU that contains no motorized travel routes or high use nonmotorized trails during the non-denning season [non-denning season includes the dates 4/1-11/15 (SRZ) or 4/1-1/30 (CYRZ), inclusive] and is more than 0.3 miles (500 meters) from a drivable road. Core areas do not include any gated roads but may contain roads that are impassible due to vegetation or constructed barriers. Core areas strive to contain the full range of seasonal habitats that are available in the BMU.

Currently, the Bear Habitat Units (BMUs) of the Kootenai National Forest have been designed with access management limitations to meet IGBC standards for "core security areas" for female grizzly bears (IGBC 1998). For non-motorized recreation trails, this includes consideration of the degree of human use where IGBC task force standards ensure that "high-intensity trails" are considered in maintaining core habitat in BMUs. Three designated BMU core areas are crossed in the Yaak by the current PNT route (Map 3). According to the 1998 revised Taskforce Report on Grizzly Bear/Motorized Access Management (IGBC 1998), no roads or trails that receive non-motorized high intensity use as defined in established cumulative effects definitions can be included in identified core areas. For grizzly bear core area calculations, high-intensity use trails must be buffered by 500m, the same as for motorized routes. Lyndaker (2011) interprets high-intensity non-motorized trail use as receiving an average of 20 or more parties per week based on a 1990 cumulative effects model (Anonymous 1990) and discusses the complexities of determining high-intensity use trails for grizzly BMUs in the Idaho Panhandle National Forest.

4.0 RECOMMENDED PLANNING AND MANAGEMENT ACTIONS TO MINIMIZE PNT GRIZZLY-PEOPLE CONFLICT POTENTIAL & HABITAT DISPLACEMENT IN THE YAAK

Overall, a viable and ecologically sensitive Pacific Northwest Trail through the Yaak presents a significant planning and management challenge for the responsible agencies. Conflict reduction, including lower impact trail options related to grizzly bears, needs to be rigorously considered and applied to all alternatives in the NEPA-EIS planning process.

4.1 Mitigation By Consideration of Lower Impact PNT Alternative Routes

Our conclusion is that the best method to reduce the impacts of the PNT on grizzly bears and their recovery in the Yaak (and at the same time reduce human and bear risk and exposure in bear country) would be for the NEPA-EIS to thoroughly review alternatives and design an optimal route that provides as small as possible an environmental impact footprint by minimizing overlap of the trail route with important seasonal grizzly bear seasonal habitats. While there are other species of concern, including those that are rare, threatened, and endangered, these are not considered in our report, while we recognize that they too, besides grizzly bears, must also be taken into account by an EIS.

Our analysis using RSP-derived grizzly bear core areas and our grizzly bear elevation seasonal habitat model for the Yaak study area indicates that the northern PNT alternative, because of its proposal to direct trail users to high elevation scenic areas, passes through habitat areas that present the highest potential for grizzly bear-people encounters combined with habitat displacement from human disturbance (maps 7 and 8). Using our map model, we were able to identify at a coarse-scale landscape level a number of potential east-west alternative and connecting PNT route corridors through the Yaak that would intersect a significantly lower amount of core grizzly area and high elevation summer-fall-winter den habitats. This included a map approximation for the Yaak of the proposed Jonkel and McMurray (1978) southern route, which was described as follows:

> *...that the trail swing far to the south to avoid both the prime and precarious grizzly range. In leaving Glacier National Park, the trail could cross to the southern end of the Whitefish Divide and follow that divide to Werner Peak, then cross Highway 93 near Olney, follow various divides to Libby Dam, stay relatively close to Highway 2 to Bonners Ferry, and then swing northwest to join with the proposed route near Northport, Washington* (Jonkel and McMurray 1978).

It was beyond the scope of our study to identify existing access (roads and trails) and viable cross-country routes related to the potentially lower impact options we identified on Map 8. Our end results were similar to the conclusions of the USFS-NPS joint 1978 PNT study that identified the northern scenic route as having the greatest adverse impacts on grizzly bears of a number of different alternative routes, including the southern route having lower impacts. We have included the minimal alternative map from the earlier PNT study (their Map 13, our Map 9).

We also caution that these lower impact alternatives must be more carefully scrutinized at finer scales than we have attempted. Some areas of the Yaak not mapped as core areas are still important critical habitats for female grizzly cohorts (W. Kasworm, pers. comm.). Additionally, the 1978 southern alternative as originally mapped could cross through the northern section of the Cabinet wilderness where it would intersect significant grizzly bear core habitat (W. Kasworm, pers. comm.).

There are also concerns about the southern PNT alternative crossing narrow linkage zones between the Cabinet Mountains and the Yaak along the Kootenai River (W. Kasworm, pers. comm.). Increased human activities could deter grizzly bears from moving across a busy trail to travel between the two areas.

4.2 Planning and Management Measures to Minimize Grizzly Bear Encounter Risk of a Final Selected Yaak PNT

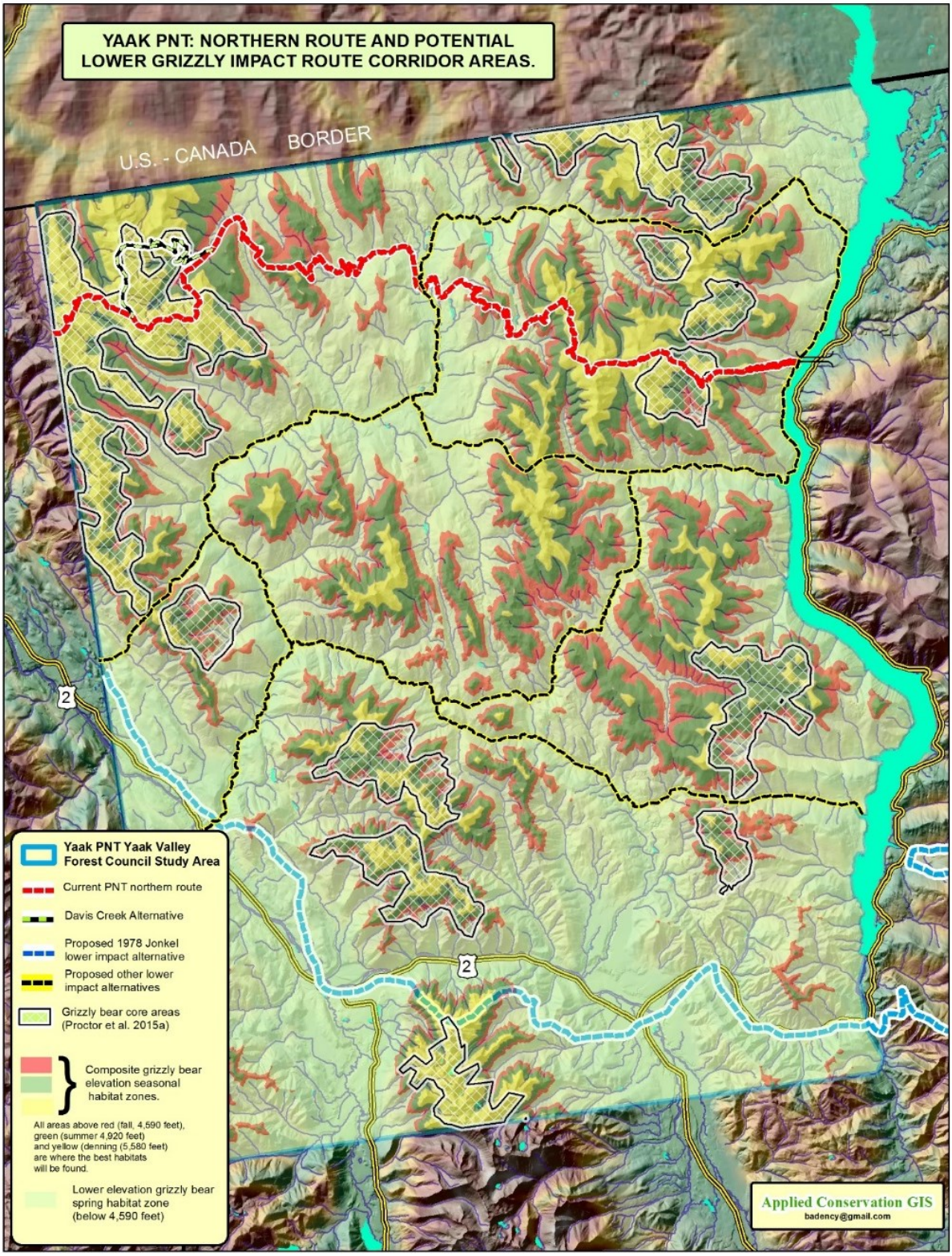
There are other standard measures to reduce the risk of grizzly bear encounters and optimize public safety that should be mandatory for whichever PNT alternative is selected by the NEPA-EIS. However, we caution that even with these measures, the northern PNT will still have the higher grizzly bear encounter risk than the other potential alternatives available and these measures will not effectively reduce the grizzly bear displacement factor resulting from the northern PNT alternative.

We suggest that route planning and management measures to minimize Yaak PNT grizzly-human conflicts can best be achieved by the careful preparation of a PNT grizzly bear-people conflict management plan, as was done for the network of trails and campgrounds in BC protected areas for the BC North Cascades grizzly bear recovery plan (McCrory 2003a). The plan should include but not be limited to the following commonly used approaches that have proven successful over time: careful route selection to avoid trail and campsite locations in or proximal to prime grizzly bear habitats and travel routes; management and siting of trails to maintain good line-of-sight; management of warning signs and seasonal closures when bear hazard situations are identified; bear-proof food/storage facilities at PNT campsites; adequate public education, including signage on safer travel in bear country (such as traveling in groups of five or more people); mandatory carrying and knowledge of the use of bear spray; restrictions or public education on the dangers of dogs-off-leash; consideration of a permit system similar to the Pacific Crest Trail, including that it be mandatory that people carry bear spray and know how to use it; and other measures.

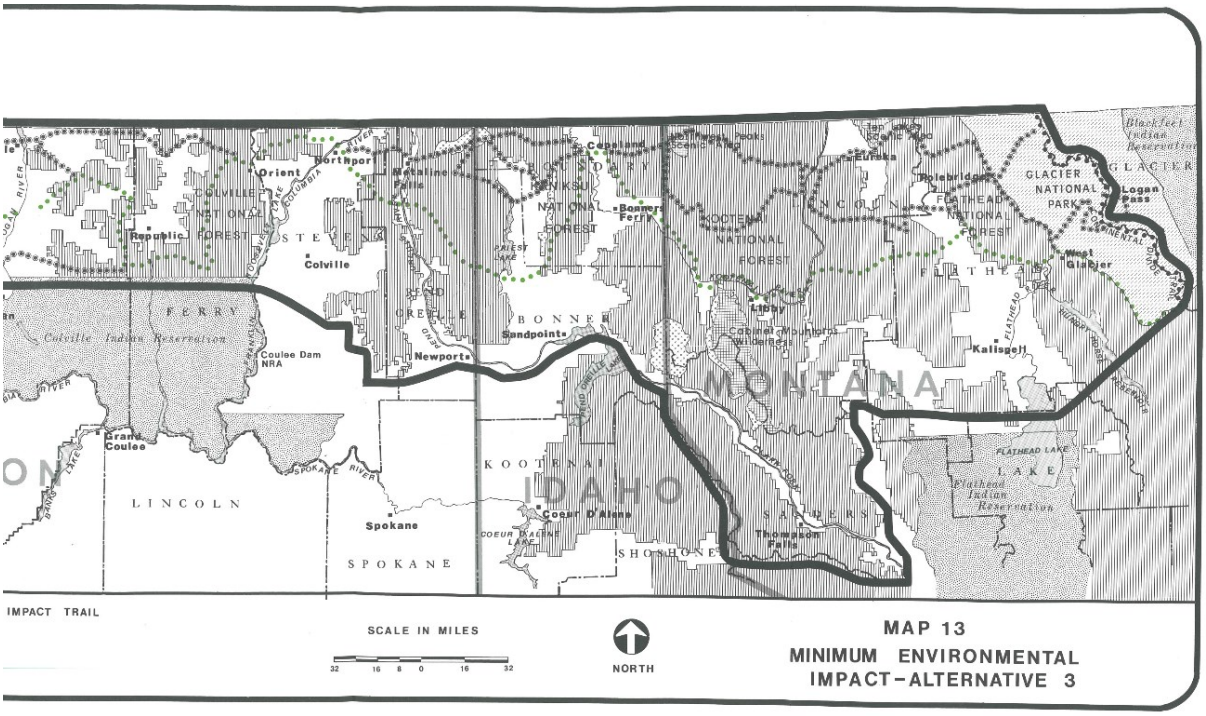
There are also some limitations to the public education approach, which is why planning to route the final PNT route and any associated campsites as far away as possible from high quality grizzly habitats should be a priority tool since it does not involve trying to manage people's behavior through bear safety messaging and enforcement. As noted by Gunter et al. (2015) for Yellowstone National Park:

> *Bear safety messaging is especially challenging because, even though the consequences of bear attack can be quite severe (severe mauling and even death), the risk of attack for most park visitors is extremely small. This makes it difficult for visitors to understand the need for adhering to bear safety recommendations*.

One aspect of public education would involve a strong recommendation or mandatory use of bear spray as a first line of defense in a close grizzly encounter as a non-lethal means to prevent human injury and reduce defense-of-life mortality loss to the tenuous Yaak grizzly bear population caused by firearm use. However, my research experience, including a review of grizzly bear ungulate hunter conflicts for the BC Wildlife Branch in northwest BC (McCrory 2003c) plus years of teaching bear safety to workers and outdoor recreationists indicates that firearms and hunter-oriented user groups are resistant to the idea of carrying and using bear spray as a first line of defence, despite studies that show bear spray to be more effective as a safer deterrent in bear encounters than firearms (Smith et al. 2008, 2012). In Yellowstone National Park, Gunther et al. (2015) found that although backcountry hikers had the highest risk of a bear attack (1 in 200,000 visitors), adherence to the use of bear spray was very low. A survey done in 2011-2014 found that only 13% of day hikers and 53% of backpackers carried bear spray. (Few people carried firearms, even though it was legal to do so but illegal to discharge one in the park.)



Map 8. Showing the northern PNT alternative and lower impact potential alternatives, including the southern "Jonkel route" that infringe significantly less on higher elevation grizzly bear core areas and summer, fall, and den habitats.



Map 9. Although difficult to discern, the map shows the different route options reviewed in the joint 1980 USFS-NPS review of the proposed PNT at that time. The more southern alternative 3 route (green on the map) was considered to have the minimum environmental impact, but even it was rejected at the time.

Recommended, even mandatory, larger group sizes to reduce the risk of a grizzly bear attack is another approach that has been applied in backcountry trail management situations, but this is also not without its limitations in terms of compliance. Herrero (2002) found that people hiking in groups of six or more people had never been subjected to an attack by grizzly bears. In 1999, Parks Canada adopted a mandatory legal group size of six or more people as one method of attempting to reduce grizzly bear encounter risk for the high level of hikers using the Moraine Lake trail in Banff National Park, which had a number of habituated resident grizzly bears. A follow up study found that compliance to a group size of six was limited, but compliance was much higher when reduced to groups of four, while the number of aggressive encounters remained low (Simic 2007). In Yellowstone National Park, Gunther et al. (2015) found that many day-hikers and backpackers did not follow recommendations by the park for a group size of three or more for hiking in bear country. The most common group size for both user groups was two people per party.

Figure 2. Kootenai National Forest grizzly and black bear information sign on west (Yaak) side of Koocanusa Reservoir bridge where northern PNT alternative crosses.

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