February 2009

AgriLIFE EXTENSION
Texas A&M System

Potential Uses for Trail Cameras in Wildlife Management

Table of Contents

Potential Uses for Trail Cameras in Wildlife Management

Justin Z. Dreibelbis, Education Program Specialist, Texas Wildlife Association
Shawn L. Locke, Extension Associate, Texas AgriLife Extension Service
James C. Cathey, Assistant Professor and Extension Wildlife Specialist, AgriLife Extension Service
Bret Collier, Research Scientist, Institute of Renewable Natural Resources, Texas A&M University

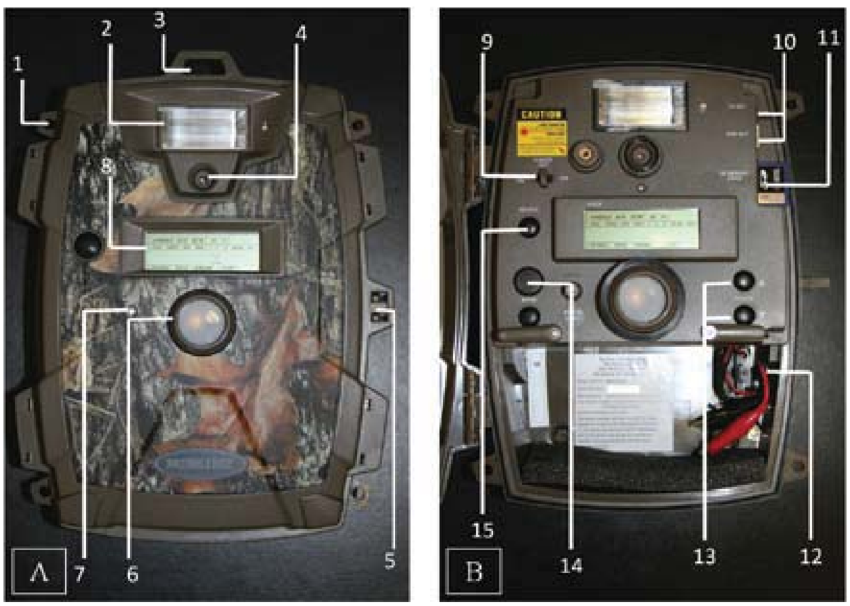

Figure 1. Diagram of the external (A) and internal (B) components a Moultrie Game Spy trail camera.
1. Mounting Cord Lug
2. Electronic Flash
3. Viewfinder
4. Camera Lens
5. Lockable Latch
6. Infrared Sensor
7. Status Light
8. LCD Status Display
9. Power On/Off Button
10. TV and USB Ports
11. SD Memory Card Slot
12. Battery Compartment
13. Change Buttons
14. Mode Button
15. Select Button.

Trail cameras have become an increasingly popular tool for viewing wildlife. Historically, trail cameras were used in wildlife research to study activity and animal behavior (Foster and Humphrey 1995, Main and Richardson 2002), identify nest predators (Hernandez et al. 1997a, 1997b, Staller et al. 2005), estimate population size (Jacobson et al. 1997, Sweitzer et al. 2000, Roberts et al. 2006), and monitor species occurrence including rare and endangered species (Karanth and Nichols 1998, Ng et al. 2004, Watts et al. 2008) among other applications. As camera technology improved, manufacturers made trail cameras commercially available and units have become more affordable and much easier to use. Trail cameras have become more efficient with the incorporation of digital technology, resulting in dramatically improved battery life and photo storage capabilities. Currently, a wide variety of trail cameras ranging in price ($130–500 USD) can be purchased at most outdoor-related stores (Appendix A).

At present, most cameras are digital, having storage media (e.g., compact flash or secure digital card), visible or invisible flash, power supply, and a trigger mechanism (Figure 1) all encased in a weatherproof protective shell that can be mounted to a tree or post. Often digital cameras are equipped to take still photos and/or short video clips. Units can be programmed to insert a time delay between photos (1 minute–1 hour) and they imprint the date and time on each photograph. The camera is typically triggered by heat and/or motion of animals within a certain distance (~60 feet). Sensitivity of the trigger can be adjusted to optimize use in day or night settings or for different size species. Although specific storage media may differ by model, storage capacity can be enormous depending on the size of memory card used (often purchased separately). Battery life that once limited digital units has advanced significantly, and currently cameras are capable of remaining operational for up to 150 days (depend-


(2a.)


