Wednesday, 18 February

1:10 p.m.

UNMANNED AUTONOMOUS VEHICLES

THOMAS B. HARDY, Professor of Environmental Flows, Texas State University, San Marcos, TX, 78666, USA

Application of Unmanned Autonomous Vehicles (i.e., drones) in support of wildlife management are increasing. The breadth of such systems range from small helicopters with flight times less than 15 minutes and low cost to acquire and maintain up to military surplus systems such as a GlobalHawk with extended loiter time but very expensive to both purchase and maintain. Texas State University has focused on the UAV developed at Utah State University (AggieAir and Minion) that are relatively cheap (~$25-50k) to purchase, maintain, and deploy while providing access to high quality multispectral digital imagery (that includes thermal IR with the Minion system). The AggieAir and Minion systems were specifically designed for applications in natural resource settings that would be affordable to typical resource agency budgets and expertise, easy to deploy in remote areas, and meet multispectral remote sensing needs. We field tested the AggieAir system over a two year period across a variety of prioritized Texas Parks and Wildlife Department resource management and monitoring needs where use of an UAS would potentially meet application needs, reduced costs, and remove pilot/observer risks. The system demonstrated its capability across a number of the test projects and suggest that a wider application is possible.

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1:35 p.m.

TEAM TOOL: HABITAT ANALYSIS MADE SIMPLE

AMIE TREUER-KUEHN, Landscape Ecology Team, Texas Parks and Wildlife, 4200 Smith School Road, Austin, TX, 78744, USA

Texas Parks and Wildlife's Landscape Ecology team has developed a Google maps based application, Texas Ecosystem Analytical Mapper, (TEAM) to deliver the Ecological Mapping Systems of Texas (EMS) data to Texas citizens. Currently, these data are only available to those with expensive Geographic Information Systems software. The TEAM application is an **interactive mapping tool** that will assist users in understanding Texas habitats and integrate vegetation data with land management and resource planning of all types. Wildlife biologists, land managers, naturalists, planners, and conservationists are able to use TEAM to view and print the EMS data in relationship to other natural feature layers such as soils, geology, hydrology and ecoregion. The TEAM application is being delivered in two phases. Phase 1 (available now) allows the user to view and print custom maps and reports of habitat data from both uploaded kml and shapefiles or areas of interest drawn within the application. Other capabilities include; exporting the map and report to a pdf and calculating the number of acres of each vegetation type within the area of interest. Phase 2 (available 2016) will add a data entry module and individual profiles for users. TEAM supports land management and conservation approaches incorporating the most current data. It also provides an avenue for community involvement in habitat understanding.

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2:00 p.m.

THE USE OF INATURALIST AT TEXAS PARKS AND WILDLIFE

CULLEN HANKS, Texas Parks and Wildlife, 4200 Smith School Road, Austin, TX, 78744, USA

The Wildlife Diversity Program (WDP) manages data on over 1,000 species of plants and animals. Given the large number of species tracked and the immense geographical extent of Texas, obtaining data is a significant logistical challenge. To overcome this challenge, the WDP is using iNaturalist to generate photo-vouchered observations of tracked species. The initial focus of the citizen science program has been a project targeting amphibians and reptiles, the Herps of Texas Project. Since its inception in 2011, this project has collected over 10,000 observations of amphibians and reptiles from over 500 participants. It has also engaged a community of naturalists that were not previously contributing to our database. To instill a sense of achievement, we are promoting life lists, leaderboards, and challenges. For 2014, we also established a Big Year Challenge to see who can find the most species of amphibian and reptile species during the calendar year. In addition, we are promoting seasonal challenges that highlight data gaps and herping opportunities. The Herps of Texas Project has generated high-quality data at relatively low cost while simultaneously engaging Texas citizens. This platform has potential utility for private landowners, parks, and professional biologists.

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2:25 p.m.

