Using constructed covers to protect infrared cameras while surveying wildlife along roadways

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ABSTRACT. We examined the effectiveness of simulated underground utility cable markers in hiding infrared cameras along a roadway. Our study took place in the summer of 2014 and winter of 2015 as part of a survey to determine whether swift fox (*Vulpes velox*) were present along the route of a planned highway expansion project in western Nebraska. Camera covers were constructed of square vinyl posts modified to conceal and camouflage the camera, and used in conjunction with a scent attractant. Camera stations were placed approximately 1.6 km apart and ran for 5 nights along a 200 km stretch of the planned construction site. There were 2,135 trap nights in the study. No camouflaged cameras were taken or disturbed in any way. The only camera placed along the roadway during the survey that was not placed in one of our covers was cable-locked to a utility pole. It was stolen within 3 days. By allowing cameras to remain in the right-of-way (ROW), obtaining access to place the cameras was greatly facilitated in many areas. The cost per camera cover was approximately $20. We conclude this method of disguising cameras is an effective one for roadside use.

INTRODUCTION

Infrared cameras have become popular tools for monitoring wildlife. They are noninvasive (Stratman and Apker, 2014), they can improve accuracy of species identification (Foresman and Pearson, 1998) even to the point of being able to identify individual animals

(Karanth and Nichols, 1998), they can improve detection rates and decrease refusals and latency to detection times (Foresman and Pearson, 1998). Improved technology has resulted in cameras that can function for many days even in inclement weather without the need to be maintained (Gompper *et al.*, 2006). Additionally, they effectively document numerous species of medium-sized carnivores (Foresman and Pearson, 1998; Maruzzi *et al.*, 2002, Gompper *et al*,. 2006; Heilbrun *et al.*, 2006; Stratman and Apker, 2014; Lesmeister *et al.*, 2015). Consequently, camera trap surveys are often preferable to other survey techniques (Foresman and Pearson, 1998; Silveira *et al.*, 2003; Gompper *et al.*, 2006).

Roadways can offer a viable framework from which wildlife surveys may be conducted (Linhart and Knowlton, 1975; Sargeant *et al.*, 2005; Sauer *et al.*, 2013). Roadways provide researchers with convenient access to stations in the road right-of-way (ROW) and may reduce or eliminate the need to obtain permission for access to survey sites. With easy access, however, comes increased visibility to passing drivers and greater potential for camera tampering including theft. Surveys that use station placement at standardized distances create the possibility of a person recognizing the pattern and may make cameras particularly susceptible to tempering.

Camera surveys may save labor cost over other techniques, but the direct cost of each station (~ $200 for a camera of intermediate quality) can be costly. Camera surveys carried out in areas with public access carry with them an increased possibility of equipment theft, and equally or more important is the loss of associated data collected by the camera.

One approach to prevent tampering, including theft, is to armor and anchor the camera station. This approach typically incorporates a metal security box and a cable to physically secure the camera in place. Security cables offer some protection, but most cables thin enough to

fit through the security box housing are also thin enough to be easily cut. Or if the cable is run directly through the camera housing, the housing itself can be broken to release the camera without affecting its functionality. Security boxes offer some protection and have been used effectively (Fiehler *et al.*, 2007). Cables or boxes add an additional cost of $20-$50 or more per camera station, and the added size may increase a camera station visibility which may be attract more human attention. Even with these measures, the camera is still susceptible to tampering or destruction. When practical, camouflaging the camera to minimize attention from people may be a better option.

The swift fox (*Vulpes velox*) is a small (~ 2 kg) canid currently listed as a state endangered species in Nebraska. The Heartland Expressway Corridor (HEC) is part of the larger Great Plains International Trade Corridor, a four-lane divided highway system currently under construction that will run from Canada to Mexico (Heartland Expressway Association, n.d.). The portion of the HEC that lies within the state of Nebraska is approximately 300 km in length and bisects recognized swift fox habitat in the panhandle of the state (NNHP, 2011). In preparation for construction expanding two-lane state highways to four-lane divided highways, the Nebraska Department of Roads (NDOR) funded a camera survey of the route to determine if swift fox were present along the route. Markers for coaxial or fiber cables are found on road ROWs throughout Nebraska roadways. They mark the location of underground utility cables. They are a common but easily overlooked feature of the landscape.