(2b.)


(2c.)

Figure 2. Trail cameras are typically used to photograph game species such as white-tailed deer (A and B) and other species that frequent feeders like feral hogs (C).

ing on specific model) or ≥1,000 pictures using battery-saving technology. A typical flash is often included but advanced models are equipped with an invisible infrared flash that does not startle animals. Numerous accessories can be purchased with the trail camera such as external battery packs and solar panels for extended life, protective cases for extreme conditions, and locking mechanisms to prevent theft.

Most people purchase a trail camera to provide "an extra set of eyes" at feeders, along game trails, and in other locations (Figure 2). For hunters, trail cameras allow scouting of multiple areas over the same period of time, and monitoring 24-hour activity at locations for specific game species such as white-tailed deer *(Odocoileus virginianus*). For wildlife enthusiasts, trail cameras provide a way to document and view shy or rarely seen wildlife such as bobcats (*Lynx rufus*), ocelot (*Leopardus*


(3a.)


(3b.)


(3c.)

(3d.)

(3e.)

Figure 3. Trail cameras provide users with an opportunity to document and view elusive species as well as observe behavior typically not seen like bighorn sheep rams fighting (E; photo courtesy of the Texas Bighorn Society). Bobcat (A), gray fox (B), coyote (C), and mountain lion (D; photo courtesy of the Texas Bighorn Society).

pardalis), and mountain lions (*Puma concolor*). See Figure 3)

Trail cameras can be used for more than just nature viewing or scouting, and can be a powerful management tool for landowners, land managers, and hunters (here after managers). For instance, information can be collected on animal movement and range size, minimum population size, demographic data (e.g., buck:doe and fawn:doe ratios), identifying nest predators, or cataloging vertebrate diversity. Trail cameras provide information that complements other sources of data collected on the property (e.g., browse surveys, spotlight counts, harvest data) to strengthen management decisions.

The goal of this publication is to identify potential uses of trail cameras for wildlife management and instruct how to manage and use information from trail cameras to assist with wildlife management on private properties.

Trail Camera Placement

One of the first questions asked when dealing with trail cameras is, "How many do I need?" The answer depends on the goals and objectives to be accomplished. For instance, Jacobson et al. (1997), suggested 1 camera per 160 acres can do an adequate job of photographing most of the deer on a piece of property. But their results may not be applicable to properties of different size and/or containing deer populations of differing densities and sex ratios. Additionally, more cameras per acre may be necessary for species with smaller range sizes or species that are considered rare or elusive. On large properties, it is not necessary to purchase numerous trail cameras but systematically move a small number of cameras (4-5) every 10 days to adequately cover the property over time. Perhaps a more efficient strategy would be to identify areas of high priority and monitor wildlife in these specified areas. However, this may bias data by not adequately surveying the entire piece of property.

Once a sufficient number of cameras is determined, camera stations should be established across the property. Aerial photographs and topographic maps of the property can aid in ensuring

(4a.)

(4b.)

Figure 4. Trail cameras can be easily mounted to a post (A) or a tree (B) within the effective range of target wildlife species.

(5a.)

(5b.)

Figure 5. White-tailed deer productivity (A), sex ratios and age structure information can be collected from trail camera photographs as well as antler quality (B).

adequate coverage and spacing between camera stations. For example, place a grid over an aerial photograph and divide the photo into 100-acre blocks. Subjectively place a camera in each block for a period of time and then move the cameras to new locations until the property has been adequately surveyed.

A common mistake committed by trail camera users is using cameras only at game feeders. It is important to realize not all wildlife species visit feeders regularly, including white-tailed deer. In fact, feeder visitation by white-tailed deer might be influenced by various population parameters such as sex ratios, age structure, and density among others. Therefore, individuals or other species may be missed by using cameras only at feeders. Alternative locations for trail cameras include natural funnels (stream crossings, draws, or corridors), game trails, water sources, or areas with wildlife sign (scrapes, rubs, scat, or tracks). Again, aerial photos and topographic maps can aid in finding these locations in addition to field scouting.

