2015 LAVA BUTTE WILDLIFE CROSSING PROGRESS REPORT

Monitoring Effectiveness of the Lava Butte Wildlife Crossing Structures

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September 28, 2016

INTRODUCTION

U.S. Route 97 is a main highway running north-south through Oregon along the east side of the Cascade Mountains. The Oregon Department of Transportation (ODOT) has documented mule deer movement across U.S. Route 97 during migration season through historical carcass collection records and telemetry studies (Coe et al. 2015). It is expected that these individuals use the Cascade Mountains for summer range and migrate east across Route 97 to the eastern portions of the Deschutes National Forest, or further, for their winter range. Due to increases in traffic in the vicinity of Sun River, a 4-mile section of Route 97 was upgraded by constructing an additional two lanes that resulted in separated north and south-bound traffic with a forested median.

In addition, historical mule deer migration routes were thought to have shifted 30 miles south where traffic volumes are not heightened (Coe et al. 2015). As a result of the shift in historical migration routes, the highway improvement project incorporated wildlife crossing structures with the goal of allowing for migration across the highway corridor while reducing vehicle-wildlife collisions. One wildlife-specific underpass was constructed at the south end of the project (hereafter South Lava Butte) specifically to facilitate wildlife passage across the Route 97. A second multi-use undercrossing was constructed alongside the seasonally closed Crawford Road. In addition to the two underpasses, four miles of exclusionary fencing was built on both sides of Route 97 to minimize wildlife entries into this stretch of highway. The fencing included four jump-out escape ramps (two on each side of the highway) to allow animals that entered the road corridor to escape without having to cross the highway.

The objective of this study is to monitor the crossing structures using remote motion-detecting cameras in conjunction with documented deer-vehicle collisions to determine the effectiveness of the wildlife crossings at minimizing vehicle-wildlife collisions, while providing safe passage for wildlife across the highway corridor. Monitoring of the wildlife crossing structures commenced with a collaboration between ODOT and Portland State University (PSU) from 2012-2014; detailed methods and results can be found in their final report (Bliss-Ketchum and Parker 2015). This 2015 interim report provides data on wildlife passage through 2015, and is a continuation of the wildlife passage monitoring conducted from 2012-2014.

Study Area

The study area is located along U.S. Route 97 in the Deschutes National Forest, approximately 15 miles south of Bend, OR. More specifically, the study area is located between milepost (MP) 149 at Lava Butte and MP 153 at South Century Drive. The north end of the project is located within the Newberry National Volcanic Monument.

Methods

Twenty-three Reconyx brand Hyperfire 800 or 900 cameras were deployed by ODOT in the prior monitoring efforts conducted in collaboration with PSU (Bliss-Ketchum and Parker 2015). Of these cameras, four were located at fence-ends or fence corners, seven at the Crawford Road underpass, four at the South Lave Butte underpass, and eight at the escape jump-outs (one tree-based and one ground-based camera at each of the four jump-outs). Cameras were initially positioned on 21 June 2012, with the intent of documenting local use by smaller animals and both successful and unsuccessful use of structures by larger animals. All camera locations have remained consistent with previous monitoring efforts to maintain quality of data, see Appendix 1 for representative photos from each camera.

Cameras were scheduled to be checked by an ODOT intern every other week. SD cards in cameras were collected, downloaded to ODOT hard drives, and later delivered to WEST for data management and analysis. Photos for each camera were logged in a database and uploaded into MapView Professional (Reconyx, Holmen, WI) for review and tagging. Each camera was set to take 1-3 pictures with each motion-activated trigger (each sequence of pictures form a single trigger are hereafter referred to as an event). The first photo from each event was tagged with species identification and structure use data (where applicable). Multiple triggers occurring from the same animal(s) were marked as ‘same as previous’ to indicate their association with an already identified event and are hereafter referred to as the series. Trigger events or series occurring within 15 minutes were presumed to be part of the same series (Bliss-Ketchum and Parker 2015), unless triggering events were explicitly distinct from one another (e.g., doe and fawn vs. two bucks). This saved time in photo tagging while minimizing duplicate counts of individuals from multiple events. It is important to note that the numbers of detections reported are not a count of the number of individual animals using the structures, but an index of use. Due to differences in camera placement relative to the structures and in trigger sensitivity among the cameras, we were not always able to confirm whether an individual crossed successfully from one side of the structure to the other. Instead, we report a count of detections for each camera to compare structure use by side, as opposed to an estimated number of wildlife crossings. Only pictures of animals positively identified to species were tagged, which resulted in some events being classified as undetermined. For fence-end and tree-based cameras at the jump-outs, we collected additional information relative to use of the structure including direction of travel (i.e., forest vs. road side) and crossing direction (i.e., forest to road or road to forest) where the movement past the structure was verified through photos in each event or series. To be conservative, only series of photos depicting the entire movement through the structure were tagged as such.