MATERIALS AND METHODS

Cable-marker mimic camera covers were created for a swift fox study in Nebraska. The intent was for the cameras to remain unnoticed as there were no means of physically securing the

cameras to immovable objects. Nebraska does not have trees along roads in much of the western part of the state, and fence posts are often metal t-posts, neither of which are conducive to hiding cameras. Before the survey, permission to place cameras in state highway ROWs was requested from the Nebraska Department of Roads, and permission to place cameras in county road ROWs was requested from 6 county road departments within the survey area. When access could not be obtained to the ROW, private landowners were contacted for access to their land. Covers were used when highway or county road ROW access was obtained, except for one camera. Where private land access was obtained, cameras were hidden off the ROW, and use of the covers was not necessary. IACUC approval was also obtained for this study from the University of Nebraska at Kearney IACUC committee, submission number #071813.

Twenty camera covers were produced by cutting ten vinyl fence posts, measuring 12.7 cm x 12.7 cm x 3.048 m, in half. Using a scroll saw, "T"-shaped holes were cut to accommodate the cameras lens and flash unit (Fig. 1). The top of these holes was placed approximately 0.7 m from the top of the cover, so when in use, cameras were approximately 0.5 m off the ground. Two 15.24 cm long bolts were placed through the post to form a platform on which to place the camera. Weighted plastic bags, we used dry beans, were used to fill the empty space behind the camera so it remained upright and flush with the inside edge of the post (Fig. 2). A vinyl white pyramid cap was placed on top of the post. Die-cut vinyl letters and numerals were added to one side of the post to mimic the signage found on actual buried cable markers in the area.

Camera stations were planned to occur at 1.6 km intervals which is a conservative estimate of the radius of the home range of swift fox (Rongstad *et al.*, 1989). This conservative value was used to give the greatest detection chance possible (Finley *et al.*, 2005). When the precise location occurred on a road intersection or driveway, the station was moved about 30 m

from the intersection to avoid being present where stationary drivers would have time to examine the covers. Covers were placed approximately 5 meters from the ROW edge and secured by burying approximately 0.15 m deep so that 1.1 m of the cover post was exposed (Fig. 3). In trial efforts, cameras orientated parallel to the road produced high numbers of false positives due to passing automobiles, so cameras were faced perpendicular to and away from the road. The distance from the road edge to the camera cover varied with the width of the ROW on various sections of the road. Typically, the ROW extended 10 m or more beyond the edge of the road surface. Once cameras were placed, a garden stake was placed 2.5m (8.2') in front of the camera and lured with a skunk essence attractant made by heating petroleum jelly, mixing in skunk essence, and then allowing to cool and solidify (see Cudworth *et al.*, 2011). The total cost in materials per cover was approximately $20.

RESULTS

Permission to place cameras in ROWs was granted by the Nebraska Department of Roads and five of the six county road departments within the survey area. We also obtained private land permission by 82 landowners in the survey area, some of which owned several parcels of land. Private locations were used in in the 5 counties where we had NDOR and county permission near towns and highway junctions to keep the camera placements as close to the survey design as possible. In the county where we did not have county road department permission, we placed cameras only on private land. Two camera surveys were carried out along the HEC: the main survey during the summer of 2014 and a small survey during February 2015. The first camera survey consisted of 278 stations, for a total of 1390 camera nights in all six counties of the study area. Of these, 113 stations (565 camera nights) were in the highway ROW

and used the manufactured camera covers. The second survey focused solely on those locations where swift fox were seen during the first survey. Eighteen cameras were run for 10 nights each for an additional 180 camera nights. Sixteen stations used in the second survey were placed in highway ROW and used the camera cover posts. Over the course of the study, a total of 745 camera nights were completed using the camera cover posts.

No cameras housed in the covers were stolen over the course of the study. Only one camera was stolen during both surveys and this camera had been cabled to a telephone pole. This was the only camera secured by this method during the study. It was taken during a planned five night survey. The cable had been cut and the camera removed.