BEHAVEPLUS: FIRE BEHAVIOR MODEL

WESLEY EVANS, Regional Fire Coordinator, Texas Parks and Wildlife Department, 6318 Old Mason Road, Mason, TX, 76856, USA

BehavePlus is an open-source computer program that allows wildlife management professionals to better use prescribed fire as tool by modeling fire behavior and fire effects. According to the Missoula Fire Sciences Laboratory, BehavePlus "is composed of a collection of mathematical models that describe fire behavior, fire effects, and the fire environment based on specified fuel and moisture conditions. The program simulates rate of fire spread, spotting distance, scorch height, tree mortality, fuel moisture, wind adjustment factor, and many other fire behaviors and effects; it is commonly used to predict fire behavior in multiple situations." What this means for the wildlife professional is that he or she can use this program to determine how weather and environmental factors can influence fire behavior. BehavePlus can also assist in setting prescribed fire parameters that will meet intended resource goals while reducing negative fire effects and/or safety hazards. This presentation will serve as an overview of BehavePlus, its inputs and products, and its uses and limitations for wildlife management professionals.

Wesley Evans
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2:50 p.m.

OSMAND MAPS & NAVIGATION

CRISTY BURCH, Regional GIS, TWIMS Specialist, Texas Parks and Wildlife Department, PO Box 1097, Menard, TX, 76859, USA

"OsmAnd (OSM Automated Navigation Directions) is a map and navigation application with access to the free, worldwide, and high-quality OpenStreetMap (OSM) data. All map data can be stored on your device's memory card for offline use." (Osmand.net, 12/16/14)

OsmAnd provides a way to view detailed street and contour maps, search for points of interest, load custom gpx track/point files and record gps tracks and points without a data connection using the device's GPS. The Wildlife Division of the Texas Parks and Wildlife Department uses OsmAnd loaded on Android devices for navigation during dove and white-tailed deer surveys. Division staff also use OsmAnd for viewing and recording gps data (i.e., landowner boundaries, waypoints, spotlight lines). Lastly, staff utilize OsmAnd as a car navigation system with voice and visual guidance for turn-by-turn directions when making new landowner visits or travelling to out-of-town meetings. OsmAnd Maps & Navigation Free edition is a full function app with a 10 file download limit (for reference: the state of Texas is one file). OsmAnd+ Maps & Navigation is the same full function app with no download limit and costs $5.99*. OsmAnd Contour line plugin costs $1.99*. *Costs are current as of December 16, 2014.

Cristy Burch
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3:40 p.m.

USE OF WEB SOIL SURVEY TO THE AID IN PLANNING OF LAND MANAGEMENT PRACTICES ON THE LANDSCAPE

GARRY STEPHENS, Wildlife Biologist, USDA-NRCS, 13434 Leopard St. Rm A-14 Corpus Christi, TX, 78410, USA

Web Soil Survey (WSS) http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm provides soil data and information produced by the National Cooperative Soil Survey. It is operated by the USDA Natural Resources Conservation Service (NRCS) and provides access to the largest natural resource information system in the world. NRCS has soil maps and data available online for more than 95 percent of the nation's counties and anticipates having 100 percent in the near future. The site is updated and maintained online as the single authoritative source of soil survey information. WSS provides agricultural producers, agencies, technical service providers, and others electronic access to relevant soil and related information needed to make land use and management decisions. The WSS provides an alternative to traditional hardcopy publications, serves as a means for quicker delivery of information, allows access to full soil survey report content, access to the most current data and allows customers to get just the information they want. Live demonstration of this application during the Techniques and Technologies Workshop will show the ease and applicability of determining certain physical, chemical and ecological aspects of a property, i.e. soil map unit delineations, ecological site delineations, rangeland productivity, and many other features.

Garry Stephens
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4:05 p.m.

USE OF ECOLOGICAL SITE DESCRIPTIONS IN LAND MANAGEMENT PLANNING

MANUEL T. DeLEON, Wildlife Biologist, USDA-NRCS, 4609 W. Loop 289, Lubbock, TX 79414

Ecological Site Descriptions (ESD) are based on data collected on thousands of plots over the past 40 years. An ecological site is a distinctive kind of land with specific physical characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation. ESDs are a synthesis of this information and are presented in four major categories that include site characteristics, plant communities, site interpretations and supporting information. ESDs are available for rangeland and forest land and can be accessed and viewed by State or Major Land Resource Area (MLRA) https://esis.sc.egov.usda.gov/Welcome/pgReportLocation.aspx?type=ESD. MLRAs are a portion of the spatial framework used by Natural Resources Conservation Service in the planning, design, implementation, and evaluation of natural resource management activities. MLRA boundaries reflect nearly homogenous areas of land use, elevation, topography, climate, water resources, potential vegetation and soils http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/?cid=nrcs142p2_053624. ESDs provide agricultural producers, agencies, technical service providers and others relevant ecological information for any land inventory, analysis, planning and land use and management decisions. Live demonstration during the Techniques and Technologies Workshop will illustrate the ease and applicability of using Ecological Site Descriptions for land management planning.