The target species will dictate camera location and placement (height above the ground). For instance, 3–4 feet above the ground is ideal for deer, but smaller species (rodents or small carnivores) may be missed. Trail cameras should be mounted to a tree or post (using wire or cord) within the effective range of wildlife (Figure 4). Most units are relatively easy to set up, but it is necessary to read the directions and program the unit properly. Always conduct a quick test to ensure it is working properly and the image quality is sufficient. The unit is now ready for use but should be checked periodically for battery life and to retrieve images.

Data Management

Before cameras are set up for the first time, it is important to set goals and determine what objectives can be gained from the pictures taken. Whether the goal is to supplement survey data with pictures taken from a well-planned camera design or to see what is using the water hole, it is important to understand that cameras can create enormous amounts of data (thousands of images) in a short amount of time, and a data-management plan is necessary.

Some camera companies such as Cuddeback® now have data-management software available that can be an excellent way to maximize the camera data. Photo-management software can also be purchased separately. Software should collect, organize, and store images such that retrieval of specific photos is quick and easy. Most software packages offer image enhancement tools that allow the user to zoom in or adjust brightness, color, and contrast for optimal picture quality and clarity. These options are beneficial in positively identifying wildlife within a photo. Nothing is more frustrating than knowing a photograph of an individual animal exists but being unable to find it due to poor organization and management. Therefore, an organizational and storage plan is recommended prior to camera placement.

Potential Uses for Cameras

Whether placed on a managed game ranch or recreational property, trail cameras can be a valuable tool for viewing animals without the observer actually being present. Many times cameras provide a better option for observation because they allow monitoring animals without disturbing them. With these photographs, you can keep track of a number of important factors critical to understanding and managing different wildlife on your property. Next, we identify specific uses for trail cameras by species or groups of species.

White-tailed Deer

Deer hunting is a multi million-dollar industry in Texas and managers are often looking for efficient ways to better manage deer herds. Cameras can be useful for managers to survey the quality and abundance of deer on the property, as well as collect data that will improve their management program. The main advantage of using trail cameras is the opportunity to scrutinize photos of deer from multiple angles and for as long as necessary. This opportunity is rare when viewing deer in the field.

Population management of white-tailed deer involves manipulating harvest rates to adjust abundance, sex ratios, and/or age structure to achieve wildlife-management goals (Demarais et al. 2000 Figure 5). A few population-survey techniques using cameras have been proposed (Jacobson et al. 1997, Sweitzer et al. 2000, Roberts et al. 2006) and tested (Watts et al. 2008) to a certain extent in different areas of the U.S. However, Ditchkoff (2007) warns landowners and managers about the dangers of naively using these techniques. People using camera-survey techniques need to understand the assumptions prior to using them. For example, one assumption is that all deer have an equal chance of being photographed. Violation of this assumption can bias the results. Ditchkoff (2007) also stresses the importance of learning the land by conducting range condition and browse surveys to be able to make responsible decisions with population data. While cameras are not a perfect way of estimating population size, they are at the very least a means for obtaining a minimum count of adult bucks present on the property (Jacobson et al. 1997).

(6a.)

(6b.)

Figure 6. Trail cameras can provide valuable information on upland gamebirds like wild turkeys (A) and northern bobwhite (B).

Photos also provide a means of collecting demographic data such as sex ratios and productivity (e.g., doe:fawn ratios). Bucks can be placed into age classes (fawn, yearling, middle age, or older age), number of points, and antler spread (inside ears, at ears, or outside ears). Each of these categories can be somewhat subjective and difficult to determine from a photograph, but multiple photographs of the same deer may aid in placing bucks into these broad categories. The number of bucks in each class can be graphed and compared among years to determine the effects of management on age structure and antler quality over time (Kroll and Koerth 2008). Through selective harvest, sex ratios, age structure, and antler characteristics, quality of the

(7a.)

