December 2017

AOHVA Environmental Literature Review Committee (ELRC) Summary

Summary prepared by
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AOHVA Preface

Science figures prominently into discussions and decisions relating to OHV use on public lands – as it should.

That said, AOHVA believes that all Albertans have the right to understand how science is being used to guide important decisions affecting their opportunity to enjoy the province's outdoor spaces; and the government has the responsibility to be upfront and open with all Albertans in that regard.

AOHVA questions the relevance and application of the literature used to support the conclusions reached by the Government of Alberta; conclusions that will change the way Albertans live, work and recreate.

> AOHVA created a committee in April 2017 – Establishment of a volunteer Environmental Literature Review Committee (ELRC) under the AOHVA umbrella to gather, assess and critique the literature used to make decisions about OHV use and open camping on Alberta Public Lands, appointing Russel Bruder as chair, Lisa Kinnear, Garett Schmidt (AOHVA), Oksana Buhel (COHV) and Luc Fournier (MMIC) as Committee Members.

This committee undertook a thorough investigation of the literature – 30 documents/1294 pages, that the Government had used to draw conclusions to change access for OHV use and open camping. We wanted to know where this science was applicable to the landscape of Alberta. The summary that the committee delivered is provided below.

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A list of thirty documents was received from the following source: Ecological Working Group. 2016. Castle Management Plan - Ecological Working Group - Summary of Science. Provided by B. Joubert, Alberta Environment and Parks, e-mail communication, March 10, 2017. (LK)

Said documents were then uploaded to an online drop box and made available for ELRC members to review. Upon review, documents were input in to an online, controlled access, Tabular Annotated Bibliography spreadsheet.

These documents can be broken down into three categories:

1. Five (5) - Government publications (management plans, reports, surveys)
2. Seventeen (17) - Academic Journal Articles (Published and peer reviewed), Masters Thesis, Research article
3. Eight (8) - Non-government organizations (reports, bulletins, press release)

The 30 documents provided to the ELRC were comprised of 1294 pages. Numerous citations contained in the original 30 documents were also explored in an attempt to gain clear understanding of the references made in the original documents. Two additional documents have been included in the references contained herein, one was further work by Forman (cited in his 1998 work), the second was a citation in the Miistakis Institute 2007 document.

Every effort has been made to condense the literature into a meaningful and relevant summary.

Firstly, the threshold of 0.6km/km2:

The premise that road densities exceeding a threshold of 0.6km/km2 is largely founded on the work of Forman and Alexander 1998.

This seminal paper on the ecological effects of roads pertains primarily to busy highways. Forman himself defines a "busy highway" as referring to a two-lane or multilane road with more than about 15,000 vehicles per commuter day (Forman et al. 2002). and a small road as having <8000 vehicles per day (22). Road effects are measured by habitat loss, degradation, and fragmentation (22). Effect distances (the distance from a road at which a population density decrease was detected) (3) were sensitive to traffic density. The effect-distances for both woodland and grassland birds increased steadily with average vehicle speed up to 120 km/h and also with traffic density from 3000 to 140,000 veh/day (3).

Forman notes all of the following in his publication (3):
Road density is an overall index that averages patterns over an area. Its effects probably are sensitive to road width or type, traffic density, network connectivity, and the frequency of spur roads into remote areas.
Road width and traffic density are major determinants of the barrier effect
Forest roads as a subset of roads in general are characterized as being **narrow**,
not covered with asphalt, **lightly traveled, and remote**.

The third component, habitat fragmentation, at a landscape scale is mainly due to wide swaths of agricultural, residential, and other land, **not roads.**

Forman's work, although heavily cited in academia, deals with major transportation arteries on a landscape scale. Much of his own research was conducted in the Northeastern US and his published work contains data from Australia, the Netherlands and Germany (3,22). He clearly states (as noted above) that road density and its effects are sensitive to road type, width, and traffic density and specifically that habitat fragmentation, at a landscape scale is not due to roads. In addition, he makes no reference to trails, trail networks, OHV's, or linear features in any of the cited documents reviewed by the ELRC.

Secondly in regards to linear features and density of all linear features:

A number of reviewed documents clearly state that the relationship between a linear feature and potential disturbance is far more complex than simply quantifying the density of linear features present.

Access management aims to mitigate potential negative effects of linear features on habitat and wildlife; however, identifying the directionality, let alone the magnitude, of these effects can be difficult due to challenges in the collection and application of access data, particularly when dealing with networks that are often complex and consist of multiple linear-feature types. Trail use, both motorised and non-motorised, has been less documented than road (paved, highways) effects, but is a form of disturbance

that is growing. Effective methods for extending this information to estimate human activity within a network structure are lacking, however, leaving an information gap for cumulative effects assessments. (17)

When studying wildlife, estimating the magnitude of human activity is a key and often challenging, and therefore ignored, step in understanding its effects on animal distribution, density, behaviour and survival. Similarly, different forms of human activity (motorised vs. non-motorised) are often overlooked, but can play an important role in wildlife responses. A more comprehensive method of estimating human activity, that incorporates network structure and spatiotemporal variation in human use of the landscape, is required. (17)

By ignoring measures of activity levels on linear features such as trails, we may be extracting incorrect inferences from our results, as shown with our application above (*see foot note below), which could have strong implications for management. (17)

*Application: grizzly bear habitat selection to assess the applicability of the model within a habitat selection framework, we used concurrently collected grizzly bear telemetry data for a male resident bear located in the study area. Inclusion of the motorised activity model output as an interaction covariate with distance to trail lowered AIC (Table S3.1), showing that incorporating this additional information accounts for more accurate estimation of habitat selection for grizzly bears. Results showed that the grizzly bear showed no selection or avoidance of trails in general; however, it showed increased avoidance (i.e. further distance from the trail) when the probability of non-motorised activity was higher. (17)

The Old Man Watershed Headwaters Indicator Project final report also recognises the importance of intensity of use of a linear feature.

A factor not measured in this assessment is the intensity of use (i.e. number of vehicles/hours). It is known that roads with high traffic volume can have far greater mortality and avoidance rates by wildlife than lower traffic, in addition to increased erosion. In addition, these two indicators assume all roads and linear features are equal in their impact in terms of soil erosion/sedimentation rates. Well-constructed and maintained roads/trails can significantly reduce erosion rates and the volume of sediments being washed into adjacent water bodies. (5)

Weaver also acknowledges the importance of traffic rates. In terms of displacement, the volume of vehicle traffic may be as important as the road itself. In western Montana, Mace et al. (1996) reported that all collared bears avoided areas within 500 m of roads having >60 vehicles per day. For roads having 11-60 vehicles per day, the majority of sample bears avoided areas within 500 m during spring (7/11), summer (6/10), and fall (8/9). For roads with 10 or fewer vehicles per day, some bears avoided while others did not. In southwest Alberta, Northrup et al. (2012) reported similar findings for bear use within 500 m of roads: (1) for roads with low traffic volume (<20 vehicles per 24 hr), bears used areas at night (even crossing roads); but (2) bears avoided or strongly avoided roads with moderate (20-100 vehicles per 24 hr) and high (>100 vehicles per day), respectively. (2)

The Global Forest Watch Canada Report also acknowledges that traffic volumes on linear disturbances can be a greater influence on wildlife movement and habitat quality that the mere presence of the linear feature itself. (21)

Two of the reports provided to the ELRC contain estimates of Linear Features visible in the Castle region, however the estimates are dissimilar in both their approach and outcomes.
… as part of the Headwaters Indicators project, Fiera Biological mapped all visible unmapped linear features based on 2012 imagery. This new inventory may overestimate the amount of ORV accessible trails due to linear feature closures, and forest regeneration along trails. However, without any supplementary information regarding the location of trail closures, and ground verification of forest successional recovery, this is the best estimate of potential ORV accessible trails available. (5) Unlike the indicators related to linear disturbances (Road Density & Density of All Linear Features), it is important to understand that while linear features may have many indirect effects related to habitat fragmentation, and cause behavioural avoidance by some wildlife species, on an areal basis they comprise only a small proportion (<10%) of the landscape in the Oldman Watershed which has been disturbed by human activity. (5)

GFWC states that "there are no current accurate measures of which linear features are being used recreationally in the Castle. Thus, to estimate use, we used a feature's proximity to roads and designated trails. We analyzed how many features were found within 100 m and 500 m of roads and designated trails in the various datasets and used those percentages to calculate other densities for comparison purposes. We did this to account for a lack of data pertaining to actual human use levels of non-designated trails and help determine potential extents of motorized recreation across the landscape." (21)
What follows is the methodology utilized by GFWC to buffer their estimate of anthropogenic disturbance in the Castle Region. No scientifically defensible explanation for the arbitrary use of a 500 m buffer was provided. Choosing to turn digitized well sites into 100 hectare polygons grossly overestimates the actual size of well sites in the Castle region.
{Authors note: For six years I held the contract to conduct vegetation control and follow up inspections on every single disposition in the shell Waterton Field several times per year. The Shell Waterton production facility footprint covers 200+ ha (outside the Castle Parks), however not one of the Shell lease holdings in the Castle area including well site, line heater, line break valve, compressor station, flare, valve junction or any site containing a combination of these exceeds 3 ha in size. The majority are well under 1 ha.}

GFWC digitized wellsites points and turned them into 100 hectare polygons, the approximate size of wellsites, by surrounding them with a 50 meter (m) buffer. Following the creation of linear and polygonal disturbance datasets, GFWC buffered all polygons (e.g. cutblocks and wellsites) and lines (e.g. roads and trails) by 500 m to account for the potential ecological impact of the disturbance. GFWC also buffered the ABMI human footprint by 500 m. The human footprint in the Castle area derived from the ABMI human footprint dataset was 146 km2 as of 2012, which represents **14% of the Castle**. (21)

The buffered human footprint is almost 66% over the total protected areas proposal. However, GFWC notes that, as pointed out by some reviewers of the draft report, the logging cutblocks appear to include both fire and salvage logging in some areas, notably the Lynx and Lost Creek area, where there was a large fire in 2003. Thus, the total human footprint may be overestimated. (21)

Both sources recognize that their method for calculating linear disturbances are estimates, and recognized that intensity of use is an important, but missing component of anthropogenic disturbance in the Castle region. GFWC's base estimate is 40% larger than that of Fiera Biological Consulting. However, GFWC's buffering of their estimates with questionable methodology that lacks scientific defensibility or ecological relevance has produced an estimate of anthropogenic disturbance that is 660% larger than that estimated from the Oldman Watershed Headwaters Indicators Project.

Third in regards to wildlife:

A significant number of the academic documents included in the environmental literature review fail to support the conclusions that the GoA is drawing to change access for OHV and open camping.

The relationship between wildlife and linear features is not straight forward. Many animals show strong avoidance of roads and trails, while others commonly use them to increase movement speed through their home ranges. Some animals are attracted to linear features due to increased vegetation growth. A number of ungulate species stay close to roads and trails, as there is a disproportionate response to human activity between prey and predators. Animal responses (outlined above) are not solely based on the presence of a linear feature, but also the intensity of use of that feature by humans. (17)
Bighorn sheep have been found to respond more intensely to hikers than to other types of recreation disturbance (mountain bikes, automobiles) because these activities tend to be more unpredictable (MacArthur et al. 1982, Miller and Smith 1985, Papouchis et al. 2001. (1)

Other evidence also implicates quiet, human-powered activities, such as hiking and skiing, in habitat degradation. For example, a paired comparison of 28 land preserves in northern California that varied substantially in the number of **non-motorized** recreationists showed a fivefold decline in the density of native carnivores in heavily used sites. Further evidence from the Alps indicates that outdoor winter sports reduce alpine black grouse, Tetrao tetrix populations and data from the UK link primarily quiet, non-motorized recreation to reduced woodlark, Lullula arborea populations. A recent metaanalysis of ungulate flight responses to human disturbance showed that humans on foot produced stronger behavioral reactions than did motorized disturbance. These studies strengthen a detailed foundational literature suggesting that anthropogenic disturbance events are perceived by animals as predation risk, regardless of the associated noise levels. (8)

Our broad-scale survey, in collaboration with citizen scientists, shows that the impact of recreational use on wildlife communities in public areas is relatively minor. For most species, habitat factors were more important than recreation in models predicting their distribution and habitat preferences. (16)

The restricted model sets present the results of using variables from one class of covariates for both occupancy and VF and showed that habitat alone explained the distribution of most species better than recreation or management alone. (16)

Regardless, both approaches were consistent in showing that recreation had relatively minor effect on the distribution and habitat preferences for most wildlife species. (16)

Including time of day for all marten detections substantially increased the sample size but did not affect the conclusion that marten circadian activity was not appreciably different in use and non-use areas. (13)
Sex ratio. —The sex ratio in use and non-use areas did not differ in either study area… (13)
None of the response variables we measured (occurrence, circadian activity, sex ratio) suggested martens were affected by the level of OHV use that occurred in our study sites. (13)
our results suggest the spatial and temporal frequency of stimuli from OHVs are not perceived by marten as significant threats." (13)
that the level of OHV use we witnessed did not affect occupancy and, therefore, did not appear to be contributing to fragmentation. (13)
… we still continue to ignore temporal predictors of human activity in many ecological studies, rather choosing to average across large timeframes, losing temporal resolution, making inferences without accurate human activity information. The relationship between wildlife and linear features is not straightforward. Many animals show strong avoidance of roads and trails, while others commonly use them to increase movement speed through their home ranges. Some animals are attracted to linear features due to increased vegetation growth. A number of ungulate species stay close to roads and trails, as there is a dis proportionate response to human activity between prey and predators. Animal responses outlined above are not solely based on the presence of a linear feature, but also the intensity of use of that feature by humans. Changes in the amount of human activity on trails or vehicle traffic on roads are likely to influence how wildlife perceive and interact with linear features. (17)
Inclusion of the motorised activity model output as an interaction covariate with distance to trail lowered AIC (Table S3.1), showing that incorporating this additional information accounts for more accurate estimation of habitat selection for grizzly bears.

Results showed that the grizzly bear showed no selection or avoidance of trails in general; however, it showed increased avoidance (i.e. further distance from the trail) when the probability of non-motorised activity was higher. (17) A landscape scale study for Y2Y found wolverines were susceptible to declines in areas where road density exceeded 1.7km/ km2. (4)

However, the paragraph that follows in the Y2Y document references the authors below and their findings which are in complete contradiction to the previous statement. Movements of wolverines in Montana are not apparently affected by rivers, reservoirs, highways, valleys, or major mountain ranges. Wilderness or remote country where human activity is limited appears essential to the maintenance of viable wolverine populations. We found, however, no differences in wolverine density between the wilderness and non-wilderness portions of our study area, nor was wolverine movement, habitat use, and

behavior different. Marked wolverines used both areas and several individuals' home areas overlapped both wilderness and non-wilderness. The non-wilderness portion, about one half of the study area, is used by humans primarily for logging and recreation. (23)

Findlay and Lenton 2001
The causal mechanisms underlying the observed relationship between adjacent road density and anuran community composition and richness are largely unknown. The observed relationships between road density, forest cover and anuran richness and community structure may not reflect direct causal relationships. (6)

ELRC Conclusion

Forman's seminal work on road density and road effects deals with major transportation arteries on a landscape scale and in no way, relates to the density of linear features in the Castle or other regions of Alberta.

The calculations of linear feature density in the Castle Parks are admittedly estimates that lack any intensity of use data even though there is consistent acknowledgement from government, academic and NGO literature sources that traffic volumes on linear disturbances can be a greater influence on wildlife movement and habitat quality than the mere presence of the linear feature itself. Multiple academic journal articles supplied by the ecological working group clearly state that the impacts of recreational use on wildlife communities in public areas is relatively minor or wildlife response to people on foot was greater than wildlife response to motorized disturbance.

It is clear that the list of documents provided to the GoA by the Ecological working group falls far short of justification for the conclusions that the GoA is drawing to change access for OHV and open camping in Alberta.

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