Manuel T. DeLeon
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4:30 p.m.

QGIS-THE OPEN SOURCE GIS SOFTWARE

JASON A. ESTRELLA, GIS Specialist, Texas Parks and Wildlife, 11942 FM 848, Tyler, TX, 75707, USA

Geographical Information Systems (GIS) continues to be an ever growing industry, with applications ranging from healthcare to service delivery. Unfortunately, some GIS programs can be costly and not easily accessible. Since its inception in 2002, QGIS has lead the way in open source GIS software, freely available to the general public, and enabling a diversity of production models, communication paths, and interactive communities. It runs on Linux, UNIX, Mac OSX, Windows, and Android and supports numerous file types. Because it is an open source product, QGIS provides an ever growing number of capabilities provided by core functions where one can manage, edit, analyze, and compose printable maps. Over the last several years, there have been numerous case studies of natural resource and conservation professionals utilizing QGIS for various global projects dealing in landscape ecology, species distribution mapping, biodiversity, ecological modeling, etc. This overview will include a look at the basic functions, tools, additional plug-ins, and how QGIS can be applied to the natural resource professional.

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4:55 p.m.

DIGITAL PLANT PRESS FOR PLANT COLLECTIONS

RYAN D. McCLINTOCK, Wildlife Biologist, USDA-NRCS, 3878 West Houston Harte Expressway, San Angelo, TX, 76901, USA

All land managers whether private landowners or range and wildlife professionals depend on the plants that grow on their land or within their work area to make their livings. The plants growing on the land can tell us a story of what is happening on the land as it relates to range and wildlife managers. The knowledge of plants, being able to identify plant species, and knowing their value is paramount in making conservation management decisions. The use of a digital scanner is one way that we as land managers can correctly identify, collect, and store images that can be useful for building a good plant collection. A plant collection, especially one that is digital is a useful way that we can teach and share with one another about local plant species. A live demonstration during the Techniques and Technologies Workshop will illustrate the ease and applicability that this can have for all land managers alike.

Ryan McClintock
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5:20 p.m.

PLANT ID RESOURCES, FROM UTILIZING PLANT FAMILIES TO INTERACTIVE KEYS UTILIZING USDA PLANTS

RICKY J. LINEX, Wildlife Biologist, USDA NRCS, 532 Santa Fe Drive, Weatherford, TX 76086

Plant identification skills are crucial to anyone working in the field of natural resources management. Ranchers, wildlife managers, agency specialists and others need to be able to reliably identify plants on the lands they manage. Where once the only source of identification was to follow through a botanical key to identify an unknown plant, there are now other resources to make identification easier and faster. Participants will gain an understanding of plant identification by plant families using similar characteristics to group plants and narrow the identification search. Participants will also follow through plant identification using the new USDA PLANTS Database Interactive ID Keys. Becoming proficient with new plant identification methods will improve identification skills enabling natural resource managers to be able to read the land and have a better understanding of the effects of land management.

Ricky Linex
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Thursday 19 February

8:00 a.m.

CONTEMPORARY METHODS FOR MONITORING BIRD MOVEMENTS

BART M. BALLARD, Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, 700 University BLVD., MSC 218, Kingsville, TX, 78363, USA

Monitoring wildlife is a key element when studying a species' ecology or developing conservation strategies. Birds provide several unique challenges that complicate their detection when biologists study aspects of their movements. For instance, many birds migrate at night or at altitudes where traditional observation methods are not practical. Additionally, their great mobility reduces the effectiveness of tracking with traditional VHF telemetry. Particularly for nonbreeding birds, VHF telemetry is often inadequate in quantifying aspects of nonbreeding ecology because of difficulties in relocating individuals and not knowing if individuals died or simply were not relocated. Furthermore, the inclusion of large time and flight costs to search large areas, as well as putting personnel in danger when flying are important drawbacks to VHF telemetry. Recent advances in monitoring birds and other wildlife have become available over the last decade and have increased our knowledge about bird migration in many areas. Monitoring birds and bats using radar technology has gained momentum in the last decade as hardware and software capabilities have made it possible to automatically record biological targets over relatively large areas. Additionally, recent technology has enabled biologists to remotely record locations of animals through the use of satellites, cell phone towers, and geolocators. Examples of information gathered through these methods will be discussed.