DISCUSSION

Camera cover manufacture proved to be well worth the time and expense for this study. It eliminated camera theft for ROW stations, allowed consistency in camera placement and offered additional weather protection to the camera equipment.

By allowing the cameras to be placed in ROWs, we could obtain most of the needed access from road departments, which greatly reduced the need to seek access from numerous private landowners. In addition, in the one county where access from the county was denied and private landowner permission could not be obtained, these camera covers allowed the use of state highway ROWs to fill in the gaps in coverage, which was crucial to the completion of the project.

The cost of materials to construct these camera covers is comparable or even cheaper than commercially available camera security options, and though not a direct comparison, our study indicated our covers were also more effective at protecting the cameras. The one camera

stolen was cabled to a telephone pole, and the lack of tampering with our cameras indicates they were effective at going unnoticed.

There are a couple of modifications that may improve the functionality of these covers. Burying the covers at each station may not have been the most efficient option. A staking system using a rebar stake may be quicker and less labor intensive to deploy. By drilling holes near the bottom and middle front of the cover, two zip ties can be used to firmly affix the cover to the rebar. In addition, by eliminating the need to bury part of the cover, each 8 foot vinyl fence post can be cut into equal lengths for three covers rather than two, further reducing the cost of construction materials. A more durable alternative to the bag of beans used the hold the camera firmly against the front of the cover is a 12 cm length of a 5.08 cm x 10.16 cm (2x4 in) board placed behind the camera and used in conjunction with a door shim which acts as a wedge. Finally, though we chose not to paint our covers, they can be painted to match the predominant color of cable markers in the area.

These buried cable marker camera covers provided efficient, inexpensive protection for the trail camera equipment used in this study. It is recommended to investigate the type of roadside markers used in the study area of future surveys and attempt to match their design as closely as possible to avoid detection.

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Figure 1: Camera cover showing bolts that form camera platform, hole for camera lens and vinyl decals added for camouflage.

Figure 2: Camera inside cover with sealed bags of beans holding camera in position.

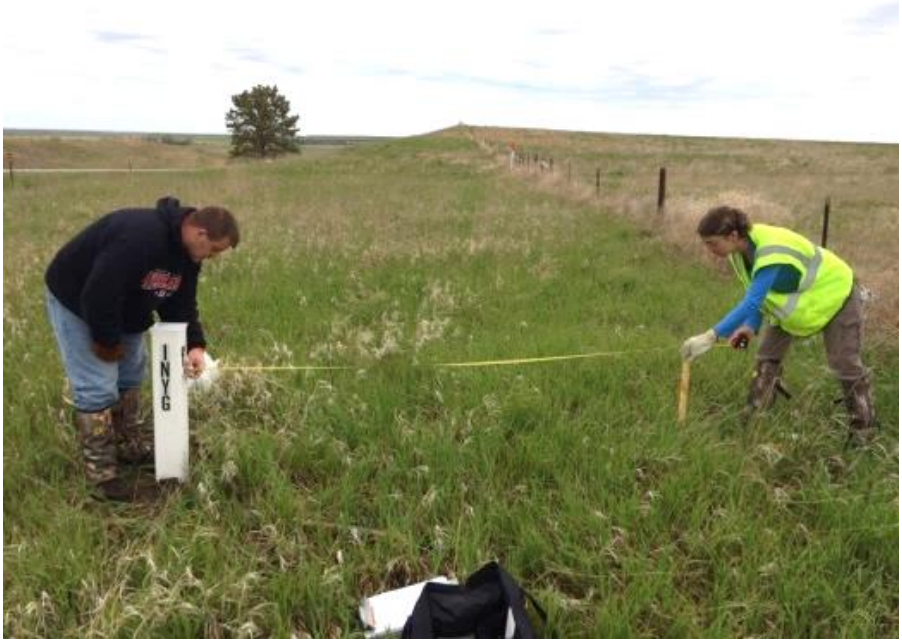

Figure 3. Camera cover position in ROW showing camera orientation (opposite roadway on left), distance to scent stake (measured for accuracy) and depth covers were buried.