INVESTIGATING METHODS TO REDUCE URBAN MOOSE-RELATED VEHICULAR COLLISIONS WITHIN THE CITY OF PRINCE GEORGE, BRITISH COLUMBIA

by

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The City of Prince George, the Insurance Corporation of British Columbia and local area Auto Plan brokers commissioned this study. Specific recommendations from this study and in this report are provided by the author for these agencies to consider and do not necessarily represent the findings, opinions or policies of these agencies.

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EXECUTIVE SUMMARY

We assessed what agencies in the Prince George area keep records on Moose-Related Vehicular Collisions (MRVC's). We obtained access to records that were available and used these records to plot collision hotspots within the city limits using available data. We inventoried countermeasures currently in use for mitigating MRVC's in Prince George and reviewed the literature on ungulate-related collisions in an effort to determine appropriate countermeasures for addressing collisions in an urban/suburban landscape. Our findings indicate that approximately 15-30 MRVC's are likely occurring in the city limits on an annual basis, and that most of these are occurring in areas adjacent to greenbelts where speed limits are generally higher and street lighting lower than in town. The data indicate that most collisions appear to occur in June and November and, according to the literature, likely to occur between dusk and dawn. Moose warning signage is the only countermeasure currently employed in Prince George. Signage is appropriately installed in some of the areas where collisions occur, but not in all areas, and in some cases signs occur where current records show a lack of collisions. Our review determined that alternative signage and other successful countermeasure options exist that should be explored for use in areas of concern. However, we recommend the development of a combination web-based/phone-in GIS record-keeping database that can be used to more accurately establish collision hotspots so that site investigations can be made to determine the most appropriate site-specific countermeasures needed. Currently, we recommend that improved moose warning signage and reduced night-time speed limits be installed in areas where more recent data suggests that MRVC's are recurrent.

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INTRODUCTION

Approximately 100 years ago, moose began migrating into the north-central interior of British Columbia. Currently, moose densities are approximately 1.3 moose/km^2 in the Prince George area (Heard et al. 1999). Although such densities are desirable from a resource, recreation, and tourism perspective, this number of moose ranging through the landscape, particularly near roadways, can pose a serious public safety threat to motorists.

Moose collision data between 1990 and 1999 suggests that approximately 300 moose-related vehicular collisions (MRVC's) occur annually on major highways in BC (Sielecki 2000). Such numbers reflect only carcasses counted along highways and since many animals are scavenged or move away from the right-of-way before dying, this number likely grossly underestimates the actual number of animals that have been hit by automobiles (Sielecki 2000). Furthermore, even though collision data from highways is available, no such data on MRVC's appears to exist for countryside roads, logging/mining roads or urban centers in BC's moose country.

Urban landscapes possess unique characteristics such as high human and vehicle densities and concentrated road networks (Nielsen et al. 2003) but, as in the case of Prince George, may also contain greenbelt areas that serve as excellent shelter, foraging areas and protection from predators for wildlife such as moose (Garrett and Conway 1999). Despite the precarious nature of mixing good wildlife habitat with high animal and vehicle densities, few studies have attempted to quantify factors influencing ungulate-related vehicular collisions in urban/suburban areas (Nielsen et al. 2003) or recommend record keeping methods to track such collisions (Premo and Rogers 2001). A lack of collision data for such areas leaves managers guessing where the next collision might occur. For this very reason, an interagency research project entitled "Investigating methods to reduce urban moose-related vehicular collisions within the city of Prince George, British Columbia" was commissioned by The City of Prince George, ICBC, Nauroth and Associates, Sussex Insurance, Brownridge and Co. and Barton Insurance Brokers and commenced in October 2003.

Our research over the last year has established a better outlook on the extent of moose-related collisions in the City of Prince George and an understanding of what is required to develop solutions that will help reduce such collisions within the city limits. The overall objective of the project was to develop recommendations to reduce material and societal costs from such collisions. Specifically, the objectives of this project were to:

Objective 1: Save costs associated with moose–related vehicular collisions in Prince George, specifically the project seeks to save the lives of both moose and motorists.

Objective 2: Determine what records are currently kept and develop a formula for a comprehensive record keeping system that can be put in place to track moose collisions and sightings.

Objective 3: Determine, through established means, when and where moose collisions are occurring in Prince George.

Objective 4: Establish what countermeasures are currently in use and make recommendations on improvements to the style and placement of such.

Objective 5: Foster an atmosphere of collaboration between project partners and use the media to educate residents as to what the project seeks to accomplish.

We report on Task Activities performed during the project in point form (Appendix A). A more detailed description of our findings is reported below.

PROJECT METHODS

We selected and contacted 32 agencies within the City of Prince George, that were likely to maintain data on MRVC's within the city limits, with an aim to review how records on MRVC's are currently kept. Here we report on data collected from the 11 agency representatives that agreed to an interview (see Questionnaire; Appendix B). Surveys were done over the phone or in person based on what was convenient for the interviewee. From these data, we established rough estimates of collision hotspots within the city limits, and what time of year these collisions were most likely to occur.

Recommendations on how to develop a robust record keeping system were developed through a synthesis of interview data, literature reviews and web searches. To determine where and when problems of urban MRVC's were occurring in Prince George and how other jurisdictions were addressing the problem, we interviewed local agencies, reviewed the literature and searched the world-wide web. We also discussed the issues with conference delegates at the North American Moose Conference and Workshop in Cornerbrook, NL.

To determine the average cost of an MRVC in the Prince George area, we solicited information from ICBC and the City of Prince George. To determine some public opinion on how residents feel about collisions within the city, we asked interviewees and some general members of the public about their views on MRVC's in the city. This was not a formal interview process and was not intended to represent the opinion of Prince George residents in general (see Task Activities; Appendix A). Extension on the project was delivered in the form of Radio, TV and newspaper interviews as well as talks and a poster presentation. These activities are outlined in the Results section and Appendices below.

Through our research, we have determined that no formal inventory of moose collision countermeasures exists within the city. Therefore, we methodically drove all major city streets and recorded any countermeasures currently in place that might indicate to motorists that a potential for collisions with moose existed in certain areas. To determine which countermeasures would be effective in the City, we reviewed the literature on mitigation measures used in other jurisdictions. As well, various countermeasure strategies were discussed at the Moose Conference in Newfoundland.

RESULTS

Most agencies that we contacted were cooperative. However, only 11 of the 32 agencies representatives felt that enough information was kept on file for them to be able to participate in a meaningful way in our interview process. Information collected from the interviewees is summarized in Table 1. A list of agencies that we contacted, but did not interview, can be found in Appendix G.

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Table 1. Summary of record keeping information collected from various agencies in the Prince George area that track data on MRVC's.

Agency	Internal Record	Full Record	Specific Data Always Recorded									Public Access
			Date	Collision Time	General Location	Specific Location	Road/ Weather Conditions	Species ID	Animal Gender	Animal Age Class	Motorist Data	
Ministry of Transportation and Highways	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	Yes
Klassic Autobody	Yes	No	Yes	No	No	No	No	No	No	No	No	Yes
City of Prince George – Public Works	Yes	No	Yes	No	Yes	Yes	No	Yes	No	No	No	Yes
Ministry of W.L.A.P	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ICBC	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	No	Yes	Yes
RCMP	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	No
Fire Department	Yes	No	Yes	Yes	Yes	No	No	No	No	No	Yes	Yes
Spruce City Wildlife	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	Yes
YRB	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes	No	No	Yes
BC Rail	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes
Conservation Officer Service	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Freedom of Information Request

We could find no literature making specific recommendations about what type of record keeping system would be most effective for warehousing and readily accessing collision data. Pooling data from records, interviews and accident scene investigations indicates that anywhere between 15 and 30 MRVC's occur within the city limits on an annual basis. These data (plotted in Figure 1; only hard data have been mapped) come from the Conservation Officer Service and City Records and show where collisions have occurred between January 1, 2001 and April 26, 2004. We arbitrarily consider an area a hotspot if more than four MRVC's were reported to occur on that stretch of road between January, 2001 and April, 2004.

Currently the only style of countermeasure in place in Prince George is moose warning signs. Some of these are found in areas where MRVC's are known to occur while others are in areas where no recent data indicates occurrence of MRVC's (e.g., Highway 97 North). Alternatively, not all areas where collisions are known to occur are equipped with signs (e.g., east and south of town; Figure 1).

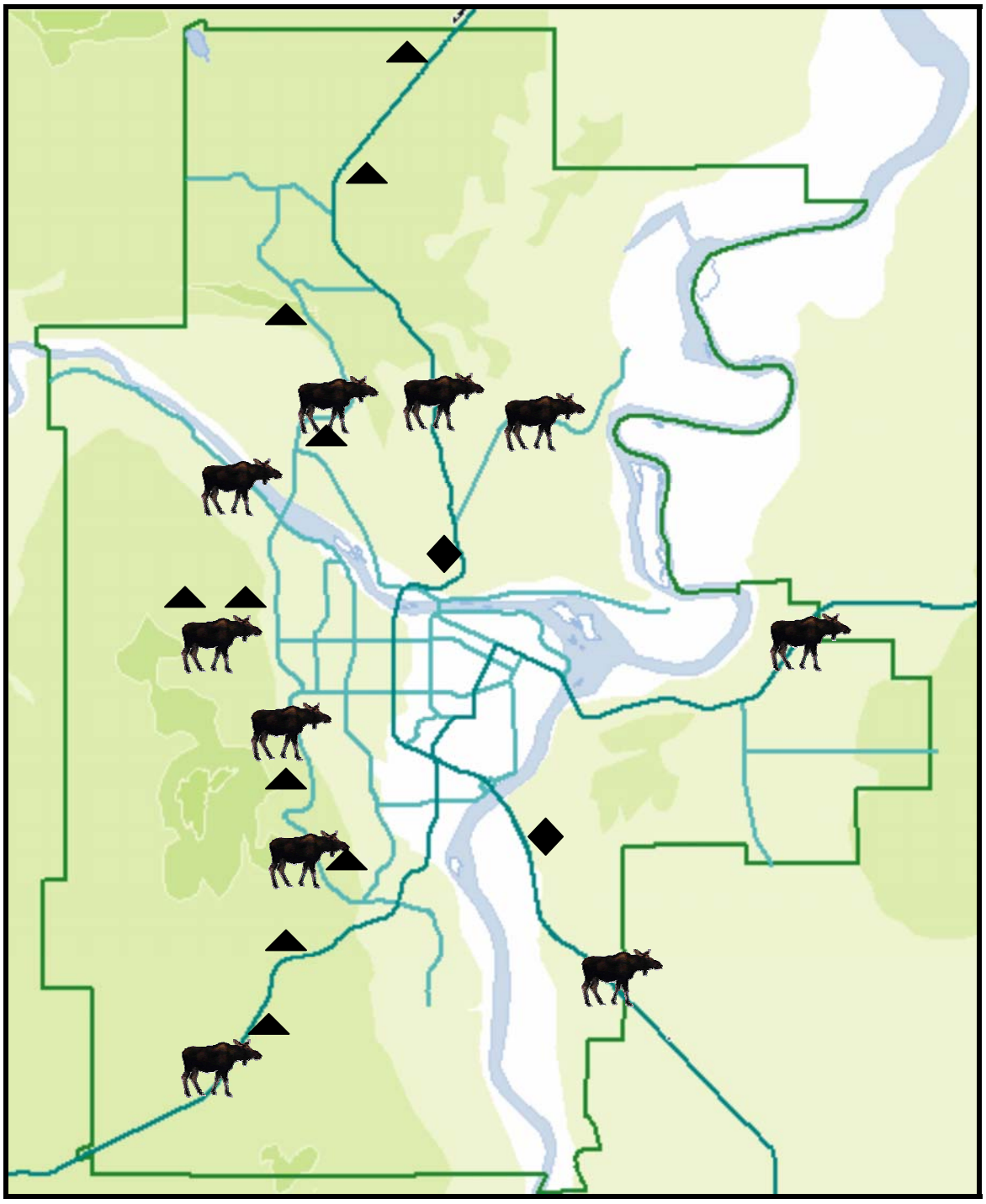

Figure 1. Road map of Prince George indicating collision hotspots (indicated with a moose icon) plotted using data taken from the Conservation Officer Service and City Records between Jan 1, 2001 and April 26, 2004. Triangles represent existing moose warning signs while diamonds indicate the placement of deer warning signs.

Dozens of countermeasures currently exist for use in ungulate-vehicle accident mitigation (Table 2), many of which could be theoretically used to reduce MRVC's in the City of Prince George.

Table 2. Various countermeasures employed in attempts to reduce Ungulate-related vehicular collisions.

COUNTERMEASURE	REFERENCE
• Exclusion/electric fencing	Goodwin and Ward 1976; Harrison et al. 1980; Reed et al. 1982; Decker et al. 1990; Child et al. 1991; McDonald 1991; Fletcher 1980; Kent 1994; Thomas 1995
• Guard-rails	Malo et al. 2004
• High lateral embankments	Malo et al. 2004
• Cattle guards	Rusch 1985
• Diversionary or intercept feeding	Fletcher 1980; Harrison et al. 1980; Wood and Wolfe 1988; Anonymous 1991; Del Frate and Spraker 1991; Schwartz and Bartley 1991; Cook and Dagget 1995; Thomas 1995; Romin and Bissonette 1996
• Grade separation (overpasses/underpasses)	Decker et al. 1990; McDonald 1991; Cook and Dagget 1995; Malo et al. 2004
• Change route alignment	Thomas 1995
• Improved warning signage	Decker et al. 1990; Del Frate and Spraker 1991; Oosenbrug et al. 1991; Schwartz and Bartley 1991; Cook and Dagget 1995; Al-Ghamdi and AlGadhi 2004
• Lighted/animated crossing signs	Goodwin and Ward 1976
• Deer mirrors	Damas and Smith 1983
• Reflectors	Decker et al. 1990
• Delineator backdrops	Thomas 1995
• Highway lighting	Moen 1979; Damas and Smith 1983; McDonald 1991
• Mannequins/silhouettes	Damas and Smith 1983; Hardy 1984

Table 2. Continued

COUNTERMEASURE	REFERENCE
• Paint antlers/fit moose with reflectors	Thomas 1995
• Increased driver visibility (rights-of-way clearing)	Moen 1979; Damas and Smith 1983; Lövsund et al. 1989; Del Frate and Spraker 1991; Waring et al. 1991; Finder et al. 1999
• Eliminate favored food/plant unpalatable species	Pils and Martin 1979; Michael and Kosten 1981; Leedy and Adams 1982; Anonymous 1991; Del Frate and Spraker 1991; Waring et al. 1991; Cook and Dagget 1995; Lehnert et al. 1996; Finder et al. 1999; Holschuh and Otter 2000; Sielecki 2000
• Reduced speed	Björnstig et al. 1984; Eriksson et al. 1985; Del Frate and Spraker 1991; Waring et al. 1991; Cook and Dagget 1995; Gunther et al. 1998; Finder et al. 1999
• Ultrasonic whistles	Muzzi and Bisset 1990
• Control population growth	Hughes et al. 1996; Sullivan and Messmer 2003
• Expanded hunting season	Jenkins 1963; Arnold 1978; Pils and Martin 1979
• Sharp-shooting	Finder et al. 1999
• Water cannons	Thomas 1995
• Sterilization	Thomas 1995; Finder et al. 1999
• Trapping/relocation	Finder et al. 1999
• Repellents	Harrison et al. 1980; Fraser and Hristienko 1982; Damas and Smith 1983; Lavsund and Sandegren 1991; Groot Bruinderink and Hazebroek 1996; Sielecki 2000
• Headlight upgrading	Damas and Smith 1983; Garrett and Conway 1999

Table 2. Continued

COUNTERMEASURE	REFERENCE
• Public awareness/education programs	Allen and McCullough 1976; Pils and Martin 1979; Björnstig et al. 1984; Del Frate and Spraker 1991; Schwartz and Bartley 1991; Belant 1995; Cook and Dagget 1995; Groot Bruinderink and Hazebroek 1996; Sutton 1996; Child 1998; Finder et al. 1999; Joyce and Mahoney 2001
• Radio announcements	Hardy 1984
• Warning sounds/sirens	Lavsund and Sandegren 1991; Thomas 1995
• Steam killing vegetation	Schwartz and Bartley 1991
• Car-mounted ultraviolet, infrared detectors	Thomas 1995
• Pyrotechnics	Harrison et al. 1980; Damas and Smith 1983
• Microwave/infrared detection/activation sign system	Damas and Smith 1983; Kinley et al. 2003
• Plastic strip curtains	Damas and Smith 1983
• Colored powder animal guidestrips	Klein 1971
• Asphalt rumble strips	Lehnert et al. 1996

Interviews and anecdotal information confirm that University/Tyner Way and Foothills Boulevard are obvious MRVC hotspots; while on the scene of an MRVC on University Way in December of 2003, a tow truck driver responding to my questioning replied that he alone had responded to 8 MRVC's in the last 4 months on University/Tyner Way and that was just him in his own truck and not his company call-outs across the rest of the city. This tow truck driver and most of the agency personnel interviewed agreed that some type of measure should be taken to more clearly document and assess the problem of MRVC's in the City.

Material damages from hitting a large ungulate in BC cost $4,059 on average (Miller 1998), although vehicle repairs following a collision with a moose in north central BC can be as high as $25,000 and averaged $5,150 in 1999 (ICBC statistics for the Prince

George Claiming Area 1999). Material damage costs may be lower than $5150 for cars colliding with moose in the city where slower speeds potentially dampen the impact at collision.

The cost (staff and equipment costs) of cleaning up a large ungulate have been determined to be approximately $250 (City of Prince George) to $350 in BC (Sielecki 2000) with over $600,000 spent in BC for site clean-ups and carcass disposals in 1999. This does not include costs due to a loss in contractor productivity or for compensation payments when workers are injured dealing with clean-ups (Sielecki 2000).

Moose have been valued at $1,680 in BC (Sielecki 2000) while the cost for each motorist injury has been estimated to cost ~ $97,000. The societal cost for each motor-related vehicular fatality has been estimated to cost $ 4.17 million (Sielecki 2000). Other costs related to MRVC's have been reviewed by Rea (2000).

City and Conservation Officer Service records indicate that collision events vary by season, with most collisions occurring in June and November (Figure 2). No accessible records clearly and consistently indicate the time of day when moose-specific vehicular collisions are occurring in the City.

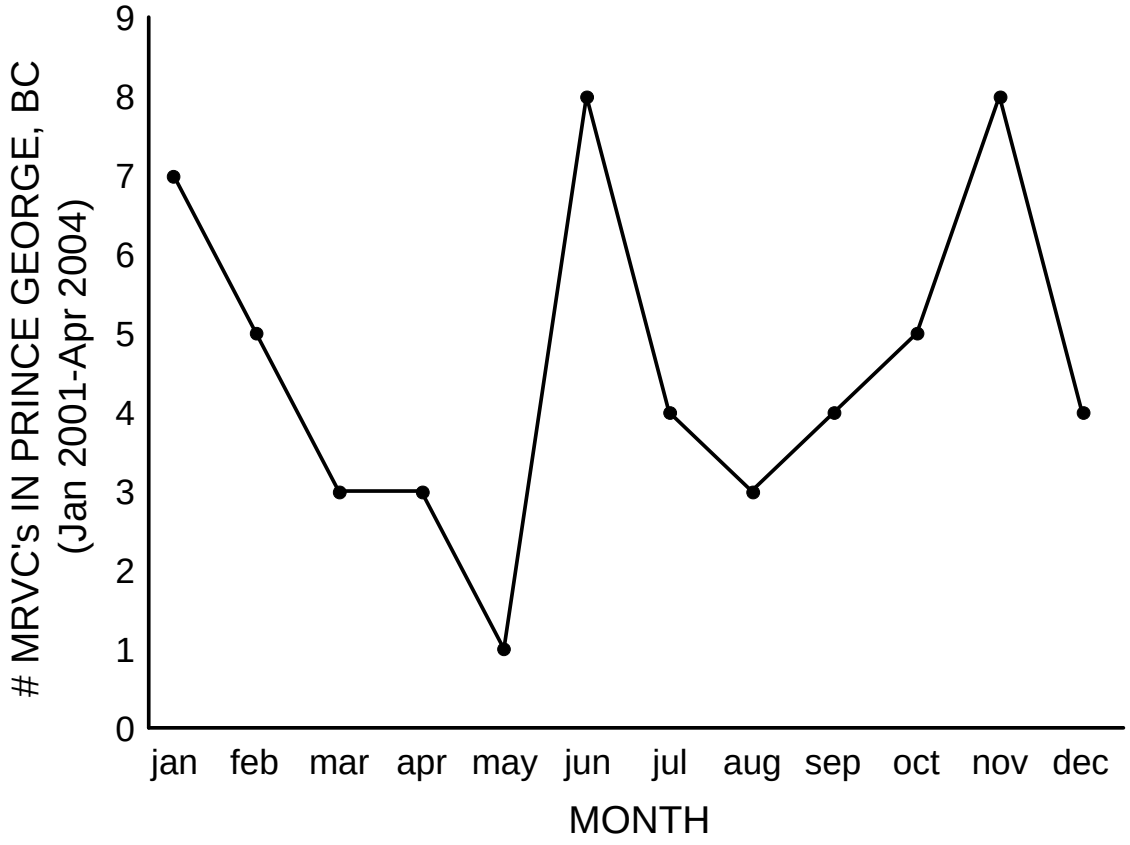

Figure 2. Number of moose-related vehicular collisions in Prince George as recorded by the Conservation Officer Service and municipal crews between Jan 1, 2001 and April 26, 2004.

In early September, PGTV did an interview with us about the project. Parts of this interview were aired on PGTV's radio station (99.3 The Drive) at 4 different times between September 10th and 12th with the full interview appearing on PGTV evening news on Sept 12th, 2003. Through the UNBC Communications Department, an interview about the project was set up and taped by Shaw Cable and aired on Shaw Cable every 20 minutes for approximately one week in early January, 2003. Interviews were done on the project by CBC Edmonton on December 23rd, 2003 and CBC Prince George on Jan 5th, 2004. Newspaper articles featuring the project were published on July 21st, 2003 (Appendix C) in the Prince George Citizen and on December 31st, 2003 (Appendix D) in the NorthEast Weekly in Fort St. John. Video footage and still images were also shot on December 5th for a video yet to be produced by the UNBC Communications Department. Additionally, we delivered an elementary presentation to the UNBC Daycare on the subject on November 18th, 2003. We presented a poster on the project at the 40th North American Moose Conference and Workshop (abstract – Appendix E; Newspaper article on Conference featuring research poster – Appendix F).

DISCUSSION

As is common in most jurisdictions (Romin and Bissonette 1996), no local agencies currently keep long term records on MRVC's detailed enough or in an available enough format to be of much use in the construction of a thorough accounting of MRVC hotspots in the city of Prince George. The local RCMP appears to have the most comprehensive database. However, such data does not exist in a digital format and is sensitive in nature and, therefore, not accessible to agencies for analysis. The City of Prince George appears to have the next most rigorously kept and most available data, but these records only account for collisions in which an animal is killed and city crews have been called in to retrieve a carcass. As well, many agencies have minimum requirements (e.g. collision must cost > $1000 in material damages or vehicle occupants must be hurt; Joyce and Mahoney 2001) before reports will even be filed.

Records from ICBC appear to be thorough. Unfortunately, many drivers never report their collisions (West and Parkhurst 2002). Therefore, ICBC records only include collisions in which a material damage claim has been made. Additionally, ICBC records occasionally lack specific information on the location and type of animal collision (moose vs. deer). Records from the Conservation Officer Service contain only those moose/vehicle encounters to which CO's are dispatched.

Because a comprehensive data collection system on moose movements and collision events is not currently in place, a system must be developed to begin to address the issue of MRVC's in Prince George. Premo and Rogers (2001) report on the use of a GIS project that is being used to guide the formulation of a deer-vehicle management plan. This system elucidates spatial and temporal patterns of deer accident hotspots and shows promise as a monitoring tool in the development of a deer vehicle accident adaptive management plan for Amherst, New York. The adaptive management plan will use the GIS data to track areas where behavioral modification (motorists and animals) will be recommended. By modifying how animals use the roadside or travel from one side of the road to the other or by reducing driver speeds or what drivers pay attention to, reductions in animal-vehicle collisions appear plausible (Joyce and Mahoney 2001). At a

minimum, such a database could be used to plot where night-time speed limits should be reduced, where better street lighting or warning signs could be installed, or where the forage base or the application of de-icing materials can be modified.

Our findings indicate that most collisions with moose in Prince George occur on the edge of more developed areas. These areas have fewer buildings and more green space and share similar attributes to those areas found by Nielsen et al. (2003) to be hotspots for urban deer collisions in two Minnesota towns. These areas also have higher speed limits. Higher speeds decrease response/braking time and directly influence the likelihood and severity of an accident (Joyce and Mahoney 2001, Sullivan and Messmer 2003).

With the exception of the Hart Highway, Highway 16 East and 97 South, moose warning signs are generally installed within the proximity of Prince George's major collision hotspots. However, many collision reports do not record exact collision locations, so it is difficult to assess if such signage is appropriately placed. For example, several MRVC's have been known to occur on the University Way hill. The moose warning sign, however, is located at the top of the grade. This sign (or some other countermeasure) should likely be located at the intersection of Foothills and University Way to warn drivers before starting up the grade and through the dangerous zone. Data records containing UTM's or latitude and longitude would assist in pinpointing exactly where collisions are occurring so that managers can more accurately locate countermeasures.

The inclusion of temporal data with this type of record keeping would help managers better determine when collision events are most likely to occur in each hotspot. Our findings indicate that MRVC's in Prince George peak in June and November. This agrees closely with the provincial winter and summer peaks (WARS; Sielecki 2000), although more pronounced peaks occur in June/July within the city than on BC highways. Other studies clearly indicate that peak collisions occur between dusk and dawn (predominantly one hour after sunset; Haikonen and Summala 2001) when visibility, and therefore reaction/braking time, is reduced (Garrett and Conway 1999). A record keeping system that included the season and time of the collision could help managers establish when and what type of countermeasures should be implemented. Several years of data collection, as well as thorough site investigations would, however, be required before specific countermeasure should be considered for use in each area.

RECOMMENDATIONS

We recommend a combination GIS/web-based and phone in system, which would likely offer the most flexibility to users and would allow for the recording of the most relevant data. A GIS-based system could form the backbone of a moose vehicle accident adaptive management plan similar to one currently under construction by Premo and Rogers (2001) for managing urban deer collisions in Amherst, New York. Such a database could be used to modify ungulate and motorists behaviors to reduce collisions once collision hotspots have been identified. A system of this nature would likely incur redundant data reports, but would be the most robust system to employ and would allow agencies dealing with MRVC's, as well as residents, to become involved in the data gathering. Empowering residents with an important partnership role would likely allow

those who are concerned with MRVC's to become involved (an official survey in Anchorage, AK. determined that 54% of residents there were concerned with MRVC's; ADF&G 2003).

A record keeping system should not only include impacts where moose are killed or where cars are rendered inoperable, but should also include data from minor accidents, swerve and miss events and even where moose are simply seen crossing, or moving around in areas adjacent to the road. Data on costs (material damages, city clean up crews, emergency personnel dispatch, medical, etc.) should be collected in a rigorous way to more accurately assess costs per collision event in the City; some MRVC's require 3-4 emergency vehicles to attend the scene. This type of system would need to be made easily accessible so that data could be recorded by not only tow truck drivers, police officers, hospital staff, etc. but also by residents. A combination web-based system where individuals can log on or call in and record the location of collisions or sightings could serve as a warehouse for such data. Such a site would complement a homepage where information about moose and other wildlife in the city could be easily located.

We suggest that once a website and phone-in system are in place that all agencies dealing with MRVC's (or other wildlife encounters) in any way are canvassed and educated about the system and encouraged to participate in the data collection. Incentives programs could be designed to reward those reporting MRVC's to ensure that each event is recorded. The City of Prince George or another vested agency could manage the website if resources are available. Otherwise, a yearly contract to create and then manage the site and data could be administered through UNBC. This could provide live data input and warehousing that could be entered into a GIS database for use in tracking animal movements and prescribing site-specific countermeasures on a regular basis. Such a system would also allow a research team to have access to live data for use in site visits/investigations, the collection of weather, temporal, and GPS data. It could also provide students with undergraduate projects and thesis data as well as employment opportunities and could be a long-term collaborative effort between UNBC and sponsoring agencies. A roadside track counting protocol could be established and rigorously applied to ensure countermeasures are being installed in appropriate places before collision events occur.

Following several years of data collection, temporal and spatial patterns of collisions would be more evident. Once identified, collision hotspots could be surveyed to establish the most appropriate site-specific countermeasure. In the darker areas, such as Tyner Boulevard, better street lighting could potentially increase visibility, while on University Way, more appropriately placed and larger warning signs with reduced night time speed limits might prove effective in reducing MRVC's.

In the interim, double-sized moose crossing signs with a diamond reflective material installed in identified collision sites are likely the most economical and effective way to reduce collision events (Al-Ghamdi and AlGadhi 2004). Standard warning signs are dismissed by drivers (Pojar et al. 1975) and are simply not effective (Al-Ghamdi and AlGadhi 2004). Reduced night-time driving speeds should also be implemented in areas of concern.

Unfortunately, no hard data on MRVC's prior to installing new countermeasures is available. Therefore the efficacy of such measures would be unknown unless an

experimental methodology is put in place to test such measures. Additionally, such countermeasures should be designed to be easily relocated since patterns of moose activity are likely to change from year to year, particularly as salvage logging operations alter city green spaces. Sightings and evidence of animals (i.e., roadside tracks) could be used to locate areas needing countermeasure installation. Finally, signage installation should be restricted to high-risk areas and not installed where it is politically correct to do so; signs are sometimes installed following a fatality even if no other MRVC's are recorded at that site. Long term driver education programs, media coverage and modules in driver training courses are likely to be best suited for developing a sustained heightened awareness of the severity of MRVC's, what warning signage is used for, and why adherence to warning signage must not be discounted (Joyce and Mahoney 2001).

SUMMARY

Land development within the City of Prince George continues to expand into moose country. This expansion, combined with stable, or potentially increasing populations of moose (mountain pine beetle are likely to convert extensive pine forests in the area into prime moose habitat), leads to the inevitable conclusion that an action plan to understand urban MRVC's should be implemented.

Adopting a proactive/preventative stance, as has recently been recommended by the Anchorage 'Living with Wildlife Planning Team' (ADF&G 2003), is relevant given that under the recently developed "Wildlife-Human Conflict Prevention Strategy," the Ministry of Water Land and Air Protection calls for BC government agencies, local governments, non-government organizations and individuals to start changing behaviors and to take some responsibility for doing things in a fashion that will prevent wildlife conflicts from occurring (Ministry Water, Land and Air Protection 2003). Specifically, the strategy calls for more research into reducing ungulate-related vehicle collisions while calling for local government and non-government groups to address these conflicts (Ministry Water, Land and Air Protection 2003).

Addressing moose-vehicle conflicts locally through the development of an accurate, comprehensive and permanent database that identifies all MRVC's within the City limits should be a top priority. Such data are crucial and could be used to construct a moose vehicle adaptive management plan that can help identify steps required to make appropriate decisions on how to mitigate MRVC's. In the interim, data from this report can be used to help identify areas of concern and to pinpoint where better measures can be taken to reduce MRVC's. Ultimately, this report and the proposed record keeping database (or some variation of it) should be used to identify where MRVC's are most likely to occur within the City and where it is most appropriate to install countermeasures to help create a safer driving environment for Prince George area motorists.

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LITERATURE CITED

Alaska Department of Fish and Game. 2003. Living with wildlife in Anchorage: A cooperative planning effort. Website article (last accessed Sept. 2004) http://www.wildlife.alaska.gov/management/planning/wildplan7b.cfm

Al-Ghamdi, A.S. and AlGadhi, S.A. 2003. Warning signs as countermeasures to camel-vehicle collisions in Saudi Arabia. Accident Analysis and Prevention *in press*

Allen, R.E. and D.R. McCullough. 1976. Deer-car accidents in southern Michigan. Journal of Wildlife Management 40:317-325.

Anonymous. 1991. Cooperative agreement between Alaska railroad corporation and state of Alaska, Department of Fish and Game, Division of Wildlife. 6 pp.

Arnold, D.A. 1978. Characteristics and costs of highway deer kills. *In*: Proceedings Wildlife and People. The 1978 John S. Wright Forestry Conference. *Edited by*: C.M. Kirkpatrick. Department of Forestry and Natural Resources and the Indiana Cooperative Extension Service. Purdue University. pp. 92-101.

Belant, J.L. 1995. Moose collisions with vehicles and trains in northeastern Minnesota. Alces 31:45-52.

Bicknell, L. 2003. New strategy to prevent wildlife/human conflicts. http://www2.news.gov.bc.ca/nrm_news_releases/2003WLAP0046-000634.htm. Accessed July 9, 2003.

Björnstig, U., A. Eriksson, J. Thorson, and P.O. Bylund. 1986. Collisions with passenger cars and moose, Sweden. American Journal of Public Health 76:460-462.

Child, K.N. 1998. Incidental mortality. *In*: Ecology and management of the North American moose. *Compiled and edited by*: A.W. Franzmann and C.S. Schwartz. Smithsonian Institution Press, Washington, DC. pp. 275-301.

Child, K.N., S.P. Barry and D.A. Aitken. 1991. Moose mortality on highways and railways in British Columbia. Alces 27:41-49.

Cook, K.E. and P-M Daggett. 1995. Highway roadkill, safety, and associated issues of safety and impact on highway ecotones. Task Force on Natural Resources (A1F52). Transportation Research Board, National Research Council. 33pp.

Damas and Smith Company. 1983. Wildlife mortality in Transportation Corridors in Canada's national parks. Impact and mitigation. Consultants report to Parks Canada, Ottawa. 397pp.

Decker, D.J., K.M. Loconti-Lee, and N.A. Connelly. 1990. Deer-related vehicular accidents in Tompkins county, New York: incidence, costs, and implications for deer management. Transactions, Northeast Section of The Wildlife Society 47:21-26.

Del Frate, G.G. and T.H. Spraker. 1991. Moose vehicle interactions and an associated public awareness program on the Kenai peninsula, Alaska. Alces 27:1-7.

Eriksson, A., U. Björnstig, and J. Thorson. 1985. Collisions between cars and mooses: An analysis of collisions with fatal personal injuries. Travel Medicine International 3:130-137.

Finder, R.A., J.L. Roseberry, and A. Woolf. 1999. Site and landscape conditions at white-tailed deer/vehicle collision locations in Illinois. Landscape and Urban Planning 44:77-85.

Fletcher, R. 1980. Reducing deer/vehicle accidents. Forestry Research West. USDA Forest Service, Fort Collins, CO. pp.5-7

Fraser, D. and H. Hristienko. 1982. Moose-vehicle accidents in Ontario: a repugnant solution? Wildlife Society Bulletin 10:266-270.

Garrett, L.C. and G.A. Conway. 1999. Characteristics of moose-vehicle collisions in Anchorage, Alaska, 1991-1995. Journal of Safety Research 30:219-223.

Goodwin, G.A. and A.L. Ward. 1976. Mule Deer Mortality on Interstate 80 in Wyoming: causes, patterns, and recommendations. USDA Forest Research Note RM-332, Rocky Mountain Forest and Range Experiment Station. 4pp.

Groot Bruinderink, G.W.T.A. and E. Hazebroek. 1996. Ungulate Traffic Collisions in Europe. Conservation Biology 10:1059-1067.

Gunther, K.A., M.J. Biel, and H.L. Robison. 1998. Factors influencing the frequency of road-killed wildlife in Yellowstone National Park. *In*: Proceedings of the International Conference on Wildlife Ecology and Transportation. *Edited by*: G.L. Evink, P. Garrett, D. Zeigler, and J. Berry. FL-ER-69-98, Florida Department of Transportation, Tallahassee, Florida. pp. 32-36.

Haikonen, H. and Summala, H. 2001. Deer-vehicle crashes: Extensive peak at one hour after sunset. American Journal of Preventative Medicine. 21:209-213.

Hardy, R.A. 1984. Resource management plan moose-vehicle collisions Terra Nova National Park. 20pp.

Harrison, G., R. Hooper, and P. Jacobson. 1980. Trans-Canada highway wildlife mitigation measures, east gate to Banff traffic circle. Banff National Park. Parks Canada, Western Region, Calgary. 88pp.

Heard, D.C., K.L. Zimmerman, G.S. Watts and S.P. Barry . 1999. Moose density and composition around Prince George, British Columbia, December 1998. Final Report for Common Land Information Base. Project No. 99004.

Holschuh, C. and K. Otter. 2000. A review of proposed mitigation techniques to maintain wildlife corridors in Field, British Columbia. University of Northern British Columbia Biology Program Technical Report. Prince George, B.C. 22pp.

Hughes, W.E., A.R. Saremi and J.F. Paniati. 1996. Vehicle–animal crashes: an increasing safety problem. ITE Journal 66:24-28.

Jenkins, D.H. 1963. Grilled venison. Michigan Conservation 32:33-35.

Joyce, T.L. and S.P. Mahoney. 2001. Spatial and temporal distributions of moose-vehicle collisions in Newfoundland. Wildlife Society Bulletin 29:281-291.

Kent, M.J. 1994. Wildlife impact assessment and mitigation for the Okanagan. *In*: Roads to the 21st century: A key to competitiveness. International Road Federation Conference and Exposition. Proceedings, Vol. 7. *Chaired by*: A.E. Radwan. Calgary, Alberta. Transportation Association of Canada, Ottawa, Ontario. pp. A.29-A.38.

Kinley, T.A., H.N. Page and N.J. Newhouse. 2003. Use of infrared camera video footage from a wildlife protection system to assess collisions-risk behavior by deer in Kootney National Park, BC. Technical Report 10p.

Klein, D.R. 1971. Reaction of reindeer to obstructions and disturbances. Science 173:393-398.

Lavsund, S. and F. Sandegren. 1991. Moose-vehicle relations in Sweden: a review. Alces 27:118-126.

Leedy, D.L. and L.W. Adams. 1982. Wildlife considerations in planning and managing highway corridors. US department of Transportation. Federal Highway Administration Report No. FHWA-TS-82-212.

Lehnert, M.E., L.A. Romin, and J.A. Bissonette. 1996. Mule deer-highway mortality in northeastern Utah: causes, patterns, and a new mitigative technique. *In*: Transportation and Wildlife: Reducing wildlife mortality and improving wildlife passageways across transportation corridors - Proceedings of the Florida department of transportation/federal highway administration transportation-related wildlife mortality seminar, Orlando, Florida. *Edited by*: G.L. Evink, P. Garrett, D. Zeigler,

and J. Berry. Florida Department of Transportation, Tallahassee, Florida. pp. 101-107.

Lövsund, P., G. Nilson, M.Y. Svensson, and J.G. Terins. 1989. Passenger car crash worthiness in moose/car collisions. *In*: The 12th International Technical Conference on Experimental Safety Vehicles. Göteborg, Sweden. pp. 410-415.

Malo, J.E., Suárez, F. and A. Díez. 2004. Can we mitigate animal-vehicle accidents using predictive models? Journal of Applied Ecology. 41:701-710.

McDonald, M.G. 1991. Moose movement and mortality associated with the Glenn highway expansion, anchorage Alaska. Alces 27:208-219.

Michael, E.D. and C.J. Kosten. 1981. Use of different highway cover plantings by wildlife. *In*: Environmental concerns in rights-of-way management. *Edited by*: R.E. Tillman. Electric Power Research Institute, Palo Alto, CA. pp. 50.1-50.7.

Miller, D. 1998. Domestic animal collisions. ICBC memorandum. 6pp.

Ministry Water, Land & Air Protection. 2003. Wildlife-human conflicts prevention strategy. http://wlapwww.gov.bc.ca/eeeb/info/wildlife_human_interaction/index.htm. Accessed July 9, 2003.

Moen. O. 1979. Risks of collision between moose and vehicles. Meddelelser Fra Norsk Viltforskning 3:41-48.

Muzzi, P.D. and A.R. Bisset. 1990. Effectiveness of ultrasonic wildlife warning devices to reduce moose fatalities along railway corridors. Alces 26:37-43.

Nielsen, C.K., R.G. Anderson, and M.D. Grund. 2003. Landscape influences on deer-vehicle accident areas in an urban environment. Journal of Wildlife Management 67:46-51.

Oosenbrug, S.M., E.W. Mercer, and S.H. Ferguson. 1991. Moose-vehicle collisions in Newfoundland – management considerations for the 1990's. Alces 27:220-225.

Pils, C.M. and M.A. Martin. 1979. The cost and chronology of Wisconsin deer-vehicle collisions. Department of Natural Resources Report 103. 5pp.

Pojar, T.M., Prosence, R.A., Reed, D.F. and T.N. Woodward. 1975. Effectiveness of a lighted, animated deer crossing sign. Journal of Wildlife Management 39:87-91.

Premo, D.B. and E.I. Rogers. 2001. Creating an urban deer-vehicle accident management plan using information from a town's GIS project. In: Proceedings International Conference on Ecology and Transportation. p. 613.

Rea, R.V. 2000. A review of the possible effects of the timing of roadside brushing on browse quality for moose: implications for moose-related vehicular collisions. Unpublished report for The Insurance Corporation of British Columbia. 86p.

Reed, D.F., T.D.I. Beck, and T.N. Woodard. 1982. Methods of reducing deer-vehicle accidents: benefit-cost analysis. Wildlife Society Bulletin 10:349-354.

Romin, L.A. and J.A. Bissonette. 1996. Deer-vehicle collisions: status of state monitoring activities and mitigation efforts. Wildlife Society Bulletin 24:276-283.

Rusch, D.H. 1985. The problem of auto-ungulate collisions in North American. In: Highway and wildlife relationships. Pp. 163-166

Schwartz, C.C. and B. Bartley. 1991. Moose conference workshop, Anchorage, May 17, reducing incidental moose mortality: considerations for management. Alces 27:227-231.

Sielecki, L.E. 2000. WARS Wildlife accident reporting system 1999 annual report (1995 – 1999 Synopsis). Environmental Management Section, Engineering Branch, B.C. Ministry of Transportation and Highways, Victoria B.C.

Sullivan, T.L. and T.A. Messmer. 2003. Perceptions of deer-vehicle collision management by state wildlife agency and department of transportation administrators. Wildlife Society Bulletin 31:163-173.

Sutton, J.E. 1996. Car vs. moose. Emergency Medical Services 25:47-50.

Thomas, S.E. 1995. Moose-vehicle accidents on Alaska's rural highways. Alaska Department of Transportation and Public Facilities, Division of Design and Construction, Anchorage, AK. 58pp.

Waring, G.H., J.L. Griffis, and M.E. Vaughn. 1991. White-tailed deer roadside behavior, wildlife warning reflectors, and highway mortality. Applied Animal Behavior Science 29:215-223.

West, B.C. and J. Parkhurst. 2002. Interaction between deer damage, deer densities and stakeholder attitudes in Virginia. Wildlife Society Bulletin. 30:139-147.

Wood, P. and M.L. Wolfe. 1988. Intercept feeding as a means of reducing deer-vehicle collisions. Wildlife Society Bulletin 16:376-380.

Appendix A. Task Activity Timeline

QUARTER	TASK ACTIVITY
1	**August through October 2003** • Review how records are currently kept by RCMP, ICBC, City crews, conservation officers, Ministry of Water, Land and Air Protection, Ministry of Highways, Prince George Regional Hospital, Spruce City Wildlife, SPCA, towing companies, auto body shops, etc. *Between November 2003 and April 2004, we (funding provided Research Assistant positions for 3 UNBC students) contacted 32 agencies within the Prince George Region that were likely to keep records on moose-related vehicular collisions (MRVC's). Of those 32, 11 agencies felt that they had enough information on moose collisions to agree to an interview on the subject. Interview questions are attached in appendix B. We report the major findings related to the objectives of the project interview in Table 1.* • Make recommendations on how to develop a robust record-keeping system. *According to the interviews, no comprehensive, accessible record keeping system exists on MRVC's in the Prince George area. Below, We outline a proposal for a combination web-based, phone-in reporting system that could be used to manage statistics on MRVC's in Prince George. The system would be accessible to agencies dealing with MRVC's and to the general public primarily for use in pinpointing hotspots.* • Review literature on car – urban moose interactions. Determine where similar problems are occurring and how other jurisdictions are addressing it to help find solutions to reduce collisions in Prince George. *We reviewed the peer-reviewed, technical and web-based literature on ungulate vehicle collisions with a focus on countermeasures to reduce such collisions in urban environments. We also canvassed other researchers studying MRVC's at the 40th North American Moose Conference and Workshop in Cornerbrook, Newfoundland in June. The only other city jurisdiction studying MRVC's appears to be Anchorage, Alaska. We reference findings from their approach and the approach of others studying urban deer collisions in the text.*
2	**November 2003 through January 2004** • Determine the average cost of a moose collision (e.g. costs for the city, ICBC, etc.) *ICBC records indicate that the average material damage claim for vehicles colliding with moose is $5150.00. We discuss other costs in the Results section.* • With available information, determine where and when moose collisions are occurring in order to establish collision trends (temporal and spatial) within the city. *Using data from the City and the CO Service, we determined that peak collision times are in June and November. There are no accessible data for the time of day. However, our review of the literature indicates that most collisions with moose occur between dusk and dawn when motorist visibility is reduced.*

	• Collect anecdotes from the above agency personnel and some public opinion on how residents feel about collisions within the city (not a formal city-wide survey; this can be done but would need to be part of a larger proposal). *Most interviewees agreed that something needed to be done about the number of urban moose collisions, although most were at a loss as to what to recommend. Other concerns were voiced about how comprehensive records are, what is being done with the moose meat, and how motorists are being educated about the issue.* • Work with UNBC's Communications Department to produce a research video on the project. *Video footage, still photographs and data were gathered for the production of a mini-documentary on the project (see Results section). Other extension activities, including radio and TV interviews and newspaper articles were also produced on the project.*
3	**February through April 2004** • Inventory countermeasures currently in use in Prince George. *In May of 2004, we inventoried countermeasures currently in use in Prince George. Currently moose warning signs (see Fig. 1 for locations) comprise the tool set currently employed within the city limits for mitigating collisions.* • Review literature on effective countermeasures and make recommendations for establishing new counter measures in collision hotspots in Prince George. *As indicated above, we did a thorough literature review to determine what countermeasures are currently in use. These are summarized in Table 2. Of all the countermeasures currently available, We recommend (in the short-term) the construction and installation of new moose warning signs and reduced night-time speed signs at sights where MRVC's appear to occur regularly. These signs would not represent a substantial financial investment and should help alleviate the problem in the interim until hard data on collision hotspots are obtained and more site-specific countermeasures can be implemented.*
4	**May through July 2004** • Analyse data and write final report – due at the end of July. *The 1-year contracts were signed by collaborators between mid-September and mid-April, 2003. Therefore research on the project did not begin until October 1st, 2003 and was not completed until September 30th, 2004.* • Present findings to collaborators at the 40th annual North American Moose Conference. *Preliminary findings of the project were presented in a poster format (see appendices E&F) to delegates at the 40th North American Moose Conference and Workshop in Cornerbrook, NL on June 16-18, 2004.*

Appendix B. Questionnaire used to interview agency personnel on record keeping procedures related to MRVC's in Prince George.

Interview questions: Urban Moose-Vehicular Collisions

1. Do you keep records of moose (or other animals)-related vehicle collisions?

2. Who keeps the records or is the expert on this issue with your agency? Can I talk to him/her?

3. Are your records accessible to the public? Can we get a copy of your records?

4. How consistent and how comprehensive are your records? Please explain. (e.g., What elements are included in reports/records? [sex of animal/size/exact location of collision, etc.]).

5. Do your records include stats on material damages/injuries/death (animal/person)?

6. What type of record keeping do you recommend?

7. Does your organization use/recommend countermeasures to reduce moose-vehicle encounters?

8. Do you know of any other countermeasures?

9. How many moose do you think/know die within the Prince George city limits each year?

10. Where do you think most collisions occur in the city?

11. How much do moose collisions cost your agency? Do you generate revenue as a result of moose collisions?

12. What do you think attracts moose to road corridors within the city? Why?

13. When do you think most moose collisions occur? (month/time of day, etc.)

14. Can we be notified if you are notified of moose collisions?

15. Do you have any further comments?

Appendix C. Newspaper article from the Prince George Citizen outlining the problem of Cars and Urban moose and showcasing the Urban Moose Collision Project.

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SECOND FRONT

Urban moose are becoming a concern

by MARK NIELSEN
Citizen staff

Collisions with moose are normally associated with highway driving, but a UNBC forestry instructor suspects such incidents within Prince George city limits are a lot more common than many people realize.

Roy Rea knows of at least seven accidents over the last nine months involving moose on Tyner Boulevard alone and believes there are other hot spots around the city where motorists could easily find themselves in a tangle with one of the animals.

Rea has made a proposal to ICBC, local Autoplan brokers, UNBC and the city to support a study to gauge the extent of the problem and where it's occurring.

"I believe we have a problem with urban moose collisions in Prince George and we should look at this particular issue," Rea said.

Once that information has been gathered, Rea said measures can be taken to lower the risk, such as putting up signs or laying down rumble strips on the road.

"Instead of saying 'Moose, next 88 kilometres' which everybody ignores, we could have some stats and say 'Slow down for one kilometre, we've had seven animals die here in the last nine months,'" he said.

It will take more than simply going through the records at ICBC, he said, because not all drivers who run into the animals make a claim. It would also be a matter of contacting tow truck companies, conservation officers, the police and the hospital.

"It would be neat to have just kind of a central, web-based data base where people could log in and report collisions," he said. "Something where we could have a very consistent record of what's going on."

The impact a 1,500-pound moose can have on a vehicle and the occupants inside can be immense, and there's also the suffering a hit animal often endures before finally dying. Moose are also something of a symbol in B.C., Rea said.

"British Columbia has more moose than any other jurisdiction in North America," he said. "A lot of people come here to see moose, moose and grizzly bears."

The study would be separate from work Rea is already doing on behalf of ICBC, B.C. Hydro and B.C. Rail to address the problem outside of city limits.

In that case, the aim is to look at the best ways to manage plants along roads and railways, especially during winter when most moose collisions occur.

Rea wants to determine whether some controlling of plant life along transportation routes will change the quality enough to send the moose in other directions to look for food.

But one thing has led to another.

"Because I do this stuff, I have people come to me all the time, and say 'What are we doing about these moose that are getting killed on Tyner all the time?,'" Rea said.

His plate already full with that project, Rea said the objective would be to secure enough funding to hire a couple students to review the literature on what's been done in other locales, and to figure out how the record keeping could be improved in Prince George.

"We do have an issue here, and we should address it," Rea said.

Submitted photo

The traffic was able to slow down when this cow moose, who forages on one side and uses a mineral pool on the other, recently took a walk across the road up near UNBC and her two calves soon followed. Others haven't been so fortunate, however, as several accidents involving the animal have occurred in the area.

Appendix D. Newspaper article in the North East Weekly (Peace River area; December 31, 2003) describing the Urban Moose Collision Project.

Moose, motorists meetings studied

By Chandra Wong

FORT ST. JOHN - Anyone who's driven our northern roads at night knows there's always a chance of hitting a moose. What the chances are, no knows for certain.

But it's being investigated by Roy Rea and students at the University of Northern B.C. (UNBC) in Prince George.

Rea, senior lab instructor for the Ecosystem Science and Management Program at UNBC, is working with UNBC students to investigate the record-keeping of accidents between moose and vehicles more in the winter. You drive to cles in urban areas.

In the end, the project will offer recommendations for building a database to manage the information around moose collisions.

"There's a large population of urban moose around Prince George," said Rea, "and there are no hard stats on the collisions. We don't know where the hotspots are.

"What we're doing is looking at the records (of moose collisions) kept by different groups like BC Ambulance, the RCMP, ICBC, towing companies and wildlife conservation officer."

Rea reports that while there are some records, they are not comprehensive, reporting on time of day and year or location.

From the research he has seen, Rea said that collisions with moose tend to increase in the fall, peak in January and drop off in the spring. Rea believes that this pattern is due to the proportion of daylight in the north.

"People are driving in the dark work in the dark. You drive home in the dark and moose are big, dark brown or black animals."

Moose weigh between 1,000 and 1,200 pounds. Most accidents have the moose sliding upthe hood and through the windshield. This results in head and neck injuries for the drivers.

Gord Garins, manager for the Fort St. John ICBC office, said that last year between Jan. 1 and Nov. 30, there were 416 vehicular collisions with ungulates (moose, elk, deer, etc.) in an area spanning from Farmington north to Fort Nelson.

ICBC claims for these accidents cost $1.1 million. This year, for the same time and location, there were 400 collisions costing $1 million in claims.

The funding for this project is coming from collaborators in Prince George. They include the City of Prince George, ICBC, Brownridge and Company, Sussex Insurance, and Nauroth and Associates.

The $9,000 for the project is mainly being spent on hiring UNBC students to do the research. Rea reports that many students are taking part because they interested in the work experience.

This is not Rea's first project involving collisions with moose. In a project funded by funded by ICBC, BC Hydro and BC Rail for the past four years, Rea has been researching methods to reduce the number of train and vehicular collisions with moose.

Appendix E. Abstract of poster presented at the 40th North American Moose Conference and Workshop, Cornerbrook, Newfoundland – June 2004

Documenting and prescribing countermeasures for urban moose-related vehicular collisions

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Moose-related vehicular collisions are on the rise throughout much of the distribution of moose. Although most collisions with moose are likely to occur in the countryside, collisions do occur in townships located within the range of moose. It is estimated that between fifteen and thirty moose are killed each year within the city limits of Prince George, in north-central British Columbia. Recently, an interagency group was formed in Prince George to specifically address the problem of moose-related vehicular collisions within the city in response to what appears to be an increasing trend in urban moose-vehicle encounters. The project is being led by the University of Northern British Columbia and includes partnerships from The City of Prince George, The Insurance Corporation of British Columbia, and four area automobile insurance brokers. Our project has four specific objectives: 1) identifying current records kept on moose collisions within the city (insurance companies, police, hospital, towing companies, Fish & Game records, etc.) and determining whether these records are comprehensive in nature (include dates, times, sex of the animal, location of collision, etc.); 2) proposing a robust and comprehensive strategy for record keeping (e.g., web-based open log book); 3) determining collisions hotspots within the city limits and; 4) conducting an inventory on countermeasures (i.e., signs) currently in place then recommending (based on a thorough literature review) site-specific appropriate and effective countermeasures for various hotspots. Our research to date indicates that the local RCMP appears to have the most comprehensive records on moose-related collisions within the city. We are using this information to help establish collision hotspots and a review of the literature on mitigation measures to identify which type of countermeasure is most appropriate for each site. Our review indicates that Anchorage, Alaska is the only other municipality studying the phenomenon of automobile collisions with moose in urban areas. In documenting the problem and prescribing possible solutions, we continue to seek information on whether other urban centers have in the past, or are currently, addressing this issue.

Appendix F. Newspaper article in the Western Star (June 18, 2004; Cornerbrook, NL) featuring a poster on the Prince George Urban Moose-Car Collision Project that was presented at the 40th Annual North American Moose Conference and Workshop.

NAL/PROVINCIAL

The Western Star Page 2

Star Photo by Gary Kean

The 40th annual North American Moose Conference being hosted by the inland fish and wildlife division of the province's Department of Natural Resources in Corner Brook finishes today with delegates touring Gros Morne National Park. Tim Thomas of the Wyoming Game and Fish Department, shown here checking out a display on moose-vehicle collisions, was among the more than 80 people from across Canada, the United States and northern Europe who took part.

Researcher warns of moose overpopulation in Gros Morne

By GARY KEAN
Star Staff Writer

CORNER BROOK

An overabundance of moose in Gros Morne National Park could result in a switch in the pattern of forest ... a large concentration of browsing moose can have an effect on vegetation that's not unlike a voracious pest or forest fire.

"It's almost like an insect outbreak," he said. "When you do get that kind of ... The result is a structural change and you lose some of the biodiversity of the fir component."

An effect of this change is that the affected browsing sites can no longer support as many moose. Considering ...

Appendix G. List of agencies contacted in an effort to determine which Prince George area agencies kept statistics on MRVC's in the City. Agencies listed here did not keep records or felt that they had no information to contribute or otherwise declined to be interviewed.

- Prince George Regional Hospital
- ECON 911 Administration
- Canadian National Railways
- Norgate Autobody
- Jack Schultz Autobody
- Queensway Autobody
- NorthStar Autobody
- Prince George Ambulance Service
- Animal Control
- SPCA
- Ron's Towing
- Ace Auto Towing
- Earl's Towing
- Classic Towing
- Roger's Towing
- KLR Towing
- Northern Capital Towing
- Brent's Towing
- We could not make contact with Prince George Search and Rescue