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8:25 a.m.

STATE-OF-THE ART TELEMETRY SYSTEMS PROVIDE A WIDE ARRAY OF APPROACHES TO WILDLIFE STUDIES

STANLEY M. TOMKIEWICZ, Director of Environmental Programs, Telonics, Inc. 932 E. Impala Ave. Mesa, Az. 85204 USA

Telonics Inc. has been involved in design and manufacturing of wildlife telemetry systems since the early 1970's. This paper addresses the selection and use of the many telemetry tools currently available to researchers. Selecting the right technology to address a research question is often the difference between getting the data required and conducting an unsuccessful study. With so many new technologies, researchers must decide how to determine an animal's position. One approach is triangulation and VHF telemetry; however, other alternatives now exist including using Doppler positioning systems such as Argos, GPS locations or geolocation. The decision is influenced by how often positions are to be obtained, when during the day positions are required, in which season, and for how long a period of time. With some positioning systems, data must/can then be either stored on the unit or alternatively transferred for processing in near- real time. When data transfer systems are required the attributes of each system must be weighed and the appropriate system selected. Today "VHF direct downloading", FM data links, and high speed spread spectrum systems must be evaluated against satellite data recovery systems such as Argos, Globalstar, and Iridium. In addition to obtaining location information, other on board sensors may be required to answer the research question. Researchers may need temperature, activity, mortality, proximity to other animals, and for marine species underwater times and depth of dive information. These biologically relevant data must often be able to be related to the position information to provide meaningful data sets for analysis.

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8:50 a.m.

THE EVOLUTION OF BRUSH SCULPTING

SHAWN VICKERS, Kiva Consulting, 1136 East Kingsbury, 262, Seguin, TX, 78155, USA

When cattle reigned supreme, brush was at the center of a battle to keep grazing areas open. Fence-to-fence clearing was commonplace. Large scale hunting and wildlife management began in the 1990's and initiated the notion that brush was desirable. Brush removal was only conducted to make areas more hunter friendly. GIS and GPS technologies were nonexistent. Pastures went fallow, and brush and trees of all species reclaimed the once open range. As the pendulum continued to swing the other way, wildlife managers began to urge a mix of both open areas and beneficial brush. Thus began the brush sculpting movement and GIS/GPS came into use. Initially, technology dictated the intricacy of patterns. While a complex pattern could be created on the computer, the equipment's inability to follow such a pattern forced a facsimile of the intended plan. Straight strips and equal spacing were the norm. Then came the concept of contoured patterns and spacing became important. Aerial photography and the presence of dedicated wildlife professionals allowed the first real evaluations of what was being done. More importantly, enough time had gone by to observe long term results. Successes and failures insisted that brush sculpting requires a site specific approach and now tends toward mott designs. GIS data allows change detection analysis offering measureable rather than anecdotal feedback. Today, we are looking long and hard at an area before modifying it and realize that it is a process rather than a one time event. As sculpting is bringing back some of the open range, the need for grass management is also returning. Tools at our disposal now include: drones, multispectral imagery, lower software and hardware costs, data acquisition from our phones, and sophisticated guidance.

Kiva Consulting coined the term "Brush Sculpting" in the late 1990's and conducted the very first technology driven brush project on a large scale.

Shawn Vickers
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9:15 a.m.