(7b.)

Figure 7. Trail cameras have been used to document nest predators of ground nesting birds. Western spotted skunk (A), feral hog (B), Texas rat snake (C; note hen in background), striped skunk (D), and common raven (E).

population can be manipulated to achieve desired management goals.

From a hunting perspective, photos allow managers to identify individuals in the population for harvest. Trophy bucks can be identified before the season, making the decision process to harvest a deer or not much easier than under field conditions. Cameras can provide year-round scouting information with minimal effort required from the manager. Cameras can also be very helpful at locating deer that are predominately nocturnal. Often, managers remark about the number and quality of deer on their property that remain unobserved.

(7c.)

(7d.)

(7e.)

Having a method to monitor deer at a variety of times can be very beneficial when it comes to evaluating the overall health the herd. Body condition can be determined from the photos. Photos can also be used to get a general estimate of range size and movements as individuals are photographed at different camera stations. All of

Figure 8. The diversity and productivity of non-game species can be monitored and documented with the use of trail cameras. A female northern cardinal (Cardinalis cardinalis) visits her nestlings (photo courtesy of Texas A&M RAMSES project).

this valuable information can supplement annual population and browse-survey data to help adjust management practices and harvest quotas.

Upland Gamebirds and Predator Community
Trail cameras can help monitor habitat use and movements of upland gamebirds such as wild turkeys (*Meleagris gallopavo*), northern bobwhite (*Colinus virginianus*), scaled quail (*Callipepla squamata*), Gambel's quail (*Callipepla gambelii)*, and lesser prairie chicken (*Tympanuchus pallidicinctus* See Figure 6) Photos can provide managers with locations and times that individuals access certain areas of the property. Photos also are good for collecting data such as female:male and poult:hen ratios. These data can provide information on the composition and productivity of the population and changes that occur on an annual basis. Again, trail camera data are not perfect but they can be used for population trends within and among years.

Another valuable use of trail cameras is nest surveillance for a variety of different bird species. Researchers in Texas (Hernandez et al. 1997a, 1997b, Dreibelbis et al. 2008) have been using motion-sensing trail cameras to monitor upland gamebird nests in different regions of the state for the last decade (Figure 7). Trail cameras allow researchers to monitor bird behavior, nest success rates, and the predator community that depredate and destroy nests.

Nest predation is a continual concern for ground-nesting gamebirds (Leopold and Hurst 1994, Hurst et al. 1996) and predation is a major cause of nest failure and adult mortality in northern bobwhite (Lehmann 1984, Rollins and Carroll

2001). Nest predation can reduce recruitment, limit population growth, and potentially make populations unsustainable (Cowardin et al. 1985).

Rader et al. (2007) found approximately 34% of northern bobwhite nests were depredated in south Texas. Predators in various parts of Texas depredated approximately 52% of wild turkey nests (Cathey et al. 2007; Figure 7). Dreibelbis et al. (2008) documented the partial predation of a Rio Grande wild turkey (M. g. *intermedia*) nest by a Texas rat snake (*Elaphe obsoleta lindheimeri*) where the hen resumed incubation and hatched the nest. (See Figure 7c.) They also documented a multiple predator event where 4 different predator species visited a single turkey nest over the course of 2 days, predating the nest and removing all evidence from the event. Data acquired from nest surveillance projects such as these can be beneficial to understanding upland gamebird nesting ecology and predator-prey relationships.

Artificial nests can provide managers with an easy and inexpensive way to document nest predators. By simply constructing artificial nests, usually made of 3-4 chicken eggs, in different areas of the property, managers can catalog different nest predators (Hernandez 1997a, 1997b). It is important to simulate a nest as closely as possible. For example, place artificial nests in grass clumps, brush piles, or cactus and lightly cover the nest with grass and leaves from the surrounding area. Then locate the trail camera within proximity of the nest so that any predator will be photographed at the nest. Human scent left behind may or may not attract some predators to the artificial nest; therefore, it may be advantageous to reduce human scent as much as possible during setup. Some researchers also suggest that different predators are attracted to artificial nests as opposed to live nests, but pictures of nest predation events can often describe trends taking place in the predator community.