Results and Discussion

For 2015, 97,919 photos were made available to WEST and were analyzed for evaluating the use of wildlife crossing structures within the study area (Table 1-4). These photo counts are lower than the actual number of photos taken because not all photos were available for analysis (Table 4).

Overall, monitoring of the Project in 2015 documented 13 mammal species, five bird species, and one reptile species (Table 2). This represents 68% of the mammal species and 50% of the bird species identified during the first three years of monitoring (2012-2014). Band-tailed pigeon (*Patagioenas fasciata*) was the only species detected in 2015 that was not previously detected (Bliss-Ketchum and Parker 2015; Table 2). The 2012-2014 report did not list unique species of lizards, thus we are unable to compare unique species of reptiles to the 2015 data. The Crawford Road underpass had 1,389 detections spread among 14 species, South Lava Butte underpass had 762 detections spread among 10 species, the jump-outs collectively had 239 detections of nine species, and the fence-ends collectively had 161 detections of four species (Table 2). The majority of all wildlife detections at Crawford Road were triggered by small mammal species (i.e., golden-mantled ground squirrel [*Callospermophilus lateralis*], and western gray squirrel [*Sciurus griseus*]) that use the structures as habitat, and not necessarily as movement corridors. Although small mammals accounted for a majority of detections at Crawford Road, mule deer were consistently detected using the Crawford Road underpass suggesting the underpass is successfully being used by mule deer. Wildlife detections at South Lava Butte were dominated by coyotes (*Canis latrans*) and mule deer (*Odocoileus hemionus*) indicating this structure is also functioning successfully for large mammal crossings. Based on the data (265 detections at South Lava Butte compared to 29 at Crawford Road), it appears that coyotes may prefer to use the wildlife-specific crossing structure as opposed to one alongside a road (i.e., Crawford Road). The species with the most detections were consistent with those most commonly detected in previous years (2012-2014; Table 2).

Mule deer were the second-most commonly detected species overall, with only seven fewer triggering events than golden-mantled ground squirrels. However, given that golden-mantled ground squirrel detections likely represent many repeated detections of the same individuals residing under the overpasses, mule deer likely represent the most abundant species using the structures for crossing. Mule deer were the second-most frequent detection at the South Lava Butte structure and third-most frequent at the Crawford Road structure. Mule deer were often detected travelling alone, but were seen with as many as eight individuals together in a series of photos. Looking at the number of individuals across triggering events, it was estimated that a minimum of 104 and 125 individual mule deer utilized the underpass structures at Crawford Road and at South Lava Butte, respectively.

Table 1. Total number of photos analyzed per camera and mule deer detection and use data.

Camera ID	Photos analyzed	Mule deer Triggers	Individuals per series	Total count of mule deer
Crawford Road	**31,368**	**249**	**1 to 8**	**488**
CR1W	7,206	66	1 to 6	104
CR2W	5,980	25	1 to 6	41
CR3W	2,938	13	1 to 6	21
CR4W	4,035	16	1 to 4	20
CR5E	1,133	20	1 to 3	28
CR6E	546	18	1 to 3	30
CR7E	9,530	91	1 to 8	244
South Lava Butte	**32,067**	**219**	**1 to 7**	**296**
SL1W	1,940	91	1 to 7	125
SL2W	1,768	13	1 to 2	14
SL3E	26,800	76	1 to 7	103
SL4E	1,559	39	1 to 4	54
Jump-Outs	**16,381**	**70**	**1 to 8**	**73**
JSW1R	421	0	NA	NA
JSW1W	1,299	16	1 to 2	20
JSE1R	221	3	1 to 3	6
JSE1W	373	7	1 to 3	11
JNW1R	8,821	13	1 to 8	30
JNW1W	1,255	14	1 to 2	17
JNE1R	3,325	14	1 to 5	21
JNE1W	1,280	3	1 to 2	4
Fence-Ends	**18,103**	**97**	**1 to 5**	**146**
NEFE	2,745	51	1 to 5	83
NWFE	13,923	1	1	1
SEFE	420	29	1 to 4	40
SWFE	1,015	13	1 to 2	17

Table 2. Total number of detections from previous monitoring efforts (Overall Detections 2012-2014) and a breakdown of 2015 species detections by structure (South lava butte, Crawford Road, jump-outs, fence-ends).