THE FUTURE OF DATA COLLECTION

DON DRAEGER , Comanche Ranch

SHAWN VICKERS, Kiva Consulting, 1136 East Kingsbury, 262, Seguin, TX, 78155, USA

ROBERT GRABOWSKI, Hydrogen Enterprises

Data collection is an essential part of wildlife research and management. In the past, data collected in the field was recorded using pen and paper. The transformation from paper to digital has also been a manual process. WIS (wildlife information system) is changing the paradigm for wildlife data acquisition. Just as GIS (geographic information system) and GPS (global positioning system) changed the way we look at the world, WIS will forever change the way we manage wildlife. We have developed the first dedicated wildlife management software suite targeting the data collection process, which removes the need for paper forms. Furthermore, our system allows easy integration into standard spreadsheet and database applications enabling data analysis customization. The Animal Census software allows the user to collect data for any species during a survey. Each animal sighting entered into the app has an associated geographic coordinate. Upon completion of the survey, the collected data can be viewed on the device and/or transferred to a desktop computer for more comprehensive analysis. The individual animal geo-location data can be used with a variety of GIS and spatial platforms such as ArcGIS, MapInfo, or even Google Earth. The Deer Capture software allows the wildlife professional to collect all applicable data on captured animals in the field quickly and efficiently. Data collection includes live weight, age, antler measurements, photos, RFID and more. This data can then be transferred to a computer without the need for any paper forms. Our company has opened the door to the boundless possibilities of WIS. These are simply the first two in a long list of future applications.

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9:40 a.m.

COLLECTING WILDLIFE SURVEY DATA WITH THE CKWRI WILDLIFE SURVEY DATABASE

MATTHEW J. SCHNUPP, Schnupp Consulting, LLC, P.O. Box 694, Kingsville, TX 78364, USA

FRED C. BRYANT, Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, TX 78363, USA

Surveying wildlife populations is a longstanding practice in the field of wildlife management. However, survey data is commonly collected inefficiently and erroneously because of cumbersome data collection procedures which can be exacerbated when geospatial data is collected. In efforts to provide wildlife professionals with an efficient and accurate way to collect geospatial survey data, the Caesar Kleberg Wildlife Research Institute (CKWRI), in conjunction with Schnupp Consulting, LLC and CyberTracker, have developed the CKWRI Wildlife Survey Database. The database runs on Windows-based handheld GPS units and the fully customizable data entry sequences allows users to accurately and fluently enter survey data. The database allows users to collect a variety of relative (e.g., belt transects, call counts, etc.) and absolute (e.g., distance sampling, sighting model, etc.) abundance survey data. Additionally, Bluetooth equipment (e.g., laser rangefinders) is compatible with the database. After field data is downloaded, data can be viewed in column form, map imagery and summary reports and exported to programs like Program Distance, Microsoft Excel and ArcMap. The Transect editing tool calculates line length and duration and if distance sampling data is collected, offset location and perpendicular distance. The database is made available to wildlife professionals who enroll for scheduled workshops, which provide participants with the knowledge and tools necessary to customize the database and collect data.

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10:30 a.m.

BOARBUSTER® "THINKING OUTSIDE THE BOX TRAP"

JOSHUA A. GASKAMP, Samuel Roberts Noble Foundation Incorporated, Ardmore, OK 73401, USA

Numerous trap designs have been used in efforts to capture wild pigs (*Sus scrofa);* however, drop-nets had never been examined as a potential tool for wild pig control. We implemented a two-year study to compare the efficacy of an 18.3 x 18.3 meter drop-net and a traditional corral trap for trapping wild pigs. Our findings indicate that 86 and 49 percent of the unique pigs were removed from treatment units using drop-nets and corral traps, respectively. Catch per unit effort was 1.9 and 2.3 hours per pig for drop-nets and corral traps, respectively. Advantageous elements of both systems were combined to produce the BoarBuster® suspended corral trap. We extended our initial study, incorporating this new technology. BoarBuster® has yielded a capture rate of 88 percent, and catch per unit effort of 0.65 hours per pig. Pigs that encounter BoarBuster® have no thresholds to cross, have no panels at ground level, can enter and exit the baited area from any direction, and are generally not looking for a trap in the canopy. The trap is also selective. Streaming video allows users to eliminate non-target captures, optimize capture rate, prevent the development of trap-shy behavior, and minimize time spent in the field. BoarBuster® is instantly gratifying when users can watch the trap fall with the touch of a button while maintaining a busy schedule elsewhere. BoarBuster® technology demonstrates how adaptive and innovative methodologies can achieve greater results in wild pig control.

Joshua A. Gaskamp
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10:55 a.m.