The predator community can change from season to season, and trail cameras are the ideal tool for observing these changes. Predators are often secretive and difficult to observe during daylight hours, rendering trail cameras as one of the few options for positively identifying predators. Cameras can be set up at random points to catch predators in their natural environment, or scent or bait stations can be used. However, there is a chance that more predators will be drawn to the area as a result of the bait, possibly having a negative effect on target animals such as game species. Traditionally, scent stations were surrounded with flour or some type of powder so researchers could identify tracks left behind. However, the potential for error in identification is great when weather (wind or rain) ruins tracks, tracks are indistinguishable by the observer, or the observer is not skilled in track identification. Cameras offer the perfect solution to this problem by positively identifying each predator that visits the station at any time of day or night. Monitoring nest predators and the predator community in general can provide managers with evidence of trends occurring over time.

Non-game Species

Non-game species can be inventoried and monitored using trail cameras (Figure 8), thus providing a baseline inventory of species on the property. Trail cameras also allow one to "capture" rare and secretive species such as ocelots, mountain lions, or black bears (*Ursus americana*) that may inhabit an area but are seldom seen. Photographic evidence is far more conclusive evidence of species occurrence than visual observation because a photo can be analyzed by several professionals and thoroughly scrutinized. Camera traps have been used to document the occurrence of smaller species like timber rattlesnakes (*Crotalus horridus*) and small rodents (Sadighi et al. 1995, Pei 1995). Events such as bird migration can be monitored using cameras to inform managers when migrants have arrived for the year and provide a list of species. Since photos can be stamped with the day and time, arrival patterns can be compared among years. Additionally, trail cameras are an excellent instrument for absentee landowners to annually monitor species occurrence and distribution on their property. A cumulative list of wildlife species present on a property can be amassed over time to provide a valuable catalog of biodiversity.

Exotic Ungulates
Managers can use trail cameras to inventory and document exotic species inhabiting their property (Figure 9). Research has shown that many of the exotic ungulates in Texas can out-compete native white-tailed deer when there is a shortage of resources by utilizing different classes of forage (Lyons and Wright 2003, Armstrong and Harmel 1981). Many managers are unaware of the large number of exotics that pass through their property on a regular basis, but it is important to know which species are present for proper management. A list of exotic species that are found on the property combined with the frequency in which they occur can help managers develop harvest quotas for exotic species.

One example of an exotic species causing problems for a native species is the aoudad sheep (*Ammotragus lervia*) in western Texas. (See Figure 9b.) This African native uses many of the same mountain ranges in Texas as the native desert bighorn sheep (*Ovis canadensis*). While they do not generally associate with one another, they use the same habitat and waterholes. Water sources such as guzzlers present a potential source of disease transmission to desert bighorn sheep. Additionally, aoudad exhibit dominant behavior over desert bighorn sheep and may impede access to watering holes and preferred habitats (Foster 2002). Once pushed away from a watering site, desert bighorn sheep may be forced to find new habitat and water holes. Potential of disease transmission and social aversion may limit the desert bighorn sheep's survival and reproduction. Trail cameras have been used to document such occurrences and the data collected have assisted biologists in developing management strategies to deal with the problem (Foster 2002).

(9a.)

(9b.)

(9c.)

Figure 9. Exotic species that may compete with native species can be documented with trail cameras. Axis deer visit a feeder in the Edwards Plateau (A), an aoudad visits a guzzler site in the Trans Pecos (B; photo courtesy of Justin Foster), and a fallow deer shedding velvet at a camera location (C).

Conclusions

The use of trail cameras can be fun and educational but also provide useful information to supplement a wildlife management plan on private property. Trail cameras can provide managers with evidence on the presence or absence of wildlife species. They can document demographic and production parameters of various species and provide valuable information for managers or those simply interested in species that inhabit their property. Although trail cameras may not provide flawless information, they will certainly supplement other management activities to present a more clear representation of the wildlife present. Often trail camera users are amazed at what they photograph on their property, and cameras provide educational and useful information for managers.