Species	2012-2014 Overall Detections	South Lava Butte	Crawford Road	Jump-outs	Fence ends
Mammals	***5867***	***760***	***1384***	***239***	***161***
American badger	13	1	0	0	0
black bear*	1	0	0	0	0
bobcat*	4	0	0	0	0
bushy-tailed woodrat	14	0	44	0	0
cottontail	140	1	37	1	0
cougar	1	0	0	1	0
coyote	214	265	29	4	64
deer mouse	50	0	15	0	0
Douglas squirrel	219	17	28	76	0
elk*	27	0	0	0	1
golden-mantled ground squirrel	1953	157	443	40	0
jackrabbit*	1	0	0	0	0
long-tailed weasel*	7	0	0	0	0
mule deer	1260	219	249	70	95
raccoon*	101	0	0	0	0
striped skunk	2	0	2	1	0
western gray squirrel	692	77	325	25	1
yellow-pine chipmunk	1156	23	212	21	0
yellow-bellied marmot*	12	0	0	0	0
Birds	***199***	***2***	***4***	***0***	***0***
American robin	7	1	0	0	0
band-tailed pigeon	0	0	1	0	0
common raven	27	0	1	0	0
dark-eyed junco	1	0	0	0	0
mountain chickadee	3	0	0	0	0
mourning dove	116	0	0	0	0
red breasted nuthatch	3	1	0	0	0
red crossbill	41	0	2	0	0
turkey vulture	1	0	0	0	0
Reptiles/Amphibians	***0***	***0***	***1***	***0***	***0***
unidentified lizard	8	0	1	0	0

*denotes a species previously documented but not detected in 2015

There were eight cameras, four tree-based jump-outs and four fence-end cameras, for which additional data on structure use was collected (Table 3). The tree-based jump-out cameras could ideally capture an event where an individual jumps from the road-side of the fence to the forest-side indicating that wildlife are using these structures as intended. The north fence-end cameras were positioned at true fence-ends and could capture whether an individual crossed from one side of the fence to the other. The south fence-end cameras were not on true ends to the exclusion fencing; instead the southwest camera (SWFE) was positioned at the farthest southwest corner and the southeast camera (SEFE) was positioned along the exclusion fencing just north of the true southeast corner.

Table 3. Structure use data on trigger events from mule deer on raised jump-outs (i.e., tree-based) and fence ends. Triggers were categorized as crossing or travelling along a structure. Structure crossing was further broken down to determine directionality of crossing and travelling along structure was broken down to indicate whether the deer was on the outside (forest side) or inside (road side) of the exclusion fence.

Camera ID	Structure crossing		Travelling along structure		Total
	Forest to road	Road to forest	Forest side	Road side	
Jump-Outs					
JSW1R	0	0	0	0	0
JSE1R	0	0	0	3	3
JNW1R	0	0	0	13	13
JNE1R	0	0	0	14	14
Fence Ends					
NEFE	14	6	28	3	51
NWFE	0	0	0	1	1
SEFE	NA	NA	27	2	29
SWFE	NA	NA	6	7	13

No events indicating successful use of jump-out structures by mule deer were documented (Table 3). Similarly, no mule deer were documented travelling on the forest side of the exclusion fencing at any of the tree-based jump-outs, instead the tree-based jump-out cameras documented 30 events of mule deer travelling on the road-side of the fencing (Table 3). All 20 mule deer structure crossing events documented at fence-end cameras occurred at the northeast camera (NEFE), with 70% of the crossings being individuals travelling from the forest-side to the road-side of the exclusion fencing. These observations indicate that the northeast fence-end may not be functioning as intended and may need adjustments to further minimize movement into the road corridor. However, although mule deer actually crossing the fence-end were more often entering the road corridor than exiting the corridor, the NEFE camera documented more individuals travelling along the forest-side of the fence than the road-side, suggesting the majority of deer are remaining on the forest-side of the fence. No structure crossings were detected at the northwest fence-end camera (NWFE; Table 3). This fence-end is also the location of high human-activity with hikers and vehicles actively moving through the area. Additionally, this fence-end terminates next to a large lava flow which likely further serves as a barrier. This human activity and relative position to the lava flow may deter deer from

crossing at this junction, as would be suggested by the low overall number of deer detections at this camera. The majority (93%) of trigger events at the SEFE camera were of mule deer travelling on the forest side of the exclusion fencing whereas the SWFE camera documented about equal occurrences of individuals inside and outside of the fencing (Table 3). This result is not surprising given the position of the cameras relative to roads and off- and on-ramps for Route 97. The SEFE camera documented the only elk (*Cervus canadensis*) observed in the 2015 dataset, which was moving south on the inside of the exclusion fence. Unfortunately, it was not possible to evaluate if this or other individuals on the road-side of the fence were able to exit via the electric wildlife mat (i.e., electroMat) setup across the off-ramps on the south end of the project, as there were no cameras setup to document activity at the electro mats.

Looking forward we expect to see many of the same species reported in 2015 and prior years (Bliss-Ketchum and Parker 2015; Table 2). It should be noted that gaps in data existed in 2015; Table 4 provides a representation by camera of time periods for which data was absent. It is not expected that the missing photos will affect the primary goal of evaluating mule deer use of the crossing structures; however, it will likely affect the overall species count and lower the chance of detecting elusive species, such as black bears (*Ursus americana*) or wolves (*Canis lupus*).