DEVELOPMENT OF A CO_2 EUTHANASIA TRAILER FOR WHITE-TAILED DEER AND FERAL SWINE AT THE KERR WILDLIFE MANAGEMENT AREA

JOHN C. KINSEY, Kerr Wildlife Management Area, Texas Parks and Wildlife Department, Hunt, TX, 78024, USA

JUSTIN A. FOSTER, Kerr Wildlife Management Area, Texas Parks and Wildlife Department, Hunt, TX, 78024, USA

RYAN L. REITZ, Kerr Wildlife Management Area, Texas Parks and Wildlife Department, Hunt, TX, 78024, USA

The need for safe and efficient means of euthanasia have been identified at both the Feral Swine Research Facility and the Donnie Harmel White-tailed Deer Research Facility at Kerr Wildlife Management Area (KWMA), Hunt, TX. Research protocol at both facilities requires live test subjects to be humanely euthanized upon completion of their respective research trials. The American Veterinary Medical Association (AVMA) Panel on Euthanasia listed CO_2 as a humane form of euthanasia for domestic swine. Previous research has identified the use of an enclosed dump-bed truck or trailer as a CO_2 chamber for efficient means of euthanizing and disposing of large numbers of domestic swine, however, there is no documentation on the efficacy of such methods on wildlife species. We manufactured a self-contained Carbon Dioxide (CO_2) euthanasia chamber (unit) on a 4.27m (14') dump trailer to be utilized as dual purpose equipment for the euthanasia of feral pigs (*Sus scrofa*) and white-tailed deer (*Odocoileus virginianus*). Three replicates of 5 feral pigs (n=15) and 2 replicates of 25 total white-tailed deer (n=10, n=15) were conducted at the KWMA. Carbon Dioxide administration began immediately post-loading and commenced for 5 minutes at an average of 20% chamber volume per minute. A 20 minute observation period followed each 5 minute CO_2 release. Individual and group behavior was monitored through the 3 viewing ports. Results are expected to impact protocol for euthanasia of research subjects at the Kerr WMA and may have wide spread implications in wildlife euthanasia protocols state wide.

John Kinsey
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11:20 a.m.

CONTROLLING FERAL HOGS WITH SPECIES SPECIFIC FEEDERS

HAROLD MONK, Wildlife Management Services, 31321 Highland Drive, Denham Springs, LA, 70726, USA

Toxicants may be more cost-effective than contemporary methods for controlling feral hogs. Target specificity is important as feral hog toxicants are not likely to be target-specific. Delivery systems evaluated in peer-reviewed journals were target specific. However, they were not designed to exclude robust and dexterous species such as bears and were not evaluated in this context. Yet feral hogs are sympatric with bears. Wildlife Management Services LLC. developed the Hog Annihilation Machine (HAM) for target specific delivery of feral hog toxicants in the presence of bears. HAM identifies target species using patented audio/video recognition technology and delivers baits (e.g. toxicants, contraceptives, or feeds) accordingly. Initial tests (WMS unpublished) demonstrated HAM was effective in feeding feral hogs and excluding non-targets. Evaluation of HAM is ongoing at the Kerr Wildlife Management Area in Kerr County, Texas.

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11:45 a.m.

AN ALL-IN-ONE SYSTEM FOR CAPTURE AND ISOFLURANE ANESTHESIA OF MEDIUM-SIZED ARTIODACTYLS

JUSTIN A. FOSTER, Kerr Wildlife Management Area, Texas Parks and Wildlife Department, Hunt, TX, 78024, USA

Rapid recovery of Artiodactyls after in-field anesthesia is infeasible and costly. We examined the use of an all-in one system for capture and anesthesia of feral pigs (*Sus scrofa*) and collared peccary (*Tayasu tajacu*) in the field. Feral pigs and javelina were captured and anesthetized with isoflurane at trap locations on 2 wildlife management areas in the Hill Country Ecoregion of Texas. Anesthesia was delivered from a portable anesthesia machine to a system we developed to serve as both trap and induction chamber. Twelve feral pigs and 12 javelina were captured, immobilized, and recovered. Induction and maintenance were sufficient for treating animals or outfitting with tracking hardware resulting in no adverse effects to subjects. Mean induction times for javelina and feral pigs were 3.7 min (SD = 1.4) and 4.0 min (SD = 1.4) respectively. Animals regained consciousness at a mean of 3.8 min (SD = 2.8) and were fully recovered by 6.4 min (SD = 4.5). Our method was safe and effective and is practical for capturing and anesthetizing Artiodactyls.

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