Lessons from Highway Wildlife Crossings in a North American Protected Area

The Banff Wildlife Crossings Project

April 2006 – Rob Ament, Tony Clevenger

Banff National Park and its environs in Alberta, Canada represents one of the best testing sites of innovative wildlife – roadway mitigation passages in the world. Although the major commercial Trans-Canada Highway (TCH) bisects the Park, a diverse range of engineered mitigation measures, including the incorporation of a variety of wildlife underpasses and overpasses have helped maintain large mammal populations and gather 25 years of important data.

History - Less than 100 years ago, the first car to reach Banff National Park traveled a dusty, narrow road from Calgary. By the early 1970s, four paved lanes of the TCH linked Calgary to the park's east gate. In the Park, vehicles funnelled onto a two-lane highway section. As traffic increased, so did accidents.

Photo 1. The good old days, motoring along Trans-Canada Highway in the Bow River Valley, Alberta. Photo Credit: Bruno Engler

As a result, in 1978, Public Works Canada proposed twinning the highway from the east gate to the Banff town site. This was followed by a second proposal to twin from Banff town site to the Sunshine Road. A debate resulted as many felt that a bigger highway would kill more wildlife and harm the park, while others felt a bigger highway would ensure safer travel for people. The debate was intense, but as a result, how a bigger highway might affect wildlife was more closely studied than ever before.

The first twinning project was approved with goals to improve travel safety for people and reduce road kill of deer and elk. Highway fencing and the use of wildlife underpasses were recommended. However, at the time, it was not known how a fenced highway might affect ungulates.

There was limited information on where wildlife crossings should be placed, how many were needed, or even what kind of underpasses deer and elk would use. What little data existed was gathered to help guide decisions.

While the first twinning phase was being built, the second was approved. The debate surrounding highway twinning in the Park continued. With this, came a push for scientific research and better knowledge of how roads impact wildlife.

Photo 2. One of two overpasses along the Trans-Canada Highway in Banff National Park constructed to maintain wildlife connectivity. Photo Credit: Joel Sartore/National Geographic Society

Monitoring Results - Consistent evidence of both the performance and effects of the 24 wildlife crossings (22 underpasses and 2 overpasses) is needed to support their continued and growing implementation by transportation and resource management agencies. There is still skepticism among some organizations regarding the conservation benefits of

wildlife crossings. Monitoring track pads in Banff's 24 crossings tell us that 10 species of large mammals have used them more than 70,000 times as of November 2005. Of these, over 55,000 have been ungulate (mostly deer and elk) although 77 have been moose and bighorn sheep. Carnivore totals include 3672 wolf passes, 915 cougar, 906 black bear and 296 grizzly bears.

Photo 3. Grizzly bear using wildlife overpass in Banff National Park, Canada.
Photo credit: Anonymous

However, the actual number of individual animals using the crossings is still unknown and only rough estimates can be made. Healthy functioning ecosystems require viable wildlife populations. Thus, it is critical to know the performance of these crossing structures at the population level. Although intuitively these measures should enhance population viability, to date, there have been no specific studies that actually address their population level effects.

Obtaining data on individuals in a population can be problematic because wide-ranging, fragmentation-sensitive species like bears typically occur in relatively low densities and have low reproductive rates. Thus, demonstrating that crossings provide for population level benefits (adult male and female movement across roads; dispersal, survival and reproduction of young) usually requires 15-20 years of intensive monitoring of radio-marked mammals. However, modern molecular techniques now make it possible to identify individual animals, their sex, and genetic relatedness with only a few hairs. These innovations could provide a powerful, relatively inexpensive, and non-invasive

way to acquire critical information regarding genetic interchange facilitated by crossings, without ever having to capture or see the animal.

Photo 4. Example of one of twenty-two wildlife underpasses constructed to mitigate the doubling of the busy Trans-Canada Highway. Photo credit: Tony Clevenger/WTI

Experiment - In 2004 and 2005, we piloted a DNA/hair-sampling system at two underpasses on the TCH in Banff. Our hair-snagging system consists of two strands of "sticky string" spanning the width of the underpass (Photo 5). Barbed wire is intertwined to enhance the efficiency of the system to obtain hairs with sufficient DNA/tissue for analysis. As our target species are large carnivores, primarily bears, the strands have been suspended at 35 cm and 75 cm above the ground. Page-wire and brush behind posts are used to "funnel" the animals toward the barbed-wire/sticky string as they pass through. Hair left on the barbs or sticky string as the animal passes through the structure was collected daily and sent off to a laboratory to identify species and individuals within species. The hair-sampling systems were also video-monitored 24-hrs a day to assess the success of the technique and to watch wildlife responses to the slightly modified underpasses. This video footage allowed us to identify and correct any experimental flaws, or negative impacts on wildlife.

Photo 5. Two-strand system of barbed-wire/sticky string used to snag DNA/hair sample of individual animals using wildlife underpass. Photo credit: Tony Clevenger/WTI

During the 2005 field season there were a total of 56 approaches to the two pilot underpasses by carnivores; 43 approaches were by bears (24 by black bears, 19 by grizzly bears). Bears turned around or avoided the underpasses less than 10% of the time; 2 of 24 black bears and 1 of 19 grizzly bears. The hair capture success rate was high for both bear species, greater than 90% of the time bears passed through the underpasses they left hair. For grizzly bears, 94% of the time they used the underpasses we were able to capture hair. For both bear species, 81% of the hair samples had sufficient DNA to allow genetic profiling. A total of 9 different bears used the two underpasses during the 3 ½ month period in 2005, 5 different grizzly bears (3 females, 2 males) and 4 black bears (2 females, 2 males).

With the success of the DNA-hair snagging experiment at two underpasses, a new 3-year study is being launched to determine the total number of individuals using the 24 structures, their gender, frequency of crossings and patterns of use. These data will be used to determine the composition of the bears in the Bow River Valley and the proportion of bears that are using the wildlife crossing structures. The results from this

project will help to evaluate the effectiveness of the wildlife crossing structures to promote genetic and demographic connectivity.

Wider Project - Performance monitoring continues at all 24 wildlife crossing structures in Banff. These results will provide measurable data on the value of these different structures in maintaining or restoring wildlife populations. Our information guided the design and location of 17 new structures to be built as part of the latest phase of TCH twinning (improvement) work - a key example of evolving science being used to inform transportation management planning decisions. It is hoped that this experience and expertise will raise international awareness and be valuable to other regions worldwide.

Photo 6. A wolf pack with pups using a wildlife overpass along the Trans-Canada Highway, captured by a remote-sensing research camera. Photo credit: Tony Clevenger/WTI

The Banff Wildlife Crossing Project's research, outreach, communications and funding are the result of a public-private partnership: a federal agency, a university institute, a non-profit organization and three North American conservation-based foundations. The partners include Parks Canada, the Western Transportation Institute at Montana State University (WTI), Friends of Banff National Park, Henry P. Kendall Foundation, Woodcock Foundation and the Wilburforce Foundation.

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