Table 3. Calendar showing approximate time periods in 2015 for which data was available, analyzed, and reported on (gray regions) and where data was unavailable (white areas).

Structure	Camera ID	January	February	March	April	May	June	July	August	September	October	November	December
Crawford Road	CR1W												
	CR2W												
	CR3W												
	CR4W												
	CR5E												
	CR6E												
	CR7E												
South Lava Butte	SL1W												
	SL2W												
	SL3E												
	SL4E												
Jump-Outs	JSW1R												
	JSW1W												
	JSE1R												
	JSE1W												
	JNW1R												
	JNW1W												
	JNE1R												
	JNE1W												
Fence-Ends	NEFE												
	NWFE												
	SEFE												
	SWFE												

Literature Cited

Bliss-Ketchum, L., and C. Parker. 2015. Lava Butte wildlife crossing monitoring project. Final report, Portland State University, Portland, Oregon, USA.

Coe, P.K., R.M. Nielson, D.H. Jackson, J.B. Cupples, N.E. Seidel, B.K. Johnson, S.C. Gregory, G.A. Bjornstrom, A.N. Larkins and D.A. Speten. 2015. Identifying migration corridors of mule deer threatened by highway development. Wildlife Society Bulletin, 39:256-267.

Appendix A: Views from remote cameras at wildlife crossing structures along U.S. Route 97 between milepost 149 to MP 153 from Lava butte to South Century Drive.

Appendix A1. Views from remote cameras at the multi-use Crawford Road (CR) wildlife underpass on U.S. Route 97. Photos are labeled with the camera ID. Photos 1a-d represent views from cameras situated on the west side and 1e-g represent cameras on the east side of the underpass.

1a. CR1W

1b. CR2W

1c. CR3W

1d. CR4W

Appendix A1. Views from remote cameras at the multi-use Crawford Road (CR) wildlife underpass on U.S. Route 97. Photos are labeled with the camera ID. Photos 1a-d represent views from cameras situated on the west side and 1e-g represent cameras on the east side of the underpass.

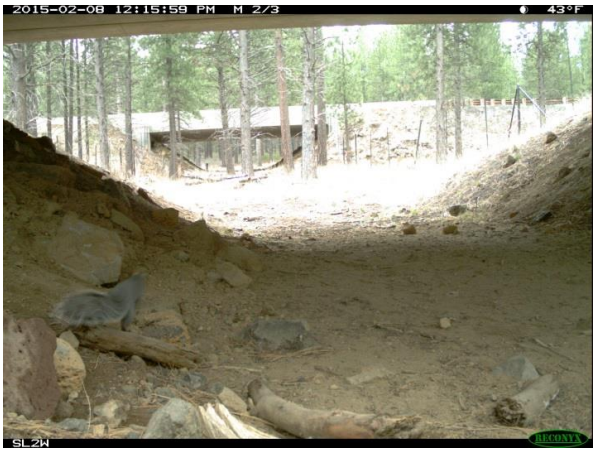
1e. CR5E

1f. CR6E

1g. CR7E

Appendix A2. Views from remote cameras at the South Lava Butte (SL) wildlife underpass on U.S. Route 97. Photos 2a-b and 2c-d represent views from cameras situated on the west side and east side of the underpass, respectively.

2a. SL1W



2b. SL2W

2c. SL3E

2d. SL4E

Appendix A3. Views from remote cameras at the jump-outs in the exclusion fencing along U.S. 97. There are two cameras for each jump-out; one tree-based and one ground-based camera.

3a. JSW1R. Southwest tree-based camera.

3b. JSW1W. Southwest ground-based camera.

3c. JSE1R. Southeast tree-based camera.

3d. JSE1W. Southwest ground-based camera.

3e. JNW1R Northwest tree-based camera.

3f. JNW1W. Northwest ground-based camera.

Appendix A3. Views from remote cameras at the jump-outs in the exclusion fencing along U.S. 97. There are two cameras for each jump-out; one tree-based and one ground-based camera.

3g. JNE1R. Northeast tree-based camera.

3h. JNE1W. Northeast ground-based camera.

Appendix A4. Views from motion detecting cameras at the fence-ends or fence-corners in the exclusion fencing setup along U.S. Route 97.

1a. NWFE. Northwest fence-end that terminates at a lava mound.

1b. NEFE. Northeast fence-end that terminates at lava mound.

1c. SWFE. Southwest fence corner near U.S. 97 south-bound off-ramp and Hwy 42.

1d. SEFE. Southeast fence line near U.S. 97 north-bound on-ramp along fence.