

Recent Off-Road Vehicle (ORV) References

Updated April 2006 by Adam Switalski, Wildlands CPR

General Reviews of ORV Impacts:

Davenport, J, and TA Switalski. 2006. Environmental impacts of transport related to tourism and leisure activities. In: *The ecology of transportation: managing mobility for the environment*, editors: J Davenport and Julia Davenport. Dordrecht, Netherlands: Kluwer Academic Publishers. 333-360.

Ministry of Water, Land and Air Protection and Grasslands Conservation Council (MWLAP and GCC). 2004. *Best Management Practices for Recreational Activities on Grasslands in the Thompson and Okanagan Basins*. Ministry of Water, Land and Air Protection, Victoria, B.C.

<http://www.bcgrasslands.org/SiteCM/U/D/8E9CD8997E4ED889.pdf>

Gaines, W.L., P.H. Singleton, and R.C. Ross. 2003. *Assessing the cumulative effects of linear recreation routes on wildlife habitats on the Okanogan and Wenatchee National Forests*. Gen. Tech. Rep. PNW-GTR-586. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 79p.

<http://www.fs.fed.us/pnw/pubs/gtr586.pdf>

Gilbert, B.K. 2003. *Motorized access on Montana's Rocky Mountain Front: a synthesis of scientific literature and recommendations for use in revision of the travel plan for the Rocky Mountain Division*. The Coalition for the Protection of the Rocky Mountain Front. 35p.

<http://www.wildmontana.org/gilbertreport.pdf>

Havlick, D.G. 2002. *No Place Distant: Roads and Motorized Recreation on America's Public Lands*. Foreword by Mike Dombeck. Island Press, Washington, DC.

Stokowski, P.A. and C.B. LaPointe. 2000. *Environmental and social effects of ATVs and ORVs: an annotated bibliography and research assessment*. School of Natural Resources, University of Vermont. 31p.

<http://www.americantrails.org/resources/wildlife/docs/ohvbibliogVT00.pdf>

Joslin, G. and H. Youmans, coordinators. 1999. *Effects of recreation on Rocky Mountain wildlife: A review for Montana*. Committee of Effects of Recreation on Wildlife, Montana Chapter of the Wildlife Society. 307p.

<http://www.montanatws.org/chapters/mt/index.cfm?tname=rrmwfull>

Wildlands CPR, The Wilderness Society, et al. 1999. *Petition to enhance and expand regulations governing the administration of recreational off-road vehicle use on National Forests*. Published by Wildlands CPR, Missoula, MT 188p.

<http://www.wildlandscpr.org/orvs/ORVpetition.doc>

ORV Impacts to Soil:

Belnap, J. 2003. The world at your feet: desert biological soil crusts. *Frontiers in Ecology and the Environment*. 1(5): 181-189.

Abstract: Desert soil surfaces are generally covered with biological soil crusts, composed of a group of organisms dominated by cyanobacteria, lichens, and mosses. Despite their unassuming appearance, these tiny organisms are surprisingly important to many processes in past and present desert ecosystems. Cyanobacteria similar to those seen today have been found as 1.2 billion-year-old terrestrial fossils, and they probably stabilize soils then as they do now. Biological crusts are vital in creating and maintaining fertility in otherwise infertile desert soils. They fix both carbon and nitrogen, much of which is leaked to the surrounding soils. They also capture nutrient-rich dust, and can stimulate plant growth. These organisms are able to tolerate extreme temperatures, drought, and solar radiation, despite having relatively little wet time for metabolic activity. Under most circumstances, they are extremely vulnerable to climate change and disturbances such as off-road vehicles and grazing livestock. Recovery times are generally measured in the decades or centuries.

Belnap, J. 2002. Impacts of off-road vehicles on nitrogen cycles in biological soil crusts: resistance in different U.S. deserts. *Journal of Arid Environments*. 52(2): 155-165.

Abstract: Biological soil crusts are an important component of desert ecosystems, as they influence soil stability and fertility. This study examined and compared the short-term vehicular impacts on lichen cover and nitrogenase activity (NA) of biological soil crusts. Experimental disturbance was applied to different types of soil in regions throughout the western U.S. (Great Basin, Colorado Plateau, Sonoran, Chihuahuan, and Mojave deserts). Results show that pre-disturbance cover of soil lichens is significantly correlated with the silt content of soils, and negatively correlated with sand and clay. While disturbance appeared to reduce NA at all sites, differences were statistically significant at only 12 of the 26 sites. Cool desert sites showed a greater decline than hot desert sites, which may indicate non-heterocystic cyanobacterial species are more susceptible to disturbance than non-heterocystic species. Sandy soils showed greater reduction of NA as sand content increased, while fine-textured soils showed a greater decline as sand content increased. At all sites, higher NA before the disturbance resulted in less impact to NA post-disturbance. These results may be useful in predicting the impacts of off-road vehicles in different regions and different soils.

Misak, R.F., J.M. Al Awadhi, S.A. Omar, and S.A. Shahid. 2002. Soil degradation in Kabd area, southwestern Kuwait city. *Land Degradation & Development*. 13(5): 403-415.

Abstract: Adverse environmental impacts of human activities are the main causes of soil degradation in the desert of Kuwait in general, and in Kabd area in particular. In this study, assessment of soil degradation in open and protected sites has been carried out using field measurements and laboratory investigations. The overall status of vegetation is nearly twice as low in vegetation cover in the open sites than in the protected ones due to overgrazing and off-road transport. Compaction of soil due to pressure exerted on the soil by vehicles led to a significant reduction in its porosity, permeability and infiltration capacity. The average infiltration rate of the compacted soils is 51 per cent lower than that of the non-compacted soils. The bulk density of the non-compacted soils is 3.4 per cent lower than that of compacted soil. The average topsoil resistance of compacted soils has increased by 83 per cent in comparison with non-compacted soil. Using the least squares method a relation between infiltration rate (IR) and penetration resistance (PR) of the topsoil for the study areas is found (i.e. $IR = -0.148 PR + 1.85$ with $R^2 = 25$ per cent). Soil strength within the soil profile shows maximum penetration resistance readings at 11.5 cm depth in average in compacted soils, while it shows maximum readings at 34.6 cm depth in average in non-compacted soils. The adverse changes in the chemical properties due to soil compaction is also investigated. A restoration plan is needed in order to reduce land degradation.

ORV Impacts to Vegetation:

Gelbard, J.L., and S. Harrison. 2003. Roadless habitats as refuges for native grasslands: interactions with soil, aspect, and grazing. *Ecological Applications* 13(2): 404-415.

Abstract: The idea that roadless habitats act as refuges for native-plant diversity against exotic-plant invasion has seldom been tested. We examined the effect of distance from roads and its interactions with soil type, aspect, and livestock grazing on native – and exotic-plant diversity in a 130 000-ha inland California (USA) foothill grassland landscape. During spring 2000 and 2001, we measured the numbers of and cover by native and exotic plant species in 92 sites stratified by distance from roads (10 m, 100 m, and >1000 m), soil type (nonserpentine), and aspect (cool, warm, and neutral slopes). In nonserpentine grasslands, native cover was greatest in sites >1000 m from roads (23%) and least in sites 10 m from roads (9%), and the percentage of species that were native was significantly greatest in sites >1000 m from roads (44%) and least in those 10 m from roads (32%). In addition, the most distant sites had the largest number of native grass species and the fewest exotic forb species. In serpentine grasslands there was no significant effect of distance on the numbers of and cover by native and exotic species. On both soils, two exotic species (*Centaurea solstitialis* and *Aegilops triuncialis*) were at their lowest frequencies, while a native bunchgrass, *Nassella pulchra*, was at its highest frequency, in sites >1000 m from roads. On nonserpentine soils only, the exotics, *Convolvulus arvensis* and *Polypogon monspeliensis*, were at their lowest frequency, while a native bunchgrass, *Poa secunda*, was at its highest frequency in the most distinct sites. Native species were more abundant on slopes than on flat sites, while on nonserpentine, natives were least abundant on warm, south facing slopes.

Roadless areas are significant refuges for native species. However, to protect these habitats from the continued threat of invasion, land managers should consider means of preventing construction of new roads, limiting off-highway vehicle access into grasslands with low road densities, identifying a regime of livestock grazing that favors the persistence of natives over the spread of exotics, and monitoring recreational trails and grazing allotments within roadless areas to detect and eradicate new infestations.

Munger, J.C., B.R. Barnett, S.J. Novak, and A.A. Ames. 2003. Impacts of off-highway motorized vehicle trails on the reptiles and vegetation of the Owyhee Front. *Idaho Bureau of Land Management Technical Bulletin* 03-3: 1-23.

Abstract: We used drift fences to trap reptiles near to and far from off-road motorized vehicle (OHMV) trails in the Owyhee Front. We also assessed vegetation. We found that at the less intensively used OHMV site (Fossil Butte), there was a tendency for more reptiles to be found at 25 m from the trails than at 2 m from the trails. However, at the more intensively used site (Rabbit Creek), there was a tendency for more reptiles to be found at 2 m from the trail than at 25 m, but both were lower than at 100 m. Native shrubs, bunch grasses, and microbiotic crust were less prevalent closer to trails and at the more intensively used site. Cheatgrass and *Chrysothamnus* spp., both indicative of disturbance, were more prevalent closer to trails and at the more intensively used site. We largely ascribe the patterns in reptile density to the effects on vegetation. Dense cheatgrass prevents movement of reptiles, meaning that in disturbed areas, OHMV trails offer the only corridors available.

Brown, A.C., and A. McLachlan. 2002. Sandy shore ecosystems and threats facing them: some predictions for the year 2025. *Environmental Conservation*. 29(1): 62-77.

From Summary:

“Many beaches also suffer intermittent or chronic pollution, and direct human interference includes off-road vehicles, mining, trampling, bait collecting, beach cleaning and ecotourism. These interferences typically have a negative impact on the system.”

From Off-road vehicles:

“A variety of vehicles, connecting with recreation or industry, may invade a sandy shore, causing different types and degrees of negative impact. Some recreation vehicles, such as motor-cycles, 4X4 vehicles and vehicles of ‘beach-buggy’ type, with large, wide tires, driven up and down dunes, often at considerable speed, cause displacement of sand and destroy dune vegetation. This can be extremely damaging in view of the fragile nature of the dune ecosystem. In addition, shore-birds are disturbed and their nests, eggs and young may be destroyed. Both these and more conventional vehicles may be driven along the beach itself. This often causes little impact along the wet foreshore, although this is not true of all beaches. On some New Zealand beaches, vast numbers of sand dollars (*Echinodiscus*) dominate the foreshore and are crushed by vehicles (S.C. Webb, Personal communication). Higher up the slope, vehicles are liable to crush semi-terrestrial invertebrates, such as isopods, *talitrid* amphipods and *ocypodid* crabs on the surface or in their burrows. Wolcott and Wolcott (1984) considered the negative effects of off-road vehicles on populations of the crab *Ocypode*, while Van der Merwe (1988) reviewed the literature on the impacts of traffic on coastal ecosystems. Van der Merwe and Van der Merwe (1988) investigated the damaging effects of off-road vehicles on the fauna of a beach, including the crushing of *Tylos* and Brown (2000) identified off-road vehicles as a major cause of the decline in populations of *Tylos granulatus* on the South African west coast. Hosier et al. (1981) noted that vehicle tracks in the sand presented barriers to the seaward progress of turtle hatchlings.”

Stensvold, M.C. 2000. The conservation status of Ophioglossaceae in southern Alaska. Proceedings of Botany 2000. August 6-10. Portland OR.

Abstract: In southern Alaska the *Ophioglossaceae* are represented by one species of *Ophioglossum* and eight named species of *Botrychium*. In the latter there are six species of moonwort ferns (subgenus *Botrychium*), one grapefern (subgenus *Sceptridium*), and *B. virginianum*, the rattlesnake fern in subgenus *Osmundopteris*. In addition, there are three distinct undescribed species and several unusual moonworts not clearly fitting known taxa. The State of Alaska does not maintain a threatened and endangered species list, but the U.S. Forest Service is mandated to manage habitats to maintain viable populations of plants; therefore *Botrychium* is afforded protection on National Forest System lands. Habitat disruption resulting from off-road vehicle use and trampling are currently the greatest human-caused threat to *Botrychium*. Several *Botrychium* occupy sandy beach-beach meadow habitat, and this habitat is used by an increasing number of off-road vehicles, resulting in *Botrychium* habitat degradation. Only after the taxonomy, distribution and habitat needs of *Botrychium* are better understood, and the various landowners cooperate in land use management, will we be able to effectively deal with *Botrychium* conservation issues across southern Alaska.

ORV Impacts to Wildlife:

Haiganoush, K.P., A.A. Ager, and M. Wisdom. 2006. Statistical methods for analyzing responses of wildlife to human disturbance. Journal of Applied Ecology 43:164-172.

Summary:

1. Off-road recreation is increasing rapidly in many areas of the world, and effects on wildlife can be highly detrimental. Consequently, we have developed methods for studying wildlife responses to off-road recreation with the use of new technologies that allow frequent and accurate monitoring of human-wildlife interactions. To illustrate these methods, we studied the response of Rocky Mountain elk *Cervus elaphus* L. to all-terrain vehicles (ATVs), one of the most prominent forms of summer recreation in North America. We studied elk because the species is not only of keen economic and social interest across North America and Europe but also exemplifies species that can be sensitive to human disturbance.

2. The study was part of a controlled landscape experiment where global positioning system (GPS)-equipped recreationists traversed an established 32-km route inside a 1453-ha elk-proof enclosure. Elk locations before and during the human disturbances were monitored using an automated telemetry system. The unique data set and study objectives led to our development of statistical methods for analysing the response of wildlife to human disturbance.

3. We developed a statistical method, referred to as a probabilistic flight response, which accounted for daily circadian rhythms in movement behaviour of elk, and related the probability of flight to distance to the disturbance and a number of environmental covariates. We also present methods for estimating spatially and temporally explicit movement vectors as a way of detecting and visualizing landscape-level movement patterns.

4. Using these methods, we observed that elk appeared to respond at relatively long distances (> 1000 m) to ATVs, and that the estimated probability of flight appeared to be higher when elk were closer to the ATV routes, even when the distance to an ATV was large.

5. Synthesis and applications. Our study quantifies the response of wildlife to human disturbance at a resolution well beyond previous work, and provides methods to improve our understanding of wildlife–human interactions related to management of wildlife and recreation. These methods may be used for any study involving accurate, frequent monitoring of animals and humans with the use of GPS or similar technologies now commonly available.

Wisdom, M. J., H. K. Preisler, N. J. Cimon, and B. K. Johnson. 2004. Effects of Off-Road Recreation on Mule Deer and Elk. Transactions of the North American Wildlife and Natural Resource Conference 69.

http://bluewaternetwork.org/reports/rep_atv_forestservice.pdf

Abstract: Objectives of the study were to (1) document cause-effect relations of ATV, horseback, mountain bike, and hiking activities on deer and elk; (2) measure effects with response variables that index changes in animal or population performance, such as movement rates, flight responses, resource selection, spatial distributions, and use of foraging versus security areas; (3) use these response variables to estimate the energetic and nutritional costs associated with each activity and the resultant effects on deer and elk survival; and (4) interpret results for recreation management. Among the study's preliminary findings: Elk began moving when ATVs were as far away as 2,000 yards but tolerated hikers to within 500, horseback riders within 800 and bicyclists within 1,300 yards. Elk run from ATVs but tend to walk away from hikers unless startled at close range. Mule deer move little when approached by all four types of recreational users but seem to leave foraging areas and move into deeper cover. Elk are far more disturbed by horseback riders than previously believed, and once they detect them are nearly as spooked by bikes as ATVs.

Bury, R.B., and R.A. Luckenbach. 2002. Comparison of Desert Tortoise (*Gopherus agassizii*) populations in an unused and off-road vehicle area in the Mojave Desert. Chelonian Conservation and Biology 4(2): 457-463.

Abstract: We examined habitat, abundance, and life history features of desert tortoises (*Gopherus agassizii*) on two nearby 25-ha plots in western Mojave Desert. An unused, natural plot had 1.7 times the number of live plants, 3.9 times the plant cover, 3.9 times the number of desert tortoises, and 4 times the active tortoise burrows than a nearby area used heavily by off-road vehicles (ORVs); these differences between the plots were all statistically significant. Further, the few large-sized tortoises in the ORV plot had less mass than those in an unused area. Although the scope of this study was limited to one paired-plot comparison, current data suggest that the operation of ORVs in the western Mojave Desert results in major reductions in habitat and tortoise numbers, and possibly the body mass of surviving tortoises.

Recent activities in the unused area negated our original design for a long-term comparison of tortoises in two relatively large, nearby control vs. treatment plots. Operation of ORV is now a major recreation in southwestern USA and its effect on wildlife merits increased research studies and management attention to better protect the remaining natural resources.

Janis, M.W., and J.D. Clark. 2002. Responses of Florida panthers to recreational deer and hog hunting. *Journal of Wildlife Management*. 66(3): 839-848.

Abstract: Big Cypress National Preserve constitutes approximately one-third of the range of the endangered Florida panther (*Puma concolor coryi*). Because recreational hunting is allowed in Big Cypress National Preserve, we examined 8 response variables (activity rates, movement rates, predation success, home-range size, home-range shifts, proximity to off-road vehicle trails, use of areas with concentrated human activity, and habitat selection) to evaluate how Florida panthers respond to human activity associated with deer and hog hunting. Data consisted of panther radiolocations collected since 1981 by the Florida Fish and Wildlife Conservation Commission and the National Park Service, which we augmented with radiolocations and activity monitoring from 1994 to 1998. A split-plot (treatment and control) study design with repeated measures of the variables for each panther taken before, during, and after the hunting season was used. We did not detect responses to hunting for variables most directly related to panther energy intake or expenditure (i.e., activity rates, movement rates, predation success of females; $P > 0.01$). However, panthers reduced their use of Bear Island ($P = 0.021$), an area of concentrated human activity, and were found further from off-road vehicle trails ($P \leq 0.001$) during the hunting season, which was indicative of a reaction to human disturbance. Whereas the reaction to human activity on off-road vehicle trails probably has minor biological implications and may be linked to prey behavior, the decreased use of Bear Island is most likely a direct reaction to human activity and resulted in increased use of adjacent private lands. Future habitat loss on those private lands could exacerbate the negative consequences of this response by panthers.

Nicola, NC, and JE Lovich. 2000. Preliminary observations of the behavior of male, flat-tailed horned lizards before and after an off-highway vehicle race in California. *California Fish and Game* 86(3): 208-212.

“Our small sample of male, flat-tailed horned lizards exhibited reduced rates of movement following disturbance from OHVs. This coupled with the fact that flat-tailed lizards are often sighted on roads (Norris 1949, Turner and Medina 1982), may make them especially susceptible to mortality from vehicle strikes. While driving a vehicle, Wone and Beauchamp (1995) observed that the majority (86% of flat-tailed horned lizards they encountered fled for short distances and stopped, sometimes under shrubs, and sometimes on OHV trails. Thus, flat-tailed horned lizards may attempt to avoid OHVs, although road mortalities have been observed when lizards fail to move out of the way of oncoming traffic (Muth and Fisher 1992)”

“The consequences of moving at different rates and directions after a disturbance may be negative or positive. If these changes fail to take the animal away from the area of impact, or the movements are energetically costly, the consequences may be negative. If the movements decrease the probability of an animal being struck by an OHV, then the consequences are potentially positive. While our analysis is preliminary because of a small sample size, the data are the first to suggest that OHV activity affects movement of the flat-tailed lizards.”

Vieira, M.E.P. 2000. Effects of Early Season Hunter Density and Human Disturbance on Elk Movement in the White River Area, Colorado. Unpublished M.S. Thesis. Fort Collins, CO: Colorado State University.

From Abstract: “I also conducted a series of pedestrian and all-terrain (ATV) disturbance trials on radio-collared elk as a first step in assessing the extent to which hunters on ATVs, relative to pedestrian hunters, may be causing increased elk movement. Radio-collared elk on accessible public land were treated with a

randomly assigned treatment of either a single pedestrian or single ATV disturbance. The gross distance moved in the 24 hours following the disturbance was calculated using before-treatment and after-treatment telemetry locations. The same group of elk was also used in the single disturbance trials were randomly selected and treated with 3 successive daily pedestrian disturbances. Instances moved in the 24 hours following each disturbance were measured. An ANOVA comparing the distance moved between the single pedestrian (mean=850 m, SE=190, n=9) and single ATV (mean=1910m, SE=480, n=8) disturbed groups showed a distinct treatment effect (P=0.048), with the ATV movement mean being more than twice the pedestrian mean....”

ORV Impacts on Pollution:

Durbin, T.D., M.R. Smith, R.D. Wilson, S. H. Rhee. 2004. In-use activity measurements for off-road motorcycles and all-terrain vehicles. Transportation Research Part d Transport and Environment 9(3): 209-219.

From Introduction:

“As emissions for individual on-highway vehicles continue to decrease, it is becoming increasingly important to understand the emissions from off-road mobile sources. Off-road recreation vehicles (also known as off-highway vehicles, or OHVs) are one important source of emissions that make a disproportionately high contribution to the emissions inventory. The category includes off-road motorcycles and all-terrain vehicles (ATVs)”

“Hydrocarbon (HC) emissions from 2-stroke engine equipped motorcycles are about 10 times greater than those from a comparable 4-stroke motorcycle on a per mile basis. For the OHV class, 2-stroke engines represent about 90% of the smog precursor emissions in California (California Air Resources Board, 2001). The HC emissions for both 2-stroke and 4-stroke motorcycles are also significantly higher than those from a typical new car. Nationally, recreational vehicles (including snowmobiles) represent approximately 10% of all mobile source HC emissions and 3% of all mobile source CO emissions (US Environmental Protection Agency, 2001). In California, emissions from recreational OHVs (including off-road motorcycles and ATVs) represent 2.8% of the reactive organic gas (ROG) emissions and 1.4% of the CO emissions from all mobile sources (California Air Resources Board, 2000).”

Other ORV Impacts:

Celliers, L, T. Moffett, N.C. James, and B.Q. Mann. 2004. A strategic assessment of recreational use areas for off-road vehicles in the coastal zone of KwaZulu-Natal, South Africa. Ocean and Coastal Management 47(3-4): 123-140.

Abstract: In January 2002, the Minister of the Department of Environmental Affairs and Tourism of the South African government promulgated new regulations controlling the use of off-road vehicles in the coastal zone of South Africa. The new regulations provided for a general prohibition on the recreational use of off-road vehicles (ORVs) in the coastal zone as well as providing procedure for approving the use of vehicles in the coastal zone under specific circumstances. The regulations now specify that recreational use of ORVs can only take place in designated recreational use areas (RUAs). This paper described the process of developing a cohesive strategy for the siting of RUAs in the coastal zone of KwaZulu-Natal. This strategy was developed to avoid ad hoc application for areas that might be unsuitable (environmentally or socially) for ORV use. Potential RUAs was identified using seven principles that disqualified areas not suitable, and subjecting the potential RUAs to a number of other considerations. The seven principles are sufficiently generic to be applied to the other three coastal provinces of South

Africa and probably further afield. This strategy identified a network of ecologically and socially justifiable RUAs along the coast of KwaZulu-Natal. These areas will not be designated automatically but each area will need to be further scrutinized by an environmental impact assessment.

Priskin, J. 2003. Physical impacts of four-wheel drive related tourism and recreation in a semi-arid, natural coastal environment. *Ocean & Coastal Management* 46(1-2): 127-55.

Abstract: The aim of the research was to assess the physical impacts of four-wheel drive related nature-based tourism in the Central Coast Region of Western Australia. This coast is 271 km long, in a natural and largely undeveloped state, but coastal recreation impacts due to four-wheel drive use has increased significantly since the 1960s. Research methods included interpretation of aerial photographs for 1965 and 1998 for a 1 km zone, measured immediately landward from the shoreline. Features associated with recreation use, such as off-road tracks and access points to beaches were digitized and analyzed using Geographic Information System. For 1965, 516.5 km of four-wheel drive tracks were measured, compared to 812.9 km in 1998. Access points to the coast also increased from 421 to 908 during the same period. Results were analyzed within 25 biophysical and five local authority units. Results within biophysical units were related to physiographic setting, beach and dune type.

Baxter, G. 2002. All terrain vehicles as a cause of fire ignition in Alberta forests. *Advantage (Publication of the Forest Engineering Research Institute of Canada)*. 3(44): 1-7. <http://fire.feric.ca/other/AD-3-44.PDF>

Abstract: This study was initiated upon the request of Alberta Environmental Protection to investigate the relationship between all terrain vehicle (ATVs) and fire ignition within Alberta's forests. The report summarizes the use of ATVs in Alberta and the specific causes of wildfires associated with these vehicles, describes fire history from 1990 to 2002, reports on other agencies' strategies to lower the probability of ATV-caused fires in forested areas, and makes recommendations for Alberta.

Bureau of Land Management. 2000. Strategic paper on cultural resources at risk. Bureau of Land Management, Washington, D.C. 18p.

<http://www.blm.gov/heritage/docum/00atriskpaper3.pdf>

From External threats:

“Uncontrolled use is the most immediate and pervasive threat to cultural resources on BLM lands. But one of the most enjoyable aspects of visiting BLM lands, compared to other federal lands, is the freedom experienced by visitors because of the lack of restrictions that are placed on them. The public lands are fast becoming more accessible, better known, and more intensively used. In many areas, urban sprawl, encroaching on previously remote areas, is turning the public lands into recreational backyards. The explosion in the use of mountain bikes and ATVs, and even the designation of backcountry byways, has dramatically increased visitation to lands that were previously used only by small numbers of hikers. This increased visitation inevitably results in intentional and inadvertent damage through collection, vandalism, surface disturbance, and other depreciative behavior.”