

# Assessing UAV-FLIR Technology to Survey Wild Turkeys

## Contact

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## Introduction

A survey methodology to obtain unbiased estimates of wild turkