A subcommittee of the SH 28 Lemhi project team conducted an informal survey with state and provincial transportation agencies, state wildlife management agencies and a university to determine what, if any, animal detection systems the agencies used and the details of their operations as well as the success of those systems. This was not an exhaustive survey; rather it was a survey that targeted agencies and organizations based on our knowledge of which agencies may have animal detection systems in operation in North America. A spreadsheet and survey form in Appendix A outline the interview questions and responses. Based on responses, we have assembled a summary of our findings.

We contacted people at these agencies and affiliations:

- Arizona Game and Fish Department
- University of California, Davis, Road Ecology Center
- Alberta, Canada, Ministry of Transportation
- Parks Canada
- British Columbia, Canada, Ministry of Transportation
- Colorado Department of Transportation
- Florida Department of Transportation
- Idaho Transportation Department
- Montana State University, Western Transportation Institute
- Nebraska Department of Transportation
- Nevada Department of Transportation
- Oregon Department of Transportation
- Utah Department of Transportation
- Washington State Department of Transportation
- US Forest Service-Wyoming Department of Transportation Liaison Program

Alberta, Nebraska, Nevada, Oregon, and Utah do not currently employ animal detection systems anywhere in the state or province. Wyoming has used animal detection systems in the past but both systems failed and there are none slated for future use. While California has a system installed on
Highway 3, it is not working well. This system uses an object detection thermal imagery system and a buried cable. In general, California has concerns about liability issues and so does not use any animal detection systems on a continual schedule. Alberta and Utah are looking into the feasibility of installing animal detection systems. Nevada Department of Transportation does not have staff capacity to maintain animal detection systems and does not currently want to contract this out. However, they took the lead in a pooled-fund study which will look at new detection options.

The types of systems that have been used or tested at these agencies include CrossTek Wildlife Solutions, Airborne Underwater Geophysical Signal, in-agency expert team constructions, Sloan Security Systems, Inc., and Advanced Telemetry Systems. Additional new technologies are in various stages of development (e.g., light detection and ranging surveying, LiDAR, 3D imaging system). The systems currently in use cost from $60,000 for a short, 2-camera design (minus the connection cost) to $2 million/mile, although not all respondents knew the cost of the system. Idaho Transportation Department deployed the lower-cost systems that used Doppler radar technology coupled with thermal imaging. More expensive systems also utilized infrared, forward-looking infrared (FLIR), and buried coaxial cable detection technology in British Columbia, Colorado, and Wyoming. All systems send a signal to driver warning signs that alert upon animal detection. We summarize specifics of these systems and their effectiveness below.

Florida, Idaho, Montana, and Washington have used animal detection systems with limited or unconfirmed success. Florida installed a system that uses a continuous infrared beam between transmitters and receivers that then trigger flashing lights on a driver warning sign. Specifically, these were "2 daisy-chained arrays of break-the-beam" technology. Smith et al. summarized this in their report: "Overall, the RADS performed from poor to fair in detecting target species; we recorded average success rates between 10.7% and 66%. We also found that on average, between 34% and 89.3% of target animals were not detected, resulting in false negatives. Over 90% of all RADS activations were classified as false positives. The resulting effect is that the large number of false positives could be desensitizing drivers to the RADS" (2016). The authors “were unable to determine the overall reduction in collision rate with targeted species because aside from data on Florida panther and Florida black bear, no pre-installation data existed on road-kills.”

In Idaho, the state originally installed two different systems: a mobile and a permanent animal detection system. Both systems used Doppler radar with thermal imaging cameras that sent a signal to four driver-warning signs. The mobile system was problematic for set-up (e.g., aiming), trouble shooting, and snow and power issues because a boom was required to get to the top of the tower to access components. Huijser et al. evaluated the effectiveness of the system and reported that “The system easily met the minimum norm for false negatives that was suggested as part of another animal detection system project funded by the Federal Highway Administration and the Montana Department of Transportation (2.5 percent vs. the suggested “allowable” maximum of 9 percent false negatives). However, the false positives may have been higher than the suggested reliability norm (24.5 percent possible false positives vs. the suggested “allowable” maximum of 10 percent false positives)” (2017). When evaluating the effects on driver behavior, the authors found that “The data suggest that the effect of activated warning signs on vehicle speed was greatest when road conditions were challenging (e.g., freezing temperatures and snow- and ice-covered road surface) and when visibility was low (night). In summer, there was no measurable benefit of activated warning signs, at least not as far as vehicle speed was concerned. Depending on the conditions in
autumn and winter, the activated warning signs resulted in a speed reduction of 0.69 to 4.43 mi/h. The effects of the system on wildlife-vehicle collisions were never tested.

Idaho’s permanently mounted animal detection system on Highway 95 is functioning but has never been evaluated for reliability, impacts on traffic speeds, or effectiveness at reducing wildlife-vehicle collisions. It has power issues and is not easy to work on.

A pooled-funds study funded by Federal Highways and 15 Departments of Transportation was conducted in Yellowstone National Park, Montana, to determine the effectiveness of an animal detection system (Huijser et al. 2009). The authors found that driver speeds were reduced by 0.9 – 1.5 mph when warning signs were activated. Wildlife-vehicle collisions appeared to be reduced during the testing of this system, but sample sizes were too small to determine if this pattern was statistically significant. The system detected elk reliably, except in blind spots with curves and steep slopes.

In 2000, the Washington Department of Fish and Wildlife began a highway mitigation project aimed to reduce elk-vehicle collisions. Approximately 10% of a small elk herd that regularly crossed Highway 101 was equipped with radio collars. Four receivers for the collar frequencies were mounted along the highway and when the receivers picked up collar signals (at about 400 m), they signaled driver warning signs to activate. Prior to system installation, an average of 2.5 elk/vehicle collisions had occurred each year on that stretch of highway. After the animal detection system was installed, only one elk-vehicle collision occurred over a six-year period. Caveats to the apparent success include that the elk herd size is only about 20 animals, annual average daily traffic ranges between 11,000 and 23,000, and elk have reduced the number of times each year they cross the highway.

The most effective animal detection systems reported are deployed in Arizona and British Columbia. Another system in Colorado showed an initial high success rate, but failed at reducing wildlife-vehicle collisions after the first year of deployment.

Arizona uses a “crosswalk” system on State Highway 260, meaning the highway is fenced to prevent animal access to the surface of the road except within a ¼-mile long crossing zone (Gagnon et al. 2010). In this crossing zone, animals can cross the road surface but are deterred from traveling the road corridor by electric mats embedded in the road (electric mats were installed 3 years after the installation of the crosswalk because animals were getting caught in the roadway between fencing). In this crossing section, thermal imagery cameras detect animals in the crossing zone and trigger driver warning signs. The fence not only keeps animals off the road surface for the length of the fence, but it also acts as a funnel to direct them to the crossing and detection zone. This system is properly functioning 93% of the time and has a false positive rate of 4%, meaning it “detects” animals when they are not actually present 4/100 detections. When signs were activated, motorists slowed their speed on average by 17% and were 60% more likely to apply their brakes. A corresponding 97% reduction in elk-vehicle collisions occurred after the system was installed. After installation of this system, however, elk passage rate from one side of the road to the other dropped by 70%.

British Columbia, Canada, Ministry of Transportation installed two wildlife detection systems on Highway 3 in 2016 (Sielecki 2017). These systems are comprised of radar and infrared camera
technology that was originally developed for airport and facilities security. The image detection software integrates the detection system to messaging systems that warn drivers of animals on the road. A team of experts who designed the unique technology developed this system cooperatively. A single setup cost $1.25 million. The system near Elko, British Columbia covers a 2.6 km (1.6 mile) section of road. The second system, near Michel, British Columbia covers a 5.5 km (3.4 miles) section of road. Annual average daily traffic is 3,300 in Elko and 2,800 in Michel. Vehicle speeds were reduced on average by 8.3 km/hour (5.2 mph) at the Elko site and 4.0 km/hour (2.5 mph) at the Michel site when warning signs flashed. At the Elko site, deer, big horn sheep, elk and bear-vehicle collisions dropped from an annual average of 15/year between 2004 and 2013, to four in 2016, after the detection system was operating for a full year. The number of deer and elk-vehicle collisions at the Michel site dropped from an annual average of 19/year between 2004 and 2013, to 15 in 2016.

Colorado Department of Transportation has installed two different animal detection systems. In 2011 in Golden, Colorado, they installed a 100-foot wide break-the-beam system from TrailMaster. The transportation department installed this system as a crosswalk, similar to the one in Arizona, with 2.5 miles of accompanying fence. The system is maintained by the transportation department, which includes snow removal and grass control. Heavy rain causes the system to indicate false detections. Wildlife-vehicle collisions were initially reduced by 80-90% on this section of road. However, the number of wildlife-vehicle collisions has steadily increased since 2011 and are now as high as they were before installation of the animal detection system. The researchers involved believe that local motorists and an advisory speed reduction contributed to early success rates. The system also experienced a high false positive detection rate and this may have contributed to its eventual failure.

In Durango, Colorado, the Department of Transportation installed a buried cable animal detection system. This system has issues with detecting bicycles, motorcycles, snow, rain and vegetation, which causes a high rate of false detections. It has also been challenging to gauge the system for detecting deer, which leads to false negative detections. No associated decreases in driver speeds have been detected. This system cost $2 million/mile.

The effectiveness of these systems in terms of reliability has been monitored widely across studies and the systems seem to have extensively varying success rates. Several systems have demonstrated success with accurate detection rates and a couple have demonstrated the ability to modify driver behaviors through reduced speeds. Several of the researchers relate this to an abundance of local, well-informed drivers. On the other hand, separate research conducted on dynamic signs alone (without animal detection systems) have demonstrated that the novelty of a sign is important for catching driver attention (Hardy et al. 2006). For further review of dynamic wildlife warning signs, see Appendix B.

The success in reducing wildlife-vehicle collisions is difficult to gauge. A few confounding elements can lead to incorrect assessments of the effectiveness in reducing wildlife-vehicle collisions. The first is a lack of control area data in many of these studies. Ideally, a study will assess changes in wildlife-vehicle collisions at the site where mitigation is installed, at another site with similar traffic and wildlife parameters where no mitigation is installed, and both of these sites will be monitored both
before and after installation of mitigation. This is essentially a before-after-control-impact (BACI) study design that provides the most credibility to associated results.

Another confounding element that was not evaluated in any of these studies is the assumption of static wildlife populations. Wildlife population health and size naturally vary over time due to many environmental factors including weather, available forage, human development, stochastic events and many other reasons. Without understanding these dynamic changes within the populations of interest over time, results of monitoring wildlife-vehicle collisions along roads could be misleading (Seiler 2001; Huijser et al. 2008 discusses the correlation between deer population trends and deer-vehicle collisions).

Highway traffic volumes also affect the ability of wildlife to move across roads (habitat permeability). Analyzing traffic volumes can help evaluate solutions to this habitat fragmentation problem. Traffic rates can reach a threshold where wildlife perceive the traffic as a barrier to movement across the road (Seiler 2001; Seiler 2003). Increasing traffic can eventually lead to animals abandoning traditional highway crossing locations. For carnivores, researchers estimate 300-500 vehicles/day is a barrier; for ungulates, 500-5,000 vehicles/day can be a barrier (Seiler 2003, Alexander et al. 2005, Clevenger and Huijser 2011). An animal detection system can function as a solution to mitigate wildlife-vehicle collisions that requires changes in driver’s behavior to obey warning signs, but fails at maintaining permeability when traffic becomes too dense for wildlife to negotiate.
Literature Cited


Appendix A. Spreadsheet and survey forms used in expert interviews
<table>
<thead>
<tr>
<th>State</th>
<th>Name</th>
<th>Title</th>
<th>Phone</th>
<th>Team Member</th>
<th>What ADS do you have?</th>
<th>Effectiveness</th>
<th>Maintenance</th>
<th>ADS Vendor</th>
<th>Use Again?</th>
<th>Cost</th>
<th>Data &amp; Reports</th>
<th>Other</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arizona</td>
<td>Jeff Gagnon</td>
<td>AZGFD Statewide Research Biologist</td>
<td>928-814-8925</td>
<td>Tim</td>
<td>Crosswalk</td>
<td>It has been installed and working for 11 years; upgrading with thermal imagery and software, working with AZDOT, then AZGFD will take over maintenance</td>
<td>CrossTek is working with British Columbia; both CrossTek and AZGFD do the maintenance; CrossTek has been very responsive and good to work with</td>
<td>CrossTek</td>
<td>Yes</td>
<td></td>
<td></td>
<td>Evaluation of an animal-activated highway crosswalk integrated with retrofit fencing</td>
<td>Works better in snow due to more even thermal coverage with animals distinguished more easily. AADT where installed: summer = 8,000-10,000; 2012-2015 = 6,000. Pros/cons: this system is a combination of radar and fencing; if it were installed without fencing it would need to be in a flat, straight location with many radars to cover the area. Without fencing, continuous radar is needed. The fence does the work of funneling.</td>
</tr>
<tr>
<td>California</td>
<td>Fraser Shilling</td>
<td>Co-Director Road Ecology Center, UC Davis</td>
<td>530-219-3282 (c); 530-752-7859 (w)</td>
<td>Tim</td>
<td>Hwy 3 in N California has an object detection thermal imagery system with buried cable; has issues and is not working well</td>
<td>Liability issues in California is major concern so not constantly being used</td>
<td>Hwy 3 in N California has an object detection thermal imagery system with buried cable; has issues and is not working well</td>
<td>Hwy 3 Report</td>
<td>Highway 3 Report</td>
<td></td>
<td></td>
<td>See email attachment</td>
<td>ADS with thermal mass imaging is the most reliable, underground cable is not reliable, driver assist systems are getting better as technology improves, e.g., autonomous vehicles; California lab is currently testing other systems; systems being developed that use multiple systems at the same time; in Italy, there is a roadside system that detects and then scares away the animal and warns the driver when anything is detected; $10,000-$15,000 for 0.5 - 1 mile coverage, it functions best with endpoints.</td>
</tr>
<tr>
<td>Canada</td>
<td>Stephen Legaree</td>
<td>Environmental Specialist, Alberta Transportation</td>
<td>Tel: 780-643-1525 / Cel: 780-293-2042</td>
<td>Renee</td>
<td>NONE</td>
<td>Concerns over how the systems have been tested (i.e., not experimentally tested to show changes aren’t due to something else in the environment)</td>
<td>Airborne Underwater Geophysical Signal</td>
<td>Probably not</td>
<td>See email attachment</td>
<td></td>
<td></td>
<td>See email attachment</td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td>Trevor Kinley</td>
<td>EA Scientist, Parks Canada</td>
<td>Tel: 250-347-6634 / Cel: 250-409-4179</td>
<td>Renee</td>
<td>AUG Signals, LADS, radar based</td>
<td></td>
<td>Airborne Underwater Geophysical Signal</td>
<td>Probably not</td>
<td>See email attachment</td>
<td></td>
<td></td>
<td>See email attachment</td>
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<tr>
<td>State</td>
<td>Name</td>
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<td>Phone</td>
<td>Team Member</td>
<td>What ADS do you have?</td>
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<tr>
<td>Canada</td>
<td>Leonard Sielecki</td>
<td>Wildlife and Environmental Issues Specialist, BC Ministry of Transportation</td>
<td>250-356-2255</td>
<td>Renee</td>
<td>State-of-the-art radar and infrared technology camera developed for airport and facility security was integrated with advanced image detection software and messaging systems</td>
<td>&quot;operating well&quot;</td>
<td>&quot;require power and communicatio n utilities&quot;</td>
<td>Development team included: PBX Engineering, FLIR 360 Surveillance, and WestCana Electric</td>
<td>Looking into Sloan (for cost reasons)</td>
<td>$1.2 million apiece</td>
<td>Wildlife Detection Systems, Highway 3, British Columbia Real-time warning systems for protecting wildlife and drivers</td>
<td>See email attachment</td>
<td>Looking into Sloan; cost is cheaper; but will be difficult with avalanche path on highway</td>
</tr>
<tr>
<td>Colorado</td>
<td>Jeff Peterson</td>
<td>Wildlife Program Manager, CDOT</td>
<td>303-512-4959</td>
<td>Tim</td>
<td>Golden-break the beam, Durango-buried cable</td>
<td>90% WVC reduction; Durango-issues with bikes, motorcycles and snow</td>
<td>Done by CDOT, snow removal, rain and grass control issues for both systems</td>
<td>Durango- $2 million/mile</td>
<td>Finalizing</td>
<td></td>
<td></td>
<td>Advisory speed reduction in Golden, here most drivers are familiar and heed the signs when they are flashing; No decrease in speeds with buried coaxial cable (Durango); difficult to dial-in sensitivity for deer; used because issues with fences and underpasses; need dedicated power source (solar)</td>
<td></td>
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<tr>
<td>State</td>
<td>Name</td>
<td>Title</td>
<td>Phone</td>
<td>Team Member</td>
<td>What ADS do you have?</td>
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<tr>
<td>Florida</td>
<td>Brent Setchell</td>
<td>P.E., District Drainage Design Engineer, Florida DOT</td>
<td>863-519-2557</td>
<td>Renee</td>
<td>RADS; continuous infrared beam between transmitters and receivers; triggers flashing lights; “2 daisy-chained arrays of break-the-beam”</td>
<td>RADS performed from poor to fair in detecting target species; we recorded average success rates between 10.7% and 66%. We also found that on average, between 34% and 89.3% of target animals were not detected, resulting in false negatives. Over 90% of all RADS activations were classified as false positives. The resulting effect is that the large number of false positives could be desensitizing drivers to the warning lights.</td>
<td>Waiting for reply. Not described in report.</td>
<td>Renee</td>
<td>Waiting for reply. Not described in report.</td>
<td>Unknown</td>
<td>Waiting for reply. Not described in report.</td>
<td>Waiting for reply. Not described in report.</td>
<td>“Driveways within the sensor zone include a magnetic loop that informs the system when vehicles “break” the beam; in these instances the warning lights are not triggered. Animals or people crossing over the driveways between sensor poles will trigger the warning beacon lights.</td>
</tr>
<tr>
<td>State</td>
<td>Name</td>
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<td>Phone</td>
<td>Team Member</td>
<td>What ADS do you have?</td>
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<td>ADS Vendor</td>
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<tr>
<td>Idaho</td>
<td>Mike Hartz</td>
<td>Senior Environmental Planner D1</td>
<td>208-772-8018</td>
<td>Tim</td>
<td>1 permanent system (Doppler radar with thermal imaging cameras and 4 signs) and 1 mobile system that was taken down (Doppler radar with FLIR cameras attached to wildlife signs)</td>
<td>Mobile system was problematic for set-up (e.g., aiming), trouble shooting and snow and power issues; Permanent system is working but never evaluated for reliability, traffic speeds or effectiveness, has power issues, not easy to work on, fine with snow</td>
<td>Mobile; originally done by Sloan, but ultimately ITD; power generator maintenance, adjustments are labor intensive, needed a boom to get to top of tower to aim correctly</td>
<td>Sloan Security Systems Inc. (Brice Sloan)</td>
<td>Tim</td>
<td>None</td>
<td>Mobile: $60,000 - $100,000 not including connection cost; Permanent system is same if there is a fixed power hookup</td>
<td>The Reliability and Effectiveness of a Radar-Based Animal Detection System</td>
<td></td>
</tr>
<tr>
<td>Montana</td>
<td>Marcel Huijser</td>
<td>Research Ecologist, WTI</td>
<td><a href="mailto:marcelhuijser@mphetc.com">marcelhuijser@mphetc.com</a></td>
<td>Renee</td>
<td>Roadside Animal Detection System (RADS) experiment</td>
<td>Mixed</td>
<td>9 different systems from 5 manufacturers</td>
<td>Comparison of ADS in a Test-Bed</td>
<td>Renee</td>
<td>Montana DOT has not identified any migratory paths or hot spots where ADS would work</td>
<td></td>
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</tr>
<tr>
<td>Nebraska</td>
<td>Jason Jurgens</td>
<td>Environmental Section Manager, NDOT</td>
<td>402-479-4418</td>
<td>Tim</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>Nebraska DOT has not identified any migratory paths or hot spots where ADS would work</td>
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<td>State</td>
<td>Name</td>
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<td>Phone</td>
<td>Team Member</td>
<td>What ADS do you have?</td>
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<td>ADS Vendor</td>
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<tr>
<td>Nevada</td>
<td>Nova Simpson</td>
<td>Environmentally Scientist, NDOT</td>
<td>775-888-7035</td>
<td>Renee</td>
<td>Don’t have staff to maintain and haven’t wanted to contract out yet. No electrified mats or concrete; not enough good data, expensive, and not staff to maintain.</td>
<td></td>
<td></td>
<td></td>
<td>None</td>
<td></td>
<td>None</td>
<td>In Tahoe, at a blind corner, radar is used to detect cars. Flashing signs warn of cars. Anytime there is snow, they don’t work.</td>
<td></td>
</tr>
<tr>
<td>Oregon</td>
<td>Cidney Bowman</td>
<td>Wildlife Passage Coordinator, ODOT</td>
<td>541-388-6420</td>
<td>Renee</td>
<td>NONE</td>
<td></td>
<td></td>
<td></td>
<td>None</td>
<td></td>
<td>None</td>
<td>See attached manuscript and PowerPoint</td>
<td></td>
</tr>
<tr>
<td>Utah</td>
<td>Randall Taylor</td>
<td>R4 Constructability and Estimating Engineer (also WVC Specialist)</td>
<td>435-893-4714</td>
<td>Tim</td>
<td>Looking at CrossTek</td>
<td></td>
<td></td>
<td></td>
<td>None</td>
<td></td>
<td>None</td>
<td>UDOT would like to install ADS in areas with high numbers of highway accesses and other characteristic s that make traditional wildlife fencing and double cattle guards difficult</td>
<td></td>
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<tr>
<td>State</td>
<td>Name</td>
<td>Title</td>
<td>Phone</td>
<td>Team Member</td>
<td>What ADS do you have?</td>
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<tr>
<td>Virginia</td>
<td>Renee</td>
<td>Buried cable system</td>
<td></td>
<td>Renee</td>
<td>I did not reach out. Do you want me to?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Evaluation of a Buried Cable Roadside Animal Detection System</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Washington</td>
<td>Kelly McAllister</td>
<td>Fish and Wildlife Biologist, WSDOT</td>
<td>360-705-7426</td>
<td>Renee</td>
<td>3-mile stretch of road that system is deployed on; average elk-vehicle collisions before project: 2.5/year; after: 1 elk-vehicle collision in 6 years</td>
<td>Collared elk transmits to beacons that flash for drivers; always maintain at least one collar on an elk in the herd</td>
<td>Advanced Telemetry Systems</td>
<td></td>
<td>Drop in WVC corresponded to highway realignment, appears that elk aren’t crossing the highway anymore (anecdotal?); non-migratory mostly; elk have settled into different situations/areas; depredations on crops, so they get hazed and hunted now</td>
<td>$75,000</td>
<td>WSDOT WVC reduction measures</td>
<td>See attached items</td>
<td></td>
</tr>
<tr>
<td>Wyoming</td>
<td>Darin Martens</td>
<td>USFS-WYDOT Liaison</td>
<td>307-413-9913</td>
<td>Renee</td>
<td>A couple tested and failed.</td>
<td>None slated for future.</td>
<td>No</td>
<td></td>
<td></td>
<td>$900,000</td>
<td>TRAPPER’S POINT WILDLIFE DETECTION SYSTEM: TECHNOLOGICAL AND INSTITUTIONAL CHALLENGES</td>
<td>EVALUATION OF THE FLASH (FLASHING LIGHT ANIMAL SENSING HOST) SYSTEM IN NUGGET CANYON, WYOMING</td>
<td></td>
</tr>
</tbody>
</table>
Data & Reports

Do you have any reports on the reliability of the ADS in your state?

________________________________________

Any data on speed reduction?

________________________________________

Was the speed reduction mandatory or advisory?

________________________________________

Do you have any data on WVC reduction?

________________________________________
Appendix B. Review of dynamic wildlife warning signs.

Wildlife Warning Signs for Motorists

After reviewing the literature in regard to wildlife warning signs and their effectiveness in reducing wildlife-vehicle collisions (WVCs), we provide information about sign use and placement along highways. Typical permanent static signs (yellow diamond with Deer Xing or image of deer) have been found to be less effective than moveable enhanced signs (Beckmann et al. 2010). Effectiveness is typically measured as driver speed reduction rather than WVC reduction because in most situations carcass data was not rigorously collected before and after signage was implemented (Sullivan et al. 2004). Enhanced signs are most effective when they possess “larger-than-typical sizes and fonts and include flashing lights, bright flagging, and reflective backing (Hardy et al 2006).” It is also important that the sign(s) be located as close to WVC hotspots as possible and that they are activated during seasonal and daily movements (migration periods and crepuscular hours, Hardy et al. 2006). Al-Ghamdi and Algadhi found in 2004 that motorists are likely to reduce speed for about 500 m before an enhanced sign and 500m after passing the sign. In 2013, Blacker and Jones surveyed motorists in Australia about their potential responses to a variety of wildlife signage. They found that motorists are more likely to respond to signs possessing evidence of WVCs (e.g., year-to-date number of carcasses found). They also found that motorists are unlikely to respond to signage that exists in areas where evidence of the problem does not exist (e.g., where carcasses are removed from the road, a displayed year-to-date number could help improve motorist response). Blacker and Jones acknowledged that what motorists think they would do and what they actually do may not be congruent. The literature emphasizes the importance of using wildlife signs during times of heightened WVC risk (Sullivan et al. 2004, Hardy et al. 2006).

Ultimately, to be effective, signs must be reliable, legible, and attention-catching; effectiveness may increase if signs are used sparingly and strategically. Sign effectiveness was measured in speed reductions and when enhanced signs were deployed in Saudi Arabia, average motorist speed was reduced between 3-7kph (1.86-4.35mph; Al-Ghamdi and Algadhi 2004). When enhanced signs were displayed to traffic during ungulate migration season in Utah, a 50% reduction in speeding vehicles was documented as well as an estimated 50% reduction in WVCs (Sullivan et al. 2004). Although enhanced signs have been shown to have an effect on speed reduction and estimated WVC occurrence, the effect is often ephemeral. Sullivan et al. demonstrated effectiveness of enhanced signs in slowing motorist speed in the first year of their study but the effect was reduced in the second year of the study (2004). Some studies demonstrate a 0% effectiveness of novel, enhanced signs on WVC reduction (Rogers 2004). Well placed, seasonal warning signs can have an impact on motorist behavior and reduce WVCs by 26% on average (Huijser et al. 2009) but even the most strategic and dynamic signs do not compare to the effectiveness of crossing structures with fencing (86%, Huijser et al. 2009). It should be noted that while signs can be effective in reducing WVCs, they do little to ensure the permeability of the landscape for moving animals (Huijser et al. 2009).

References