Literature Cited

Armstrong, W. E. and D. E. Harmel. 1981. Exotic mammals competing with the natives. <http://www.tpwd.state.tx.us/publications/pwdpubs/media/pwd_lf_k0700_0103.pdf>. Accessed 25 March 2008.

Cathey, J. C., B. Collier, K. Melton, B. Cavney, J. Dreibelbis, S. L. Locke, S. J. DeMaso and T.W. Schwertner. 2007. The Rio Grande wild turkey: their biology and management. Texas A&M University System, Texas Cooperative Extension Publication B-6196 Pp. 1-16.

Cowardin, L. M., D. S. Gilmer, and C. W. Shaiffer. 1985. Mallard recruitment in the agricultural environment of North Dakota. Wildlife Monographs 49:1–37.

Ditchkoff, S. 2007. "Scientific" vs. "Artistic" deer management. Wildlife Trends – Practical Wildlife Management Information 7:7–11.

Dreibelbis, J. Z., K. B. Melton, R. Aguirre, B. A. Collier, J. Hardin, N. J. Silvy, and M. J. Peterson. 2008. Predation of Rio Grande wild turkey nests on the Edwards Plateau, Texas. Wilson Journal of Ornithology, 120:906-910.

Foster, J. A. 2002. Guzzler use and habitat selection by desert bighorn sheep at Black Gap Wildlife Management Area, Texas. Thesis. Sul Ross State University, Alpine, Texas USA.

Foster, M. L., and S. R. Humphrey. 1995. Use of highway underpasses by Florida panthers and other wildlife. Wildlife Society Bulletin 23:95–100.

Hernandez, F., D. Rollins, and R. Cantu. 1997a. Evaluating evidence to identify ground-nest predators in west Texas. Wildlife Society Bulletin 25:826–831.

Hernandez, F., D. Rollins, and R. Cantu. 1997b. An evaluation of Trailmaster camera systems for identifying ground-nest predators in west Texas. Wildlife Society Bulletin 25:826–831.

Hurst, G. A., W. L. Burger, and B. D. Leopold. 1996. Predation and Galliforme recruitment: an old issue revisited. Transactions of the 61st North American Natural Resources Conference 61:62–76.

Jacobson, H. A., J. C. Kroll, R. W. Browning, B. H. Koerth, and M. H. Conway. 1997. Infrared-triggered cameras for censusing white-tailed deer. Wildlife Society Bulletin 25:547–556.

Karanth, K. U., and J. D. Nichols. 1998. Estimation of tiger densities in India using photographic captures and recaptures. Ecology 79:2852–2862.

Kroll, J. C., and B. H. Koerth. Trail cameras: toys no more. http://www.northamericanwhitetail.com/deermanagement/dm_1003cameras/. Accessed 3 March 27, 2008.

Lehmann, V. W. 1984. Bobwhites in the Rio Grande Plain of Texas. TexasA&M University Press, College

Station, USA.

Leopold, B.D., and G. A. Hurst. 1994. Experimental designs for assessing impacts of predators on gamebird populations. Transactions of the 59th North American Natural Resources Conference 59:477–487.

Lyons, R. K., and B. D. Wright. 2003. Using livestock to manage wildlife habitat. Texas A&M System, Texas Cooperative Extension Service. B-6136, Pg. 1-10.

Main, M. B., and L. W. Richardson. 2002. Response of wildlife to prescribed fire in the southwest Florida pine flatwoods. Wildlife Society Bulletin 30:213–221.

Ng, S. J., J. W. Dole, R. M. Sauvajot, S. P. D. Riley, and T. J. Valone. 2004. Use of highway undercrossings by wildlife in southern California. Biological Conservation 115:499–507.

Pei, K. 1995. Activity rhythm of the spinois country rat (*Niviventer coxingi*) in Taiwan. Zoological Studies 34:55–58.

Rader, M. J., T. W. Teinert, L. A. Brennan, F. Hernandez, N. J. Silvy, and X. B. Wu. 2007. Identifying predators and nest fates of bobwhites in southern Texas. Journal of Wildlife Management 71:1626–1630.

Roberts, C. W., B. L. Pierce, A. W. Braden, R. R. Lopez, N. J. Silvy, P. A. Frank and D. Ransom Jr. 2006. Comparison of camera and road survey estimates for white-tailed deer. Journal of Wildlife Management 70:263–267.

Rollins, D., and J. P. Carroll. 2001. Impacts of predation on northern bobwhite and scaled quail. Wildlife Society Bulletin 29:39–51.

Sadighi, K., R. M. DeGraaf, and W. R. Danielson. 1995. Experimental use of remotely-triggered cameras to monitor occurrence of timber rattlesnakes (*Crotalus horridus*). Herpetological Review 26:189–190.

Staller, E. L., W. E. Palmer, J. P. Carroll, R. R. Thornton, D. C. Sisson, and R. P. Thornton. 2005. Identifying predators at northern bobwhite nests. Journal of Wildlife Management 69:124–132.

Sweitzer, R. A., I. A. Gardner, W. M. Boyce, J. D. Waithman, and D. V. Vuren. 2000. Estimating sizes of wild pig populations in the north and central coast regions of California. Journal of Wildlife Management 64:531–543.

Watts, D. E., I. D. Parker, R. R. Lopez, N. J. Silvy, and D. S. Davis. 2008. Distribution and abundance of endangered Florida Key deer on outer islands. Journal of Wildlife Management 72:360–366.

Appendices

Appendix A. Specifications on three popular, commercially available brands of trail cameras.

	Model	Trigger Technology[1]	Battery Life	Megapixels	Flash Range (ft)	Video Clips	Flash Technology	Media	USB Cable	Delays	Sensitivity Adjustment	Password Protection	MSRP
Cuddeback	No-Flash	PIR	500-1,000 images	1.3–3.0	40–60	–	Infra-red	Com-pact Flash	No	1 min - 1 hr	Yes	Yes	$449.99
	Expert	PIR	500-1,000 images	3	60	Day	White	Com-pact Flash	No	1 min - 1 hr	Yes	Yes	$399.99
	Excite	PIR	500-1,000 images	2	40	–	White	Com-pact Flash	No	1 min - 1 hr	Yes	No	$299.99
Moultrie Game Spy	I-60	PIR	150 days	6	50	Day/ Night	Infra-red	SD card	Yes	1 min - 1 hr	NA	Yes	$339.99
	M-60	PIR	150 days	6	50	Day	White	SD card	Yes	1 min - 1 hr	NA	Yes	$279.99
	I-40	PIR	150 days	4	50	Day/ Night	Infra-red	SD card	Yes	1 min - 1 hr	NA	No	$239.99
	M-40	PIR	150 days	4	50	Day/ Night	White	SD card	Yes	1 min - 1 hr	NA	No	$209.99
	D-40	PIR	60 days	4	40	Day/ Night	White	SD card	No	1 min - 1 hr	NA	No	$129.99
Bushnell	Trail Scout Pro	PIR	30 days	3, 5, 7	30	Day/ Night	Infra-red	SD card	No	1 min - 1 hr	Yes	Yes	$429.95
	Trail Scout	PIR	30 days	2, 3, 5	45	Yes	Infra-red	SD card	No	1 min - 1 hr	Yes	Yes	$259.95
	Trail Sentry	PIR	30 days	2–5	30–45	Yes	Infra-red	SD Card	No	1 min - 1 hr	Yes	Yes	$259.95

1 – Trigger technology refers to how the camera is set off; PIR – Passive Infrared.

Appendix B. Data sheet for trail camera surveys[1].

Date	Ranch											
	GPS Location		Deer				Upland Game Birds			Mammalian		Non-Game
Camera #	X	Y	No. of Bucks	Unique Bucks	Does	Fawns	Male	Female	Juvenile	Predators	Exotics	Species
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
Totals												

1 – Weather data associated with the survey period is useful because animal movements are affected by climate.

Issued in furtherance of Cooperative Extension Work in Agriculture and Home Economics, Acts of Congress of May 8, 1914, as amended, and June 30, 1914, in cooperation with the United States Department of Agriculture.
Edward G. Smith, Director, Texas AgriLife Extension Service, The Texas A&M System.