THE BIGHORN WILDLAND RECREATIONAL TRAIL MONITORING PROJECT

AN INTERIM RESEARCH SUMMARY FROM 2004 – 2006

AWA
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EXECUTIVE SUMMARY

Since the 1970s, when the Bighorn Backcountry was identified as a provincially significant wilderness area, management priorities have focused on watershed protection, wildlife habitat conservation, and dispersed non-motorized recreation activities. AWA has actively supported these priorities and, for more than 30 years, has sought protected area designation for the Bighorn area (Bighorn Wildland). In 2002, through the Bighorn Backcountry Access Management Plan, the Alberta Ministry of Sustainable Resource Development (SRD) formally permitted motorized recreation in areas where these activities were formerly illegal and where they may cause long-term deleterious impacts on water quality, vegetation, historical trails, and wildlife. It is our opinion that these activities may also exclude many non-motorized recreationists from using the same trails as motorized users.

AWA monitored the impacts of recreational use in the Bighorn Backcountry from 2004 through 2006. Our goal was to assess the efficacy of management in the area with respect to the objectives of Forest Land Use Zone (FLUZ) planning, which includes the protection of areas "containing sensitive resources such as fish and wildlife and their habitats, vegetation, soils and watershed" (SRD 2002b: 10). We evaluated three main criteria that will provide an indication of management efficacy in the FLUZ: 1) willingness of backcountry users to abide by FLUZ regulations, 2) extent of landscape damage present, and 3) trends in motorized vehicle activity. Our study focused on a 76-km network of motorized and non-motorized trails in the Upper Clearwater-Ram FLUZ.

1) *Willingness of backcountry users to abide by FLUZ regulations*

The total number of illegal passes by motorized vehicles during non-designated periods increased from 0.37 Passes Per Day (PPD) in 2004 to 0.63 PPD in 2006. The proportion of illegal passes relative to the total number of passes recorded increased by 7% from 2004 to 2006.

2) *Extent of damage present*

The amount of area damaged along all trails is approximately 20% of the total length of all trails. These damaged areas include 244 instances of trail braiding or widening. Trail damage was most common along trail sections farthest from the Hummingbird Provincial Recreation Area. The number of Erosion Events (EEs), a measure of trail degradation used by SRD, was as high as 5.58 per kilometre on some trails. The number of EEs associated with OHV use was proportionally higher than the number of EEs associated with equestrian use on six of seven trails. The combined footprint from random backcountry campsites in the study area was 50,574 m^2. This area is roughly equivalent to 32 NHL ice surfaces. Garbage was found and removed from 54% of campsites. We found more than one non-designated trail junction for every kilometre of designated trail in the trail network. We documented 89 trail water crossings throughout the network. Only 7% of these water crossings had formal crossing structures present, and 72% of the 89 water crossings went through a permanent water body.

3) Trends in motorized vehicle activity

Sixty-eight percent more motorized traffic was recorded in 2006 than in 2004. On four trails with summer traffic counts, we found a 39% to 227% increase in vehicle passes over three years. Winter traffic counts increased on two trails by 46% and 163% respectively, and declined on

another trail by 95% over two winter seasons.

These three lines of evidence strongly suggest that current management in the Bighorn Backcountry will not protect the environment from degradation caused by recreational impacts: 1) neither regulated use nor voluntary compliance is reducing the amount of illegal use, 2) current levels of recreational activity are causing severe environmental degradation, and 3) there is an increasing trend in user density. AWA is advocating for changes to current access management policies and FLUZ regulations in the Bighorn Backcountry that will improve SRD's ability to meet the environmental objectives of the FLUZ. It is the opinion of AWA that protection of watershed, native vegetation, and wildlife habitat must take management precedence over all other uses of this sensitive foothills and alpine area, as was recognized by the 1977 Eastern Slopes Policy (Government of Alberta 1984) and reiterated in the 1986 Nordegg-Red Deer River Sub-regional Integrated Resource Plan (Alberta Forestry 1986).

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INTRODUCTION

Recreational trail use is growing in Alberta as more people become engaged in backcountry activities and as unregulated access to wilderness areas increases with new infrastructure development (Canada West Foundation 2006). Alberta's backcountry users include naturalists, hunters and anglers, hikers, cross country skiers, mountain bikers, trappers, ranchers, rock climbers, rafters, commercial outfitters, and equestrian, off-highway vehicle (OHV) and snowmobile riders. These backcountry users come from a variety of communities with equally varying values and opinions about wilderness protection and management. These myriad views can lead to severe challenges for consensus-based land-use management under the Alberta government's "multi-use" paradigm (Canada West Foundation 2006). The Alberta Ministry of Sustainable Resource Development (SRD) is responsible for meeting the often competing demands for new recreational opportunities from these user groups. SRD must also address human impacts on water quality, forest maintenance and regeneration, wildlife habitat, and other backcountry services. Given the severity of cutbacks to government departments through the 1990s, it is not surprising that government agencies responsible for overseeing recreation access are ill-equipped to plan, manage, and enforce recreational activities in backcountry areas.

This report is intended to provide complementary data and analysis for government agencies responsible for access management decisions in the Bighorn Backcountry[1] area, which lies approximately 90 km southwest of Rocky Mountain House. The public and the government have long recognized the Bighorn Backcountry as a provincially significant water catchment area and wildlife habitat supply falling under the Prime Protection Zone of both the Eastern Slopes

[1]AWA prefers the use of the term Bighorn Wildland. Refer to Appendix C for information on the history of the area and related name changes to the region.

Policy (Government of Alberta 1977, revised 1984) and the Nordegg-Red Deer River Sub-regional Integrated Resource Plan (IRP) (Alberta Forestry 1986). These policies met water and wildlife habitat objectives by, among other means, limiting motorized access and industrial development in the Prime Protection Zone. In 2002 the Bighorn Backcountry was placed under new access management regulations through the designation of six Forest Land Use Zones (FLUZ). The FLUZ regulations enabled the government to legally designate recreational trails for specific uses and seasons. The government also publicized access to the Bighorn area with a map, brochure, and website (SRD 2006a) and officially permitted motorized (mixed-use) trails in some areas through the Bighorn Backcountry Access Management Plan (AMP) (SRD 2002a). The overall effect of these actions may have led to adverse recreational impacts in an area previously considered by the government and the public as provincially significant for wildlife, water, and non-motorized recreational opportunities.

In recognition of the sensitivity of the Bighorn Backcountry to potential impacts associated with recreation, SRD's Land and Forest Division (LFD) created a trail impact monitoring program (SRD 2003) based on the recommendations of the Bighorn Advisory Group (SRD 2002b), a multi-stakeholder group designed to provide access management advice to SRD. Through this monitoring program, LFD aims to manage the Bighorn Backcountry "to ensure the protection of the environment, while allowing responsible and sustainable recreational use" (SRD 2006b). Similarly, the Alberta Wilderness Association (AWA) felt that adverse environmental impacts to the Bighorn Backcountry may occur following the changes made to access regulations in 2002. In this way, SRD (2003), the Bighorn Advisory Group (SRD 2002b), and AWA recognize that access management regulations can be improved through monitoring studies that address changes to environmental conditions as a result of recreational activity.

The purpose of this study is to evaluate key indicators of management success in the Bighorn Backcountry five years after the implementation of the Access Management Plan. Five years is adequate time to gather data on trends, and it coincides with LFD's scheduled reporting of the government's own recreational monitoring project (SRD 2003), due out in 2007. We felt that SRD's ability to ensure that the Bighorn Backcountry's environment is protected (*sensu* SRD 2006b) may be jeopardized by 1) an inadequate effort to ensure user compliance with FLUZ regulations; 2) inadequate trail location, construction, and maintenance with respect to local terrain conditions and acceptable intensities and types of permitted recreation activity; and 3) targeted publicity of the area to particular user groups and facility upgrading at Hummingbird Forest Recreation Area.

First, we predicted that if efforts to ensure user compliance with FLUZ regulations are inadequate, then illegal traffic (both during the off-season and on undesignated trails) will increase relative to the total amount of traffic present. At the same time, we may expect a short-term increase in illegal activity because of an overall trend in increasing trail use and a lag-time in the adoption or awareness of new regulations. Second, we predicted that if trails are poorly located, constructed, or maintained, 1) there will be high amounts of trail degradation throughout the area, 2) sections of individual trails will have higher amounts of degradation than other sections, and 3) there will be unequal attribution of trail damage among user groups since trails are not designed for their particular uses. Third, we predicted that the manner in which access to this area has been publicized will lead to an overall increase in off-highway vehicle traffic during the study period.

At this point we wish to clarify that this study was not intended to single out any particular user group that recreates in the Bighorn Backcountry. Due to resource constraints,

AWA has limited access to technological and logistical opportunities for data gathering, and this is reflected in our reporting. For example, our traffic counters can not reliably detect passes by equestrian users, thereby excluding some information from an important recreational user group in the study area. Nonetheless, as the goal of this study is to highlight the importance of the Bighorn Backcountry as a wilderness resource and the potential ease with which environmental conditions in this area can degrade due to inappropriate recreational use, we feel justified in recommending the best possible management solutions for the area. In this way, both motorized and non-motorized access issues are addressed in this report in so much as these activities are each contributing to environmental degradation.

METHODS

Study area

This study took place in the Ram-Clearwater FLUZ within the Bighorn Backcountry, which is located approximately 90 km southwest of Rocky Mountain House (Figure 1). The Bighorn Backcountry is adjacent to Banff and Jasper National Parks and consists of approximately 5,000 km^2 of public lands. Within the Bighorn Backcountry, the Ram-Clearwater FLUZ is the largest of the six FLUZs, with an area of approximately 2,000 km^2. The Upper Clearwater/Ram FLUZ consists of Alpine and Subalpine subregions of the Rocky Mountain Natural Region. Most of the trails we focused on occur within the Subalpine, an area characterized by forests of lodgepole pine (*Pinus contorta*), Engelmann spruce (*Picea engelmannii*), and subalpine fir (*Abies lasiocarpa*); high elevation meadows comprising hairy wild rye (*Elymus villosus*), June grass (*Koeleria cristata*), and bearberry (*Arctostaphylos uva-ursi*); wetlands; and shrub areas. Large carnivores (e.g., bears, wolves, cougars), ungulates (e.g., deer, elk, and bighorn sheep),

songbirds, and cutthroat and bull trout are also prevalent here. Since the 1970s, there has been no industrial activity in the Upper Clearwater/Ram FLUZ, in contrast to adjacent lands on the Bighorn's eastern boundary.

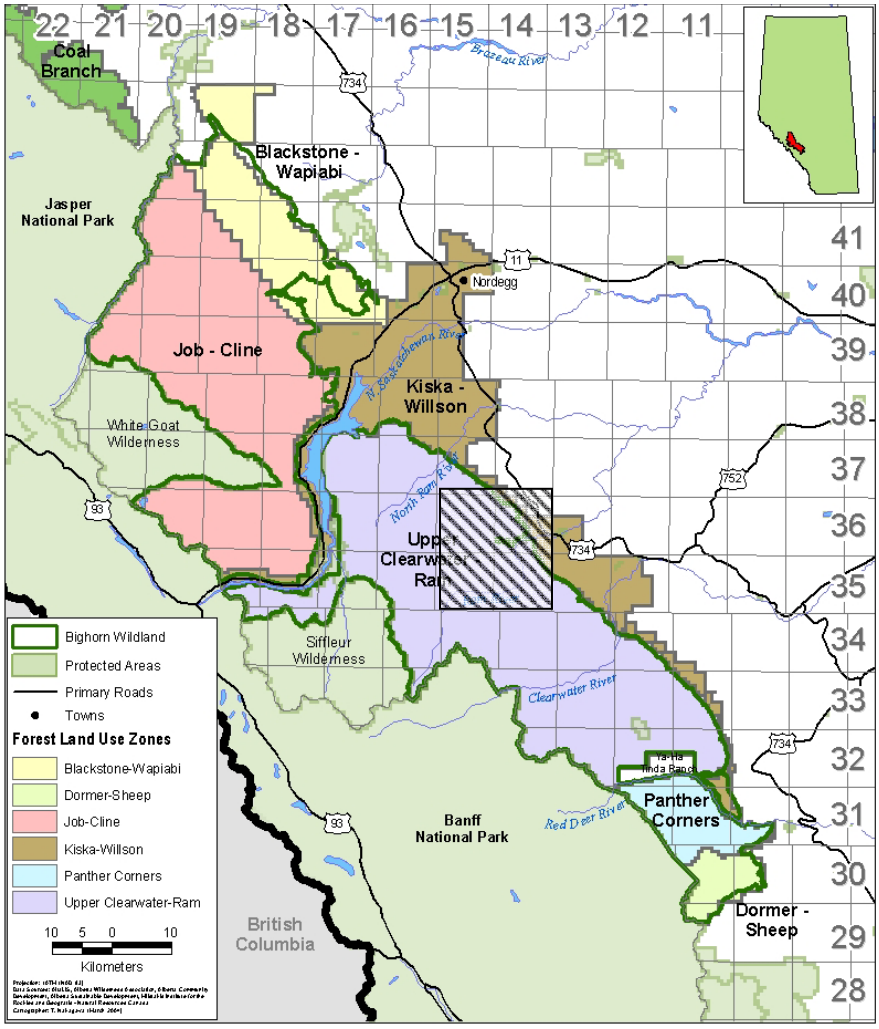

Figure 1. General location of study area. The specific study area is indicated by the cross-hatched square near the centre of the figure (see Figure 2). Legal land survey coordinates are shown along the right and top margins of the map.

Data Collection

We chose to focus this study on designated trails that provide year-round access to recreation in a relatively pristine landscape within the Upper Clearwater/Ram FLUZ. The trails are identified on the FLUZ map published by SRD (2006b; revised from 2003). We divided the trail network into seven research sections based on SRD's naming scheme, and where designated trails were not named, we added complementary names to specific stretches (Figure 2). Four of these seven trails are former resource exploration roads dating to before 1970; these include the Onion Lake Trail (ONC), Hummingbird Creek Trail (HUM), Canary Creek Trail (CAN), and Ranger Creek/South Ram River Trail (RNG). The three trails unnamed by LFD include Back Trail North (BTN), Back Trail South (BTS) and Back Trail Ranger (BTR). These three sections appear to be former equestrian trails that are now designated for motorized access and, for the most part, are more remote and less developed than ONI, HUM, CAN, and RNG. For classification purposes, we combined the lower portion of the Ranger Creek Trail with the South Ram River Trail to its junction with BTR (Figure 2). This classification allowed us to efficiently survey the trail network as well as incorporate a variety of trail regulations, such as temporal restrictions and equestrian versus OHV, into the study.

Trend in illegal activity

To address our first prediction relating to trends in motorized vehicle use in non-designated times or places, we recorded motorized vehicle traffic, year-round, using traffic counters (supplied by TRAFx Research Ltd., Canmore, AB). These counters sense disturbances to the electromagnetic field caused by a large passing metal object and record the direction of travel and frequency of passes of motorized vehicles within a 2-m range. Passes by equestrian and other non-motorized

users, including mountain bikes, are not detected by these counters. We placed each traffic counter near a trail and about 20 cm below ground surface to enable detection of passing vehicles and to minimize disturbance of the device by animals and people. Before burial, the recording devices were placed inside waterproof containers. Each container was then placed inside two plastic freezer-proof food storage bags and sealed.

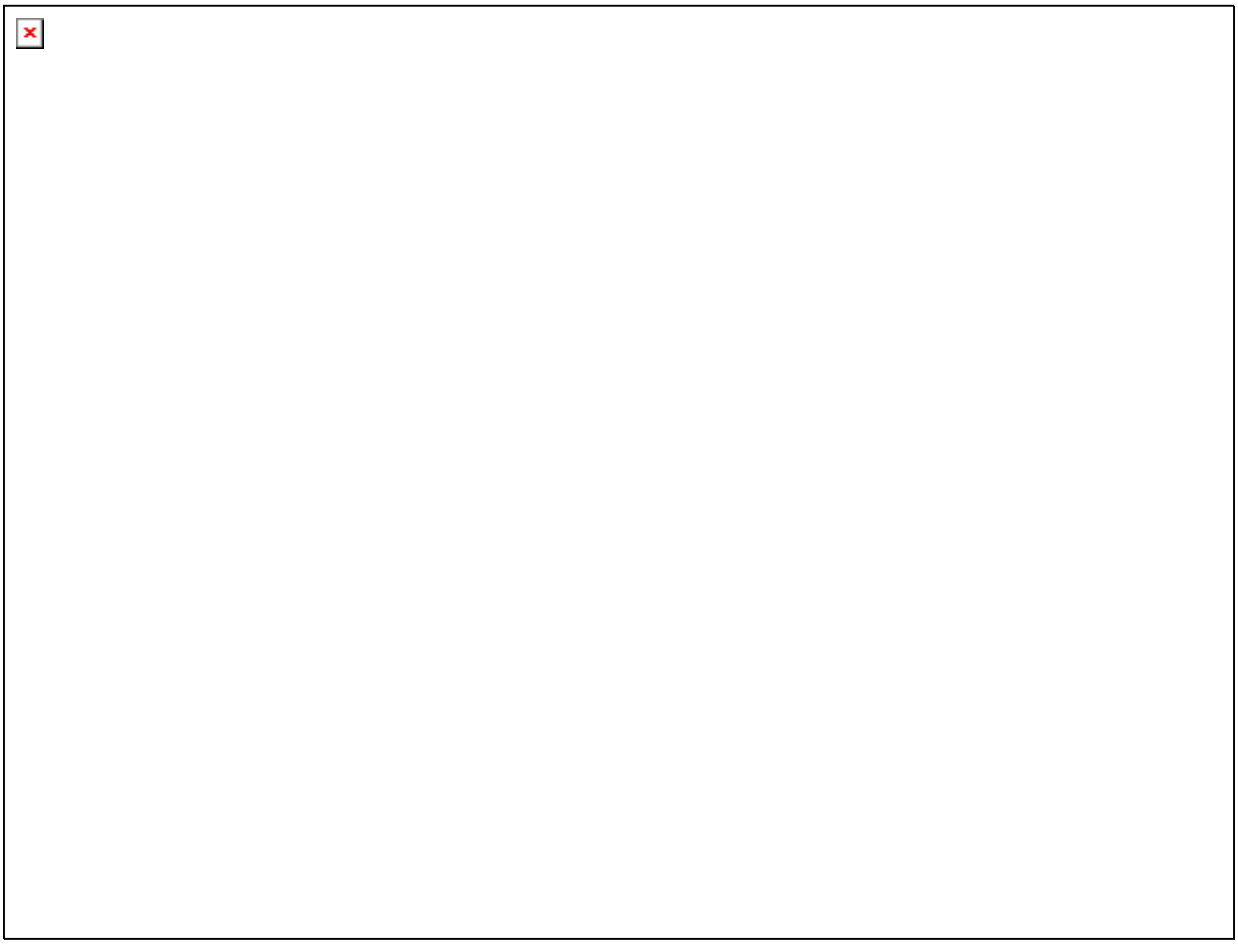

Figure 2. Location of trails monitored during this study.

The data recorded by these units were uploaded in the field – typically in late June/early July and again in late summer/early fall – to a handheld pocket PC unit (Dell Axim X5, Dell Inc., North

York, ON) and later uploaded to a PC for analysis. After uploading data to the handheld device, traffic counter batteries were changed and the devices were reburied in their original locations.

Eight traffic counters were used in this study, although one was later found to be defective; we are therefore only reporting the results of seven. One traffic counter was placed on each of ONC, HUM, CAN, BTN, and RNG near the most likely access point of the trail (see Figure 2). Two traffic counters were placed on non-designated trails near Onion Lake to capture potential illegal use of non-designated trails in those areas. The vehicle counters were in place from 2004 to 2006 and were not moved during the course of this study, with the exception of Counter #1. Counter #1 was moved to the opposite side of the trail in 2005, as it failed to register passes in July/August 2005 due to the construction of a partial barrier to motorized traffic that diverted vehicles beyond the 2-m detection range of the counter (D. Samson, pers. comm.).

We used regulations published in SRD (2006a), with corresponding seasonal access changes made in 2005 to indicate when a trail section was open or closed. We then assessed the number of vehicle passes that fell inside and outside the regulated period.[2] All trails except RNG are designated for OHV access from July 1 to March 15 (2005-2006) or July 1 to April 30 (2004). OHV access is permitted on RNG from December 1 to March 15 (2005-2006) or December 1 to April 30 (2004). Snowmobile access is permitted on all trails, expect RNG, from July 1 to April 30. Snowmobile access is permitted on RNG from December 1 to April 30.

We divided the number of passes recorded during closed periods by the total number of passes recorded for each traffic counter within each year (2004-2006). We excluded days when the traffic counters were not functioning due to battery failure. For the two traffic counters

[2]We recognize that backcountry patrols by the LFD officials, as well as trappers, may be included within these counts.

monitoring permanently closed trails, we included information on the total number of passes counted, since all passes by motorized vehicles along these trails are considered illegal.

Extent, intensity, and distribution of trail degradation

In order to determine if our second prediction was correct – that trail degradation throughout the system is common, severe, and associated with certain vulnerable sites and with specific user groups – we surveyed the trail network for four types of recreational activity impact: 1) damage sites, 2) water crossings, 3) campsites, and 4) non-designated trails. Damage sites were defined as part of a designated trail where the rutted depth exceeds 0.05 m and where vegetation damage exceeds a width of 3 m. We chose this depth as it signifies enough soil loss or compaction to affect plant regeneration (Godefroid et al. 2003). The 3-m width we chose is similar to trail design guidelines in British Columbia (2.2 m; BCMoF 2000), Newfoundland (4 m; ECGNL 2004); and Ontario (2.5 m; CDCSSMA 2003), and it is also reflected in SRD's definition of a designated trail (3 m; SRD 2002a). Note, however, that SRD guidelines for monitoring trail damage (SRD 2003) are inconsistent with these measures.[3] On hardened sections of some trails (i.e., ONC, CAN, HUM, RNG), we were less strict in these definitions to account for the presence of historical roads, which in many cases were already more than 3 m wide. In these

[3]The Access Management Plan (SRD 2002b:10) defines a designated trail as "that part of the route to a width of three metres (9.8 feet) or less as approved by a Forest Officer, and a parking zone of 10 metres or less on either side of the trail." This equates to 23 m in width for a designated trail. In the Recreation Trail Monitoring Guidelines, trails are considered 10 m wide: e.g., "any tracks or obvious evidence of use beyond the 10 m wide established trail will be considered a trespass" (SRD 2003:3) and "the cross-sectional area is measured by placing a rope or rigid bar across the trail (all 10 meters)" (SRD 2003:2). It is unclear if SRD considers a designated trail 23 m or 10 m wide; however, neither of these widths is considered acceptable for a backcountry recreation area by AWA and several North American jurisdictions.

cases, damage was assessed as obvious vegetation trampling or trail widening beyond the main "road".

Once a damage site was identified, we 1) geo-referenced the site with a handheld GPS unit (10 m± accuracy; Garmin or Magellan), 2) photographed the area, 3) measured the depth of the rut at the deepest point with a tape measure, 4) measured the width of the site at its widest point with a tape measure, and 5) pace-counted the length of the damaged site. When measuring the depth of ruts, we noted when a site was deeper than 25 cm for a distance of 3 m, which qualifies the site as an Erosion Event (EE) (Figure 3). The EE designation is based on LFD standards for trail integrity and, under current objectives, the number of EEs per kilometre of trail is expected to stay the same or decrease over time (SRD 2003). We also classified each damage site and EE by the type of tracks present: motorized, equestrian, or mixed. Motorized vehicle tracks are characterized by two parallel ruts formed by the wheels, approximately 1.0 to 1.6 m wide, with tire tread marks showing in moist soil conditions. Equestrian tracks are characterized by a single track, roughly 45 cm wide, with crescent-shaped marks from horseshoes present in moist soil conditions. Mixed tracks are characterized by the presence of both motorized and equestrian tracks. We also looked for evidence of hikers, mountain bikers, and horse-drawn wagon tracks at all sites. Interpretation of user group association at a site by the presence of tracks is most indicative of recent use rather than total use of that trail. We are most likely underestimating the amount of equestrian use on mixed-used trails since OHV tracks can easily mask horse tracks. This underestimation is perhaps increased because horses may avoid hard-surfaced trails (and wet crossings) and take an alternate route.

Water crossings were defined as areas along designated trails where at least one of the following features was found: a physical crossing structure (e.g., a bridge or ford), water in a

visibly permanent stream bed, water running on the trail, or an impermanent stream bed (e.g., ephemeral stream). At each water crossing, we photo-documented the site and geo-referenced the coordinates with a handheld GPS unit.

Figure 3. Measuring the depth of an Erosion Event along RNG.

Campsites were defined as areas where overnight camping activities likely occurred and where at least one of the following was found: one or more fire pits, tree-cutting, camping furniture (e.g., tables, chairs, storage, latrines), tielines or corrals for horses. We photographed, geo-referenced, collected garbage if present, and pace-measured the length and width of each site.

Non-designated trails were defined as spur lines from the main trail with evidence of recent activity by hikers, bikers, equestrians, or OHVs that extend beyond 10 m from the junction of the main trail. We assigned recreational activity association based on track evidence (see above) for the first 10 m of each non-designated trail, as measured from the junction of the non-designated trail and the designated trail. We chose 10 m as the minimum length of a spur trail because this length exceeds the area regulated by the "parking zone" (SRD 2003) used by the LFD monitoring program. Furthermore, this classification allows us to quantitatively differentiate between a trail braiding or widening (i.e., a damage site) and a non-designated trail. At each junction of the main trail and the non-designated trail, we photographed and geo-referenced the site using handheld GPS units.

We summarized the total number of damage sites, water crossings, random campsites, and non-designated trails for each trail. Using GIS (ArcGIS 9.2, Environment Systems Research Incorporated, Redlands, CA), we divided each of the seven trails into unit lengths of 500 m and summed the total number of EEs within each section. This information was then mapped to provide a qualitative assessment for the location of environmental degradation throughout the trail network. We then repeated the mapping analysis but showed the distribution of non-designated trail junctions within each 500 m section.

Overall trend in traffic volume

For our third prediction, that the overall amount of traffic in the area is increasing, we analyzed data from the digital traffic counters placed on designated trails. We compared the number of passes at each counter during a replicable window over a two- or three-year period, depending on the availability of data. One window was established for summer use (approximately July 1 to

September 30) and one for winter use (December 1 to January 31). We used replicable recording windows specific to each traffic counter, rather than complete years, because of different operating periods among individual devices (see Appendix A).

Error handling in traffic counts

The TRAFx traffic counters did have some errors in data recording that may have either underestimated or exaggerated the actual number of vehicle passes. The traffic counters may have underestimated the actual number of vehicle passes if they missed vehicles passing beyond the 2-m detection range or because two or more vehicles were driving close together and were counted as a single pass. Traffic counters were known to be non-functioning during certain periods due to battery failure, thus missing some recordings. Each period where the traffic counters did not report data are shown in Appendix A. All analyses relating to temporal trends in traffic volume are adjusted by the number of reporting days for each individual traffic counter.

The traffic counter may have exaggerated the actual number of vehicles due to recording errors. To find and address these errors, we executed the following protocol once data were uploaded to the PC. First, we removed counts that appeared to be repeated: that is, if there was a second (or more) pass at the exact same recorded time and date, then the additional pass(es) were deleted. Second, we removed counts associated with counters being unearthed for reviewing. Lastly, we removed extra counts that may have been associated with a slow-moving vehicle. Slow-moving vehicles can trigger extra counts at exactly two-second intervals but will record these passes as if they were moving from opposite directions. The traffic counter is equipped with a two-second buffer, meaning that no additional passes will be recorded within two seconds of one another. By excluding these counts, we reduce the likelihood that a slow-moving vehicle

will trigger more than one count for a single slow-moving vehicle, but we also exclude those situations where two vehicles may have passed one another at the traffic counter within a two-second interval. Overall, traffic counts reported in this study are conservative estimates of the actual number of vehicle passes.

RESULTS

Trend in illegal activity

We found that the total number of passes by motorized vehicles during non-designated periods increased from 0.37 Passes Per Day (PPD) in 2004 to 0.63 PPD in 2006. The total number of passes made during non-designated periods also increased by 7% relative to the total amount of traffic recorded in the trail network (Figure 5). All trails showed increases in the proportion of motorized traffic during non-designated periods except for RNG, where use decreased during this period (Table 1). We found that the number of illegal passes made on two non-designated trails peaked in 2005 and was lower in 2006 than in 2004. These two trails represent 2% of the non-designated trails encountered during this survey.

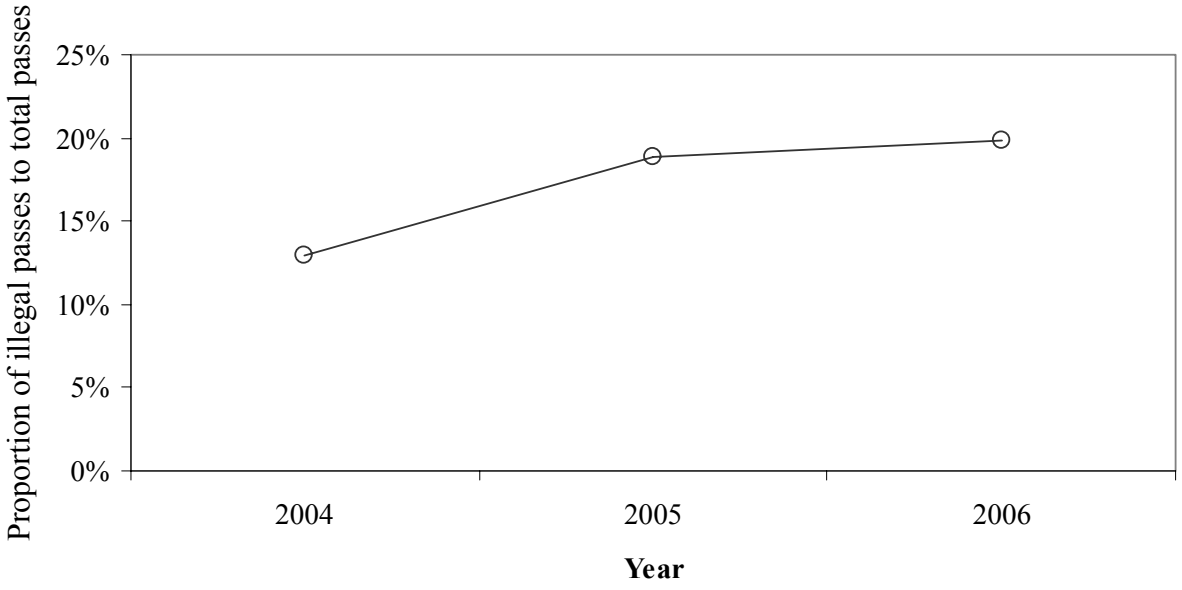

Figure 4. Percentage of illegal Passes Per Day per year out of the total number of passes. Data from designated trails only.

Table 1. Ratio of illegal passes to the total number of passes recorded for designated trails.

Trail	2004	2005	2006
ONC	0.04	0.19	0.18
CAN	0.05	0.17	0.37
RNG	1.00	0.66	0.33
BTN	0.00	0.11	0.14
HUM	n/a	n/a	2.03
TOTAL	**0.13***	**0.19***	**0.20***

*Total excludes values from HUM due to limited overlapping data collection window.

Extent, intensity, and distribution of trail degradation

We surveyed over 76 km of designated trails and found 453 features of concern. These features were not distributed equally among trails (Tables 2, 3 and 4) or sections of trails (Figure 5). The sum length of damaged trail sections varied from 7% of the BTN to 64% of the BTR, for an overall length of 20% of the 76-km trail network. The number of Erosion Events (EEs) was highest on BTR (5.58 EE/km) followed by BTS (3.13 EE/km), while CAN (0.93 EE/km) and HUM (0.91 EE/km) had the lowest density of EEs. Overall, we found roughly one EE for every 600 m of trail in the network. The number of EEs associated with OHV tracks was proportionally higher than the number of EEs associated with equestrian tracks on every trail except for RNG. On RNG, equestrian tracks were associated with 86% of the EEs (see Figure 3). The maximum width of damage sites on all trails was an average of 8.87 m (n=223), with the two widest damage sites on ONI (50 m) and RNG (50 m). The mean maximum depth was greatest on BTR (0.45 m) and BTN (0.44 m) and the deepest site we found was 1.6 m on BTR.

More than one non-designated trail junction was found for every kilometre of designated trail in the trail network, and most of these occurred along RNG and were associated with equestrian trail use (Figure 6). Non-designated trails found along BTN, BTR, BTS, and ONC were most often associated with OHV use (Table 5).

The density of campsites was similar among trails, with one site for every 2 km of trail throughout the study area (Table 4). Campsites ranged in size from 25 m^2 to 12,000 m^2 (both on RNG), for a combined footprint from all campsites of 50,574 m^2 in the study area. For a familiar comparison, this area is roughly equivalent to 32 NHL ice surfaces. Additionally, we found garbage left behind at 54% of campsites, with the majority of these sites occurring along RNG.

Table 2. Damage site summary by trail.

Trail	Length (km)	Damage sites per km	Total length of damage sites (m)	Percent of trail damaged
BTN	11.04	1.54	826	7
BTR	3.77	8.50	2,421	64
BTS	5.12	4.69	1,188	23
CAN	9.68	2.17	2,983	31
HUM	13.15	1.06	1,684	13
ONC	15.34	3.78	5,882	38
RNG	18.10	3.43	6,565	36

We documented 89 water crossings throughout the network with the highest water crossing densities along CAN, HUM, and BTS (Table 4). Of these 89 water crossings, 7% had formal crossing structures present while 72% had permanent water moving through them. Of the six crossing structures we found, two were on ONI and two were on BTN. In many cases vehicle tracks were found adjacent to crossing structures indicating that some riders are avoiding their use (Figure 7).

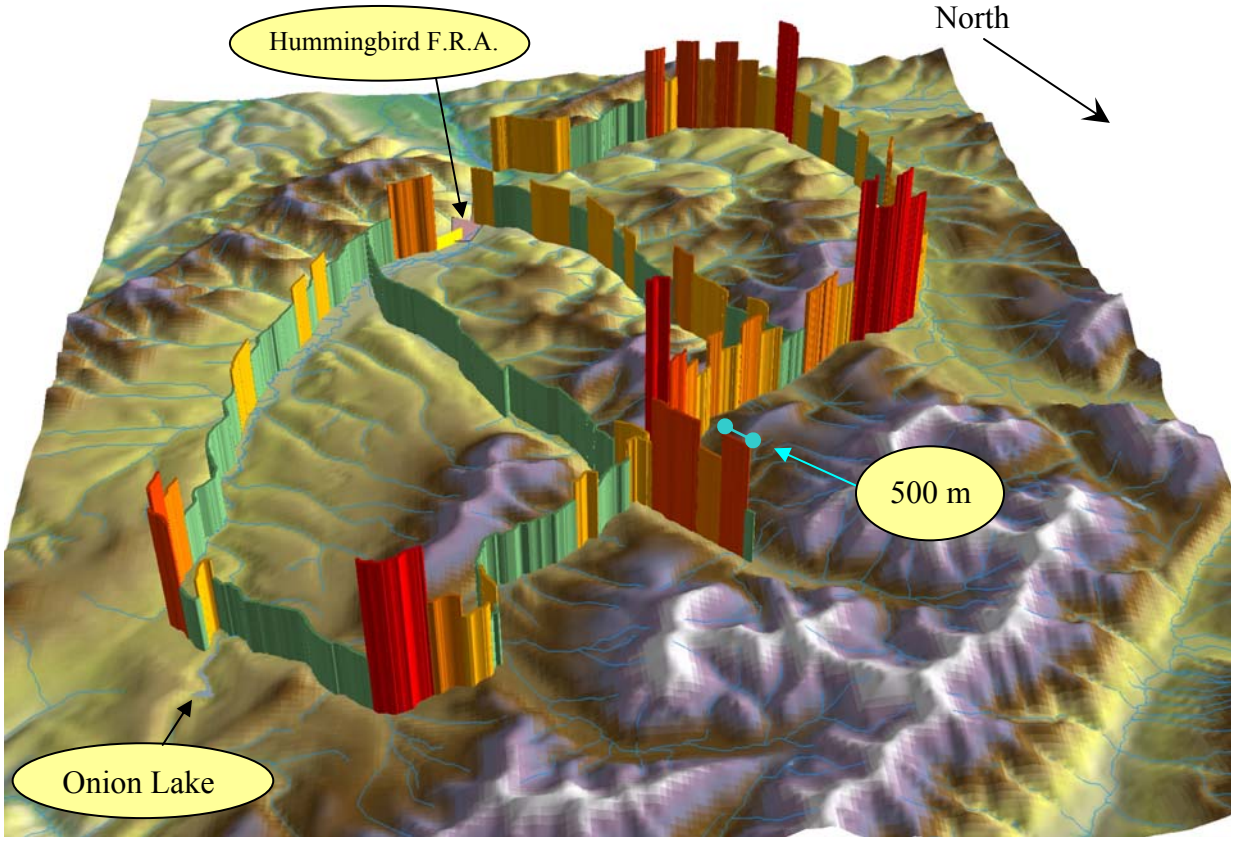

Figure 5. Erosion Event (EE) distribution within the trail network, view looking southeast from above the North Ram River headwaters. Height and colour of 500-m trail sections is related to the number of EEs within each section: 0 EEs=green; 1 EE=yellow; 2 EEs=orange; 3 EEs=dark orange; 4-6 EEs=red. Scale is variable on this projection, but the length of individual trail sections is 500 m. See Figure 2 for names of individual trails.

Table 3. Erosion Event summary by trail and user group association.

Trail	Length (km)	EE per km	% of damage sites with an EE	Motorized EE	Equestrian EE	Multi-user EE
BTN	11.04	1.18	76%	13	1	1
BTR	3.77	5.58	66%	20	4	3
BTS	5.12	3.13	67%	11	7	2
CAN	9.68	0.93	43%	7	4	2
HUM	13.15	0.91	86%	11	0	0
ONC	15.34	1.24	33%	19	0	0
RNG	18.10	1.93	56%	3	35	3

Table 4. Other recreational impacts, summarized by trail.

Trail	Length (km)	Random campsites per km	Non-designated trails per km	Water crossings per km
BTN	11.04	0.45	1.18	1.09
BTR	3.77	0.00	2.12	0.53
BTS	5.12	0.59	0.59	1.17
CAN	9.68	0.62	0.52	2.58
HUM	13.15	0.23	1.14	1.75
ONC	15.34	0.72	0.65	0.59
RNG	18.10	0.55	2.38	0.72

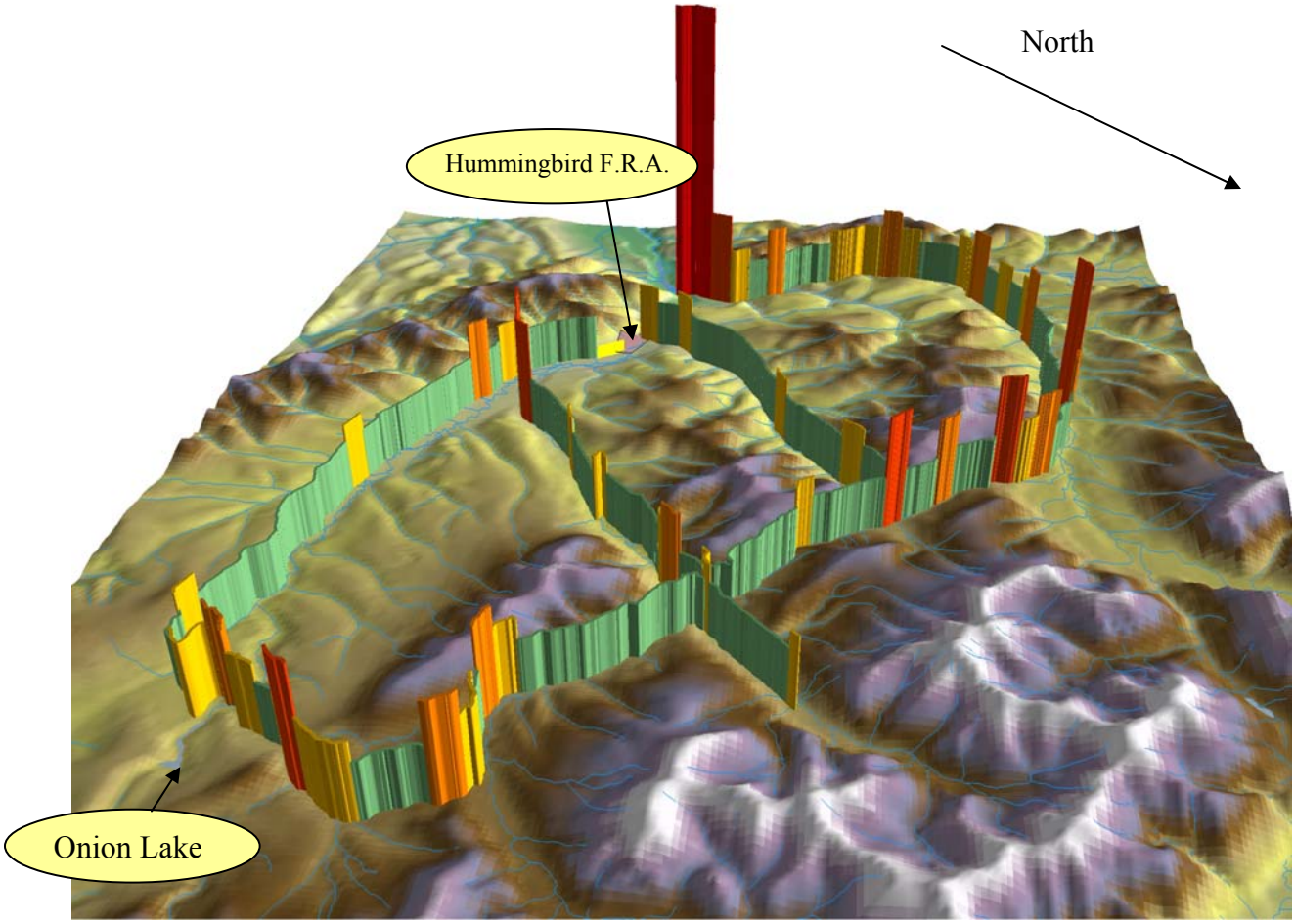

Figure 6. Non-designated trail distribution within the trail network; view looking southeast from above the North Ram River headwaters. Height and colour of 500-m trail sections is related to the number of non-designated trail junctions within each section: 0=green; 1=yellow; 2=orange; 3-5=dark orange; 6-9=red. The length of individual trail sections is 500 m, but the scale is variable on this projection. See Figure 2 for names of individual trails.

Table 5. Non-designated trail use by user group association.

Trail	Motorized*	Equestrian*	Mixed–use*
BTN	10	3	0
BTR	3	3	1
BTS	2	1	0
CAN	1	3	1
HUM	5	9	1
ONC	3	0	7
RNG	0	34	4

*Refer to text for explanation of how impacts were assigned to each activity.

Figure 7. A water crossing on BTN. The bridge was placed on the main trail, but users continue to drive OHVs through the creek on the left side of the photo.

Overall trend in traffic volume

We found a 68% increase in the overall number of vehicle passes on designated trails during the summer period from 2004 to 2006, with the most dramatic increases at HUM and ONC (Table 6). RNG was excluded from this table because motorized recreation is not permitted on this trail during the summer.[4] Summer motorized activity along CAN was highest in 2005, and higher in 2006 than 2004, suggesting an overall increase in traffic volume. We found an increase in the number of vehicle passes (Table 7) for two (ONC, CAN) of three traffic recorders operating during the winter recording window (December 1 to January 30). Motorized traffic along BTN appears to have been sporadic in the winter of 2005-2006.

Table 6. Summer traffic trend on designated trails, 2004-2006.

				Total number of vehicle counts			
Traffic recorder	Trail	Trend	3-year change	2004	2005	2006	Dates
1	ONC	INCR	137%	382	n/a	906	Jul 1-Sep 30
4	CAN	INCR	39%	236	379	327	Jul 1-Sep 10
7	BTN	INCR	81%	210	343	381	Jul 1-Sep 11
8	HUM	INCR	227%*	134	438	n/a	Jul 11-Aug 30

*Trend reported for 2004-2005 only, due to traffic recorder malfunction in 2006.

[4]Incidentally, we found a declining trend in (illegal) motorized traffic volume during the summer months on RNG, coinciding with results presented in Figure 4.

Table 7. Winter traffic trend on designated trails, 2004-2006.

				Total number of vehicle counts		
Traffic recorder	Trail	Trend	2-year change	2004-2005	2005-2006	Dates
1	ONC	INCR	46%	24	35	Dec 1-Jan 30
4	CAN	INCR	163%	8	21	Dec 1-Jan 30
7	BTN	DECR	95%	38	2	Dec 1-Jan 30
8	HUM	n/a	n/a	n/a	n/a	n/a

DISCUSSION

The wilderness environment in the Bighorn Backcountry is being negatively affected by recreational activities. We found that the amount of illegal activity is increasing, that trail damage is severe and common, and that the overall use of the area is growing. We will first discuss the implications of our main findings and then present management recommendations for addressing these issues. We evaluate our findings based on the first of three objectives of the AMP, which states that the intention of the FLUZ is to "protect areas containing sensitive resources such as fish and wildlife and their habitats, vegetation, soils and watershed" (SRD 2002a:10).

Trend in illegal activity

We found an overall increase in the amount of OHV traffic during non-designated periods, suggesting that 1) enforcement efforts during the closed period are inadequate, and/or 2) a

growing number of OHV users are unwilling to abide by FLUZ regulations. Our results do not support commonly used statements like "5% of the rowdy users ruin it for the 95% of the compliant users" (SRD 2006c). Instead, we found that approximately 20% of motorized users are violating FLUZ regulations, and this number is growing annually. An exception to the increase in out-of-season trail use was found on RNG, where motorized traffic is decreasing.

We found that the number of illegal passes made on two non-designated trails decreased over the course of the study; however, these two trails represent 5% of the non-designated trails we found that had evidence of use by motorized vehicles. If traffic trends on these two trails are indicative of network-wide use patterns, then there may be an increasing willingness among OHV riders to abide by, or become aware of, some FLUZ regulations. At the same time, further research is warranted to determine the extent of non-designated trail use, as our sample size is limited in this regard. Anecdotal evidence documented during this study suggests that signs or barriers placed at the junction of non-designated and designated trails can reduce the frequency of illegal use (Figure 9).

Extent, intensity, and distribution of trail degradation

We found extensive damage (≈20% of all trails) and intensive erosion (1 EE for every 600 m of trail) throughout the trail network. There were particularly high levels of damage on BTS and BTR (Figure 10). In most cases, this damage was associated with OHV use, except on RNG, where 93% of the 41 EEs was associated with equestrian use. Both equestrian and motorized users appear capable of causing similar levels of trail damage in the area; however, we do not have data on the relationship between equestrian-user density and associated levels of trail damage. Anecdotal evidence suggests that the hardened conditions of the eastern portion of the

ONI trail are at least partly responsible for the relative absence of OHV- and equestrian-related damage here. The relatively flat slope along some sections of ONI, CAN, and HUM may also contribute to the durability of these sites to trail activities (Coleman 1981).

Figure 8. SRD has placed a sign beside the trail stating that no motorized vehicles are permitted. Illegal activity persists but is declining at this site. The sign states: "Forest Land Use Zone. No motorized vehicles permitted."

Figure 9. Trail degradation due to a combination of poor water drainage and excessive motorized traffic. Pooling water in one section of the trail leads to trail braiding and exacerbates vegetation loss and soil erosion.

We found that trail widths in damaged areas (i.e., mean=8.87 m) vastly exceed the width required for two passing OHVs or horses. SRD (2002a) defines an OHV as having a wheel-base of 1.86 m or less. A trail designed for vehicles with this width would have a theoretical maximum width of 5.6 m for two-way traffic, which includes a 1.86-m safety buffer between oncoming traffic. In other jurisdictions, trail widths are even less than this 5.6-m theoretical maximum. For instance, the standard width used for two-way OHV trails is 2.2 m in British Columbia (BCMoF 2001), 2.5 m in Ontario (CDCSSMA 2003), 2.4 m in Wisconsin (WDNR 2005), 3 m in Nebraska (NGPC 2006), 2.1 m in Iowa (IDoT 2000), and 2.4 m for the United States Forest Service (USFS 2005). Similarly, equestrian trails are generally 0.5 m wide and possibly 3 to 4 m wide in some places for passing (BCMoF 2001; USFS 2005). Dale and Weaver

(1974) found that equestrian trails with 10,000 human visits per year ranged in width from 0.75 to 2.0 m. By comparison, we commonly found trail widths near 9 m, with the busiest trail in our study (ONI) having only approximately 1,000 vehicle passes per year over a three-year period. The results of our study and others (e.g., Snyder et al. 1976; Griggs & Walsh 1981; Iverson et al. 1981; Payne & Leninger 1983; Trunkle & Fay 1991) indicate that recreational trail use causes soil degradation and vegetation loss due to soil compaction and trampling. Thus, if SRD is unwilling to address environmental damage within the 23-m-wide swath of a "designated trail" (SRD 2002a), then the areal extent of tolerated vegetation and soil loss could be up to 175 ha within our study area.

In 93% of cases where designated trails encounter streams, there are no crossing structures present to help minimize the effects of OHVs or horses on water quality and fisheries. Even though we found that most water crossings occurred at permanent streams, we found few cases where bridges or fords have been established to achieve water management objectives. Without these structures, people using OHVs and horses to cross streams are causing increased bank erosion and sedimentation of the stream bed (Brown 1994; Baayens & Brewin 2002), which can in turn affect fish populations (reviewed in Baayens & Brewin 2002). Furthermore, streams in the study area are designated as Class C under Alberta's *Water Act* (*Water Act*, R.S.A. 2000, c. W-3). This designation means that from May 16 to August 31 (which partly coincides with the permitted season for OHV use on designated trails), pipeline or telecommunications construction must operate using "isolation" techniques to protect water quality while crossing streams (Alberta Environment 2000). Alberta's *Water Act* (*Water Act*, R.S.A. 2000, c. W-3) states that for a Class C stream, "any accumulations of silt and sediment within the isolation area resulting from the works in the trench must be removed to a location where the materials will not

enter a water body" (Schedule 3, Part 3, Section f). Allowing recreational trail damage on the scale we document here seems wholly in violation of the Act's guidelines, which were established to protect wildlife and water resources.

Overall, trail sections further away from the Hummingbird Forest Recreation Area (BTN, BTS, BTR) suffered greater amounts of damage than the hardened, flat sections of ONI, CAN, and HUM. Interestingly, these latter three trails had the highest motorized traffic densities in our study. In other words, we found relatively low amounts of damage on highly traveled trails. The discrepancy between traffic density and trail damage strongly supports the notion that many trails in the Bighorn Backcountry are not properly designed and sited for their currently regulated use.

Overall trend in traffic volume

We found a substantial increase (68%) in the number of vehicle passes recorded during the summer months between 2004 and 2006. These numbers are likely underestimates of the actual amount of traffic on the trail network due to limitations in data recording by the traffic counters and because of SRD management intervention during 2005. In 2005 portions of the trail network were closed due to abnormally high amounts of precipitation (D. Samson pers. comm.); nonetheless, it is clear that motorized vehicle use is increasing on ONC and BTN. These results support our prediction that trail use in the area will increase following the establishment of the AMP and that the AMP was not merely regulating established, "long-term" users. In this way, problems associated with motorized recreation (see Appendix D) can be expected to increase in the future. For example, higher traffic volumes along designated trails (see Figure 11) can lead to a loss of effective habitat amount for elk (Preisler et al. 2006).

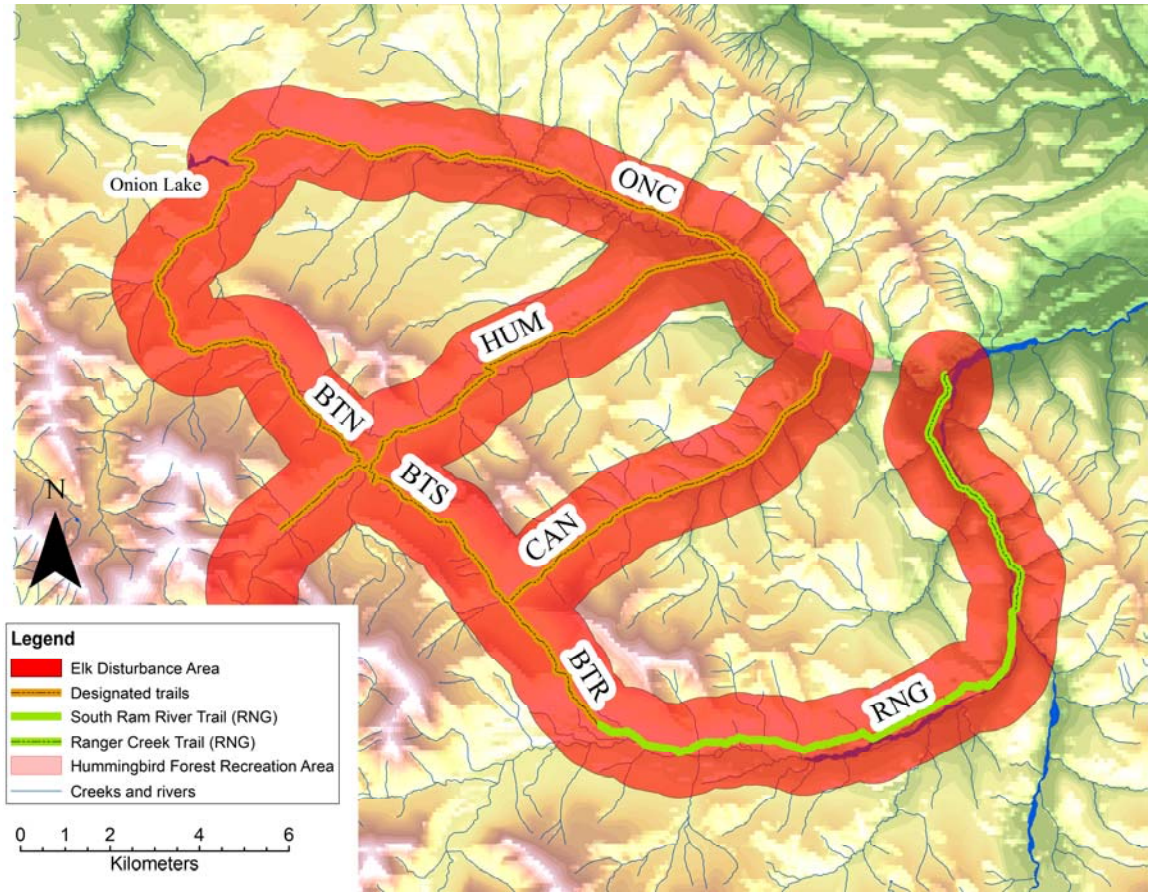

Figure 10. Trail network showing disturbance area to elk (*Cervus elaphus*), an area approximately equal to 14,355 ha (see Figure 2 for map metadata). This map is based on the results of Preisler et al. (2006), who found that probability of a flight response by an elk to an approaching OHV was ≈0.2 when the elk was 500 m from a trail and an OHV was 1,000 m away. The probability of disturbance increases both as elk are closer to the trail and as OHVs are closer to the elk. For example, the probability of response was closer to ≈0.6 when the elk was 20 m from the trail and the OHV was 1,000 m away. Likewise, the probability of response was as high as 0.4 for elk 20 m from a trail when an OHV was 3,000 m away.

Given the increasing lack of compliance with FLUZ regulations, the extensive damage to the trail network, and the trend in increasing traffic density, current management efforts in the

Bighorn Backcountry are failing to meet the goal of the FLUZ regulations to protect "areas containing sensitive resources such as fish and wildlife and their habitats, vegetation, soils and watershed" (SRD 2002a:10). The extent and intensity of impacts reported here jeopardize the very possibility of a quality backcountry recreation experience in the future for all users and are inconsistent with wildlife habitat and watershed protection objectives.

RECOMMENDATIONS AND FUTURE RESEARCH OBJECTIVES

Issue: Protection of the Bighorn Backcountry's environment is long overdue.

1.0) Honour the commitments made by previous government officials to protect the Bighorn area as a Wildland Park and fulfill the objectives of long-standing, publicly supported land management policies by restricting motorized recreation in the Prime Protection Zone. If the primary goal of the FLUZ – which is under the guiding principles of the Eastern Slopes Policy (Government of Alberta 1984; Alberta Forestry 1986) – is to protect watersheds and wildlife habitat, then management of recreation must align with these priorities. The structure of the Bighorn Backcountry (specifically the Upper Clearwater/Ram FLUZ) ecosystem is typical of high elevation areas along the Eastern Slopes of the Rocky Mountains: thin, light soils along with high precipitation. These areas are very susceptible to damage caused by high levels of human activity. As industrial activity intensifies elsewhere in the province, the Bighorn Backcountry will become increasingly valued for its pristine wilderness condition to meet recreation, watershed, and wildlife habitat objectives. Prudent management intervention is needed as soon as possible to prevent further, and possibly unrecoverable, damage from occurring in this area.

Issue: Illegal use of trails is increasing.

2.1) Increase enforcement patrols in backcountry areas, especially along BTN, BTS, and BTR trails.

2.2) Ensure that all secondary trails are physically blocked and signed at the junction, with language indicating that motorized users proceeding off of the main trail are in violation of FLUZ regulations. We sampled traffic along a small portion of the non-designated trails in the area, and while we found somewhat decreased use on certain trails, others showed a lot of illegal traffic. Well-placed signs appear to reduce the use of non-designated trails. However, signs have often been vandalized (e.g., removed or shot through), which reinforces the need for more enforcement. Such behaviour is an indication of the animosity some users have toward backcountry regulation.

2.3) Redesign elements of the trail network to facilitate safety and enforcement patrols. Some trails (especially along the border of the Kiska-Wilson FLUZ and the Ram-Clearwater FLUZ, on the north end of the Job-Cline FLUZ, and in the Dormer-Sheep FLUZ) and Random Sledding Areas are not clearly marked, so users may not know what areas are legal or illegal for OHV use. Furthermore, the many non-looping trails disperse an already scarce enforcement presence. Looping network trail designs would help alleviate some of these issues.

Issue: Trail location and design is inappropriate for the types of use permitted in the FLUZ.

3.1) Ensure that amateur stewardship efforts to repair damaged trail sections are overseen by professional engineer and construction personnel. We found evidence of trail stewardship by local clubs, as encouraged by SRD, but in some situations these efforts will only temporarily address the problem. For example, in many cases, water movement near or across the trail is not adequately addressed by the drainage methods used (H. Unger, pers. comm.). Attempts by stewardship groups to reduce the impact of their own activities within the Bighorn Backcountry are commendable; however, additional expertise is needed in these endeavours and a more systematic approach to trail improvement must be implemented.

3.2) Address water quality and fisheries objectives by improving water crossings along designated trails through the construction of bridges for permanent streams and hardened fords for ephemeral streams. Approaches to streams should be hardened with gravel to reduce bank erosion and fenced to encourage their use. Evidence of driver avoidance of crossing structures suggests that many users are unaware of the impacts of OHVs on water quality.

3.3) Monitor random campsites along trails, especially along ONI and RNG, for presence of garbage and semi-permanent facilities. Close sites to further use where reclamation is necessary.

3.4) Increase management responsiveness to changing trail conditions by closing areas until repairs are made or the area naturally regenerates. SRD has shown willingness to adjust trail regulations based on local conditions in 2005 and, specifically, on BTN in 2006. We encourage these efforts and urge LFD officers to more closely examine other trail sections based on our results. We also point out that the damage leading to these trail closures was anticipated at the earliest meetings of the Bighorn Advisory Group (SRD 2002b). We recommend initiating a pilot project to measure the recovery of damaged areas and to project recovery times. This would allow managers to move forward with restoration projects throughout the area.

3.5) Enforce a 3-m-wide trail designation. The 10-m or 23-m designated trail width (SRD 2002b) in the Bighorn is far wider than in many jurisdictions in North America where OHV use is common. Having more reasonable and enforceable trail widths will help minimize environmental degradation as well as improve the efficiency of stewardship efforts. This may require revision of the FLUZ regulation.

Issue: Density of motorized traffic is increasing in the area.

4.1) Conduct a survey of users in the area with the goal to determine

i) how the area is being used by each user group,

ii) how to avoid multi-user conflict, and

iii) how to minimize environmental degradation and develop a more comprehensive and sustainable management vision for the area.

4.2) Incorporate broader perspectives on the Bighorn Backcountry Access Management Plan Standing Committee by including representatives from the conservation sector on this committee. Currently there is no conservation group or non-motorized recreation group representation on the committee. While some may have the view that "all participants are concerned with the environment" and therefore a dedicated conservation position is unnecessary, this argument defies the logic of a stakeholder committee. For example, hikers do not represent horseback riders and snowmobilers are not represented by quadders. A dedicated environmental perspective is clearly under-represented on this committee, given the Prime Protection Zone designation for many areas in the Bighorn Backcountry and the increasing intensification of recreational activity.

Future action for the Alberta Wilderness Association in the Bighorn Backcountry

1) Conduct a trailhead survey of all different users.
2) Conduct a focal group survey with recreation organizations.
3) Continue monitoring efforts using traffic counters.
4) Spot-check severely disturbed areas for management intervention and update the photo-database of areas, where appropriate, to compare with baseline data.
5) Continue to bring management/enforcement issues to the attention of authorities.

CONCLUSION

Our study provides evidence of severe impacts to the environment caused by recreational activities in the Bighorn Backcountry. These impacts violate the intent of the Bighorn Backcountry Access Management Plan and the FLUZ regulations. Allowing recreational activities to continue at current levels is wholly inconsistent with the vision of the Prime Protection Zone designation under the Eastern Slopes Policy.

The recreational impacts in the Bighorn Backcountry described here underscore the sort of access management issues that are becoming common throughout the province (Canada West Foundation 2006). Similar issues are apparent in the Castle-Crown, the southeast slopes, Kananaskis Country, the Ghost-Waiparous, and areas further north along the Eastern Slopes. As access management issues continue to dominate backcountry land management, the need to develop comprehensive policy and management plans that accommodate all user groups is increasingly apparent. Within these, our government must establish clear and enforceable regulations that will ensure the protection of wildlife, watersheds, and all ecosystem services.

Recreational access issues in the Bighorn Backcountry represent both a challenge and an opportunity for users and governments. The challenge will be to meet the concerns expressed by individual user groups while ensuring that the value of the land is not depreciated for others. The opportunity before us is to bring traditionally disparate users together to become actively engaged in the resolution of these issues. The first step toward reaching this goal is for the provincial government to resume an active leadership role in public land stewardship.

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Appendix A. Reporting periods for traffic counters, 2004-2006.

Traffic counter (Trail)	Year	2004				2005												2006											
	Month	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9			
	1 (ONC)											**11**		**1**															
	2 (ONC)*																												
	3 (ONC)*																												
	4 (CAN)																												
	5 (ONC)*	**31**																											
	6 (RNG)			**5**								**12**																	
	7 (BTN)																												
	8 (HUM)	**31**										**11**											**21**			**11**			

*Non-designated trails

Periods when the recorders were deemed malfunctioning are highlighted in grey. Bold numbers indicate the day when the traffic recorder was not recording.

Appendix B. Photo documentation of selected recreational impacts in the Bighorn Backcountry.

1) An undesignated "frolic area" on Onion Lake. The tracks in the lakebed on the left side of the photo are from OHVs and have been found in this location every year since at least 2003.

2) A poorly designed water crossing along HUM. Sites like these are contributing to water quality degradation and fish habitat loss.

3) Use of a non-designated trail by at least one OHV rider near traffic counter 3 in the Onion Lake area.

4) Trail braiding along the ONI trail. Note the puddling on the left branch.

5) A section of damaged trail along HUM. Poor trail construction is leading to water pooling and rutting along this OHV track.

6) Reclamation efforts along BTS by SRD. Costs of reclaiming damaged areas, as well as additional enforcement personnel needed for backcountry patrols, need to be included in any cost-benefit evaluation of managing this wilderness resource.

7) Backcountry campsite along RNG.

8) Garbage gathered from one backcountry campsite along RNG.

Appendix C. History of the Alberta Wilderness Association's interest in the Bighorn Backcountry.

- **1972 –** AWA begins clean-up in Bighorn Area – Pinto Lake.

- **1973 to 1974 –** Province-wide public hearings include a review of the AWA's proposed Wildland Recreation Areas (areas proposed for wilderness preservation like Willmore Wilderness Park). Included is what the Alberta government later names the Bighorn Wildland Recreation Area (proposed Panther Corners, Ram-Whiterabbit and White Goat Wildland Recreation Areas).

- **1975 –** Alberta government announces that it accepts the protection recommendations of the 1974 Environment Conservation Authority report into the future of the Eastern Slopes:

  "This will ensure that while some carefully selected projects will proceed in certain areas, vast tracts of land will be kept in a natural and wilderness state. A conservative estimate is that a ***minimum of 70% of the Eastern Slopes Region will be maintained in present natural or wilderness areas.****"*

  (Government of Alberta, Policy Statement on the Eastern Slopes)

- **1979 –** Eastern Slopes Policy designates most of Bighorn as Prime Protection Zone, off-limits to industry and OHV use.

- **1981 –** Following the establishment of Kananaskis Country in 1977, the Alberta government proposes to establish a second country, David Thompson Country – a large area in west-central Alberta including the currently proposed Bighorn Country.

- **1982 to 1984 –** AWA is a full public consultant to the Nordegg-Red Deer River and the Rocky-North Saskatchewan Sub-Regional Integrated Resource Plans.

- **1984 to 1994 –** AWA conducts a yearly trail clean-up blitz in the Bighorn Area.

- **1986 –** At the AWA's annual meeting, the Minister of Forestry announces completion of the Nordegg-Red Deer River Integrated Resource Plan and names the Bighorn Wildland Recreation Area in response to the AWA's proposal. The government releases a park-like brochure, and the Wildland Area goes onto government maps.

- **1992 –** In a letter to the AWA, the Minister of Tourism, Parks and Recreation states his belief that the Bighorn Wildland Recreation Area "could be legislated in a manner that would provide both an appropriate level of protection and facilitate opportunities such as hiking, cross-country skiing and equestrian use.… It is our hope that imminent decisions will result in an opportunity for this positive strategy to get underway."

- **1993 –** The government appoints an Advisory Committee on Special Places 2000 and recommends that areas already managed as wildlands, including Bighorn Wildland Recreation Area, be formally designated as protected areas by the end of 1994.

- **1994 –** AWA adopts the Bighorn Historic Trail through Alberta Land and Forest Services. Located in the Rocky-Clearwater Forest, the trail starts at Crescent Falls and goes to Wapiabi Gap and on to the Blackstone Gap. In addition, AWA asks to adopt an extension of this trail, from the Blackstone, over the Chungo Gap to the FLUZ boundary on the east.

- **1996 –** An Alberta government report, *Parks and Protected Areas: Their Contribution to the Alberta Economy*, finds the economic contribution of provincial parks and other legally protected areas to be comparable to that of other resource-based sectors and, in particular, similar to the agricultural and forestry sectors. The report calculates only the recreation and tourism values, noting that there are also social, environmental, and other economic values from parks. In terms of employment, parks are similar to the forestry and energy sectors.

- **1998 –** The "Bighorn Country" Wildlands Coalition is established, with members consisting of provincial organizations, local citizens, outdoor recreationists, ecotourism operators, and

guides and outfitters from the Sundre, Nordegg, Rocky Mountain House, and Red Deer areas. The Coalition's goal is the following:

> *To encourage the establishment of "Bighorn Country" as a means of ensuring the protection of this outstanding wildland for present and future generations while providing for heritage appreciation and a range of recreation and eco-tourism opportunities which are dependent on undeveloped, natural environments.*

- **1998 to 2001 –** AWA participates in the Alberta Forest Service–Friends of the West Country–Sunpine regular meetings in Rocky Mountain House.

- **2000 –** AWA undertakes extensive discussions with Talisman Energy Inc. and the EUB regarding drilling and pipeline plans for Bighorn Country.

- **2001 –** AWA withdraws from the "Bighorn Country" Wildlands Coalition due to board change in direction. Government denies existence of Bighorn Wildland. AWA demands that promised Bighorn Wildland Recreation Area be protected by legislation. Alberta government sells gas leases under Bighorn Range and within Bighorn Country, in the Wapiabi-Blackstone valleys.

- **2001-2002 –** AWA participates in Bighorn Access Management Advisory Group.

- **2002 –** AWA initiates public forums to discuss the future of the Bighorn Wildland. AWA declines to sign off on the Bighorn Access Management recommendations. AWA gives a presentation to Standing Policy Committee. Bighorn Backcountry Access Management Plan is endorsed by Alberta Cabinet. The plan goes to Caucus for final approval. The plan allows motorized access into Prime Protection Zone in violation of the Eastern Slopes Policy.

- **2003 –** AWA launches the Bighorn Recreation and Impact Monitoring Program. AWA publishes a new book, *Bighorn Wildland*, and begins a book tour through Alberta communities to educate Albertans about the Bighorn and conservation, and to re-launch the

Bighorn campaign. AWA meets with Mike Cardinal and representatives to demand Wildland Park designation for the Bighorn and the prohibition of motorized and industrial access.

- **2004** – The tenth anniversary of AWA's stewardship of the Bighorn Historic Trail.

- **2005** – AWA meets with Minister of Community Development Gary Mar to discuss, among other items, designating Bighorn as a Wildland Park in celebration of Alberta's centennial year. Mar indicates that with the current government, it is extremely difficult to get any new protected areas in Alberta. Although Mar says that he wants Alberta's parks to be the "lens through which the world sees Alberta," he says his focus is to maintain existing parks in Alberta with upgrades to infrastructure and programming. This is backed up in following months with the release of the budget allocating approximately $60 million to parks for infrastructure, staffing, and fire prevention. Unfortunately, there is no mention of the creation of any new parks or protected areas.

- **2006** – AWA continues community outreach efforts and meets with members of the Alberta Equestrian Federation to review concerns of common interest, including trail damage and overuse. Restoration efforts and plans to work together are discussed. AWA completes the 2006 field season (five field trips) and interim report for the Bighorn Wildland Recreation Monitoring Project (BWRMP) 2005 season. An executive summary of 2005 BWRMP interim report is sent to SRD, Clearwater Area. The report contains 10 recommendations on policy and management of the Hummingbird Recreation Area. AWA discusses some points at a meeting with SRD, Clearwater Area and requests a written response to our recommendations. AWA holds an additional meeting with SRD, Clearwater Area to discuss TRAFx data in detail, as well as locations of damage, etc. AWA receives acknowledgement from SRD, Clearwater Area on the 2005 Interim Report; they note that AWA concerns and many recommendations have been included in their work plans for this year. An Executive Summary of BWRMP, covering letter, and copy of the *Bighorn Wildland* book are sent to all MLAs. AWA participates in government-led meetings and processes regarding R11

FireSmart and the Ya Ha Tinda Environmental Assessment related to elk management ideas and plans. AWA participates in meetings and open house sessions in Sundre with SRD Forest Service, individuals, and local interests in response to development plans submitted by Panther River Adventures under the ATRL process. Oil and gas development in the Bighorn area are reviewed routinely throughout the year with the major companies operating in the area. AWA continues its commitment to the Bighorn Historic Trail with the completion of a successful trail-clearing trip. Concerns with trail conditions and usage report are filed with SRD, Clearwater Area.

- **2007 -** AWA completes the first phase of *The Bighorn Wildland Recreational Trail Monitoring Project: An Interim Research Summary from 2004 – 2006*. The report is officially released in a meeting with SRD Minister Ted Morton. Presentations are made to SRD staff from Clearwater Area; discussions and collaboration with field staff are ongoing. A recreational user survey is developed and organized user groups as well as individual users are surveyed to learn more about recreational user interests and values for the Bighorn area.

Appendix D. Annotated bibliography on the impacts of motorized recreation on various environmental features.

Feature	Impact	Effect	Jurisdiction	Source*
Soil	Toxins	Lead contamination from exhaust.	Wisconsin, USA	Collins & Sell 1982
Soil	Erosion	Soil loss 8 times greater in areas with vegetation loss caused by recreation.	California, USA	Snyder et al. 1976
Soil	Erosion	OHV caused cracks 24 cm deep within 1 season on wet soils.	California, USA	Griggs & Walsh 1981
Soil	Erosion	Sediment transport was 196 times greater and 80 times greater in heavy and moderate OHV-use areas, respectively, compared to no-use areas.	California, USA	Griggs & Walsh 1981
Soil	Compaction	Vegetation loss, water surface runoff increases, decreased sub-surface infiltration capacity.	California, USA	Iverson et al. 1981
Vegetation	Loss	Up to 99% of vegetation loss occurred after 32 passes by an OHV.	Northern Great Plains, USA	Payne et al. 1983
Vegetation	Weeds	2,000 knapweed seeds spread over 10 miles in 1 pass by a vehicle.	Montana, USA	Trunkle & Fay 1991
Water	Habitat	Sediment deposition in streams increases with OHV traffic volume and stream velocity.	Victoria, Australia	Brown 1994
Water	Toxins	Brook trout showed lead and hydrocarbon uptake from winter OHV use; fingerling stamina decreased in polluted areas.	Maine, USA	Adams 1975
Wildlife	Various	Decreased population size (45-80%) and biomass of reptiles, songbirds, and mammals in OHV areas.	California, USA	Bury et al. 1977
Wildlife	Bighorn sheep	Use of a watering site was 50% less when OHVs were in the area.	California, USA	Jorgensen 1974
Wildlife	Grizzly bear	Avoid areas with >10 vehicles per day.	Montana, USA	Mace et al. 1996
Wildlife	Elk	Flushed from areas near trails when a OHV approached at 3,000 m.	Oregon, USA	Preisler et al. 2006
Wildlife	Trout	Sedimentation of stream water by OHV crossing upstream was at levels high enough to affect behaviour and growth of trout.	Alberta, Canada	Baayens & Brewin 2002
Wildlife	Mule deer	Harassment by OHVs caused changes in behaviour, increased energy expenditure, and decreased reproductive success compared to un-harassed deer.	Alberta, Canada	Yarmoloy et al. 1988
Aesthetic	Wilderness features	85% of OHV trails were visible one year after impact.	Northern Great Plains, USA	Payne et al. 1983
Safety	Wildland fire	An average of 6.5 forest fires per year have been caused by OHVs between 1990 and 2001, with 4 caused by OHVs in 1990 and 12 caused by OHVs in 2002.	Alberta, Canada	Baxter 2002

*Complete reference information available on request.

Appendix E. Project summary: Bighorn Wildland Recreational Impact Monitoring Study

Inputs

Field work

Personnel: 990 staff hours
1,650 volunteer hours

Capital costs: $64,000 staff costs
$20,000 *Bighorn Wildland* book
$9,000 expedition costs (e.g., food, transportation)
$7,000 traffic recorders
$4,000 video documentary
$2,000 equipment (GPS, camping, safety, tools)
5 donated reconnaissance flights

Outputs

Baseline documentation of recreational impacts on 76 km of trail, including photographs, geo-referencing, and measurements of illegal trails, water crossings, damage sites, and random campsites.

Interim report presented to Hon. Ted Morton, Minister of Sustainable Resource Development (March 23, 2007).

Meeting with AEF (Alberta Equestrian Federation) (November 14, 2005).

Meeting with Hon. Gary Mar, Minister of Community Development, to discuss, among other items, designating Bighorn as a Wildland Park in celebration of Alberta's centennial year (February 2005).

Poster presentation at the Interdisciplinary Research and Management in Mountain Areas Conference. Banff, AB. *"*Monitoring the Impact of Recreational Activities for Long-term Management in the Bighorn Wildland, Alberta*"* (September 24, 2004).

Meeting with Hon. Mike Cardinal, Minister of Sustainable Resource Development, and representatives to discuss Wildland designation for the Bighorn and the prohibition of motorized and industrial access (November 2003).

Meetings with various Alberta MLAs regarding issues concerning the Bighorn (starting in October 2003).

Publication of the *Bighorn Wildland* book (September 2003).

Production of the documentary *Broken Promises*, with assistance from George Sibley of Gale Force Films (2003).

Various letters, meetings, and phone conversations between AWA and SRD officials in the Rocky Mountain House office (2003-2007).

Commencement of the Recreational Impact Monitoring Project (May 2003).

Appendix F. Inconsistencies in official statements with respect to access management in the Bighorn Wildland

Statement	Source	Contradiction: field evidence	Contradiction: policy
The widening and development of new trails requires written approval from a Forest Officer. Avoid wet, soft and sensitive areas.	Guidelines for Enjoying the Bighorn Backcountry (SRD 2006)	91 non-designated trails established as of 2006, with OHV tracks on 41% of these. 125 Erosion Events along trails. Mean width of damaged trail sections is ≈9 m, maximum =50 m. 244 cases of trail braiding and widening (AWA 2007).	
The Bighorn Backcountry is managed to ensure the protection of the environment, while allowing responsible and sustainable recreational use.	Introduction: Bighorn Backcountry (SRD 2006)	Illegal use of trails is increased by 7% from 2004 to 2006. Approximately 20% of motorized vehicle traffic was recorded during non-designated (illegal) periods. Trail degradation was found on 20% of the trail network and motorized traffic in the area is increasing (AWA 2007).	
The area was included in the 1977 (revised 1984) Policy for Resource Management of the Eastern Slopes and also in the Nordegg-Red Deer River Sub-Regional Integrated Resource Plan of 1986. These plans remain in place, and are now (as of 2002) supported further by a Bighorn Backcountry Access Management Plan, developed with input from an Advisory Group and from the public at large.	Bighorn Backcountry Access Management Plan (SRD 2002)		The Nordegg-Red Deer River Sub-Regional Integrated Resource Plan of 1986 explicitly prohibits motorized recreation in areas now approved for these activities by the Access Management Plan, especially in the Ram-Clearwater FLUZ.
Alberta implemented regulations in 2002 around camping, trail riding, and OHVs to protect Bighorn Backcountry's wilderness environment.	Bighorn Backcountry Access Management Plan (SRD 2002)	91 non-designated trails established as of 2006, with OHV tracks on 41% of these. 125 Erosion Events along trails. Mean width of damaged trail sections is ≈9 m, maximum=50 m. 244 cases of trail braiding and widening (AWA 2007).	The Nordegg-Red Deer River Sub-Regional Integrated Resource Plan of 1986 explicitly prohibits motorized recreation in areas now approved for these activities by the Access Management Plan, especially in the Ram-Clearwater FLUZ.

Designated Trail: A road, trail or seismic line designated by signage and on maps for use by Off-Highway Vehicles (OHVs) and snowmobiles. The route may or may not be open for use by other forms of access. The OHV trail includes that part of the route to a width of three metres (9.8 feet) or less as approved by a Forest Officer, and a parking zone of 10 metres or less on either side of the trail. Within Forest Land Use Zones, OHVs and snowmobiles must remain on the trail.	Bighorn Backcountry Access Management Plan (SRD 2002)	91 non-designated trails established as of 2006, with OHV tracks on 41% of these. 125 Erosion Events along trails. Mean width of damaged trail sections is ≈9 m, maximum=50 m. 244 cases of trail braiding and widening (AWA 2007).	A 23-m trail width wherein damage to water, soil, and vegetation is allowed to occur is inconsistent with environmental protection objectives.
A Forest Land Use Zone can be used to: Protect areas containing sensitive resources such as fish & wildlife and their habitats, vegetation, soils and watershed.	Bighorn Backcountry Access Management Plan (SRD 2002)	91 non-designated trails established as of 2006, with OHV tracks on 41% of these. 125 Erosion Events along trails. Mean width of damaged trail sections is ≈9 m, maximum=50 m. 244 cases of trail braiding and widening (AWA 2007).	
No-Go Zone: An area where OHV or other form of access (as posted) is not permitted, including any lands off the designated trails other than parking areas; any lands within 100 metres of a lake, pond or non-flowing body of water; any meadows, swampland, marsh, stream, grassed slope or other area off the designated trail.	Bighorn Backcountry Access Management Plan (SRD 2002)	Water crossings over 89 streams, of which 7% had bridges (AWA 2007). 91 non-designated trails established as of 2006, with OHV tracks on 41% of these. 125 Erosion Events along trails. Mean width of damaged trail sections is ≈9 m, maximum=50 m. 244 cases of trail braiding and widening (AWA 2007).	
There must be adequate resources to ensure that regulations can be effectively enforced.	Recreational Access Recommen-dations for the Bighorn Area (Bighorn Advisory Group 2002)	Illegal use of trails is increased by 7% from 2004 to 2006. Approximately 20% of motorized vehicle traffic was recorded during non-designated (illegal) periods.	

Activities allowed in this area will be restricted or delayed if present levels of activity are shown to compromise environmental integrity.	Recreational Access Recommen-dations for the Bighorn Area (Bighorn Advisory Group 2002)	Water crossings over 89 streams, of which 7% had bridges (AWA 2007). 91 non-designated trails established as of 2006, with OHV tracks on 41% of these. 125 Erosion Events along trails. Mean width of damaged trail sections is ≈9 m, maximum=50 m. 244 cases of trail braiding and widening (AWA 2007).	The Nordegg-Red Deer River Sub-Regional Integrated Resource Plan of 1986 explicitly prohibits motorized recreation in areas now approved for these activities by the Access Management Plan, especially in the Ram-Clearwater FLUZ.
User groups should be engaged directly in stewardship programs, giving them more responsibility for facility improvements and maintenance, but cautioned that the provincial government must also have adequate resources in place.	Recreational Access Recommen-dations for the Bighorn Area (Bighorn Advisory Group 2002)	Stewardship efforts are poorly engineered to address water drainage issues near trails with OHV and high density equestrian traffic (AWA 2007).	
Temporary or permanent closures should be implemented in areas where continued use of those areas will have negative effects on fish and wildlife populations, natural habitat conditions, watershed integrity or traditional aboriginal sites.	Recreational Access Recommen-dations for the Bighorn Area (Bighorn Advisory Group 2002)	Water crossings over 89 streams, of which 7% had bridges (AWA 2007). 91 non-designated trails established as of 2006, with OHV tracks on 41% of these. 125 Erosion Events along trails. Mean width of damaged trail sections is ≈9 m, maximum=50 m. 244 cases of trail braiding and widening (AWA 2007).	
Where areas have deteriorated from overuse, these areas should be restored to natural conditions. This is especially true of areas around alpine lakes. Appropriate measures must be taken to ensure that the damage will not re-occur.	Recreational Access Recommen-dations for the Bighorn Area (Bighorn Advisory Group 2002)	The lakebed of Onion Lake had new OHV track marks every year from 2004-2006 (AWA 2007). Water crossings over 89 streams, of which 7% had bridges (AWA 2007). 91 non-designated trails established as of 2006, with OHV tracks on 41% of these. 125 Erosion Events along trails. Mean width of damaged trail sections is ≈9 m, maximum=50 m. 244 cases of trail braiding and widening (AWA 2007).	

Some members believe that OHV use in the prime protection zone is specifically prohibited by existing policy. Other members believe that designated trails would be consistent with existing policy.	Recreational Access Recommen-dations for the Bighorn Area (Bighorn Advisory Group 2002)		The Nordegg-Red Deer River Sub-Regional Integrated Resource Plan of 1986 explicitly prohibits motorized recreation in areas now approved for these activities by the Access Management Plan, especially in the Ram-Clearwater FLUZ.
Some members believe that OHV use causes damage to terrain and disruption to wildlife and people in areas they access. Others believe that OHV users will be highly responsible and will be positive contributors to the protection of the area, and the maintenance of trails and facilities.	Recreational Access Recommen-dations for the Bighorn Area (Bighorn Advisory Group 2002)	Illegal use of trails is increased by 7% from 2004 to 2006. Approximately 20% of motorized vehicle traffic was recorded during non-designated (illegal) periods. Trail degradation was found on 20% of the trail network and motorized traffic in the area is increasing (AWA 2007).	Uncontrolled vehicle access and lack of maintenance on roads leading up … Onion Creek … have resulted in terrain damage and erosion (Alberta Forestry 1986)
Where trails or campsites are too close to sites habitually used by ungulates or carnivores, these facilities should be moved or closed. In some cases, it may be necessary to restrict backcountry camping to designated campsites.	Recreational Access Recommen-dations for the Bighorn Area (Bighorn Advisory Group 2002)	Figure 11 (AWA 2007).	
The intent of the Prime Protection Zone is to preserve environmentally sensitive terrain and valuable ecological and aesthetic resources. Regional objectives which are considered compatible with the intent of this zone include those of watershed, fisheries and wildlife management, and extensive recreational activities such as hunting, trail use (non-motorized) and primitive camping.	A Policy for Resource Management of the Eastern Slopes, revised 1984 (Government of Alberta 1984)	Water crossings over 89 streams, of which 7% had bridges (AWA 2007). 91 non-designated trails established as of 2006, with OHV tracks on 41% of these. 125 Erosion Events along trails. Mean width of damaged trail sections is ≈9 m, maximum=50 m. 244 cases of trail braiding and widening (AWA 2007).	Bighorn Backcountry Access Management Plan (SRD 2002)

The main land use in this Resource Management Area is back-country recreation. Uncontrolled vehicle access and lack of maintenance on roads leading up … Onion Creek … have resulted in terrain damage and erosion.	Nordegg-Red Deer River Subregional Integrated Resource Plan (Alberta Forestry 1986)		Bighorn Backcountry Access Management Plan (SRD 2002)
As motorized vehicle use is generally not compatible with resource values in this Resource Management Area, restrictions are required.	Nordegg-Red Deer River Subregional Integrated Resource Plan (Alberta Forestry 1986)	1,629 motorized vehicle passes were recorded on 5 trails in the summer of 2006, an increase of 68% from 2004 (AWA 2007).	Bighorn Backcountry Access Management Plan (SRD 2002)
Objectives and guidelines: To provide access appropriate to non-motorized back-country recreational activities, including reclamation of existing motorized access.	Nordegg-Red Deer River Subregional Integrated Resource Plan (Alberta Forestry 1986)	1,629 motorized vehicle passes were recorded on 5 trails in the summer of 2006, an increase of 68% from 2004 (AWA 2007).	Bighorn Backcountry Access Management Plan (SRD 2002)
A staging area will be developed at the confluence of Canary and Hummingbird creeks for equestrian and hiking users in the Ram River drainage.	Nordegg-Red Deer River Subregional Integrated Resource Plan (Alberta Forestry 1986)	1,629 motorized vehicle passes were recorded on 5 trails in the summer of 2006, an increase of 68% from 2004 (AWA 2007).	Bighorn Backcountry Access Management Plan (SRD 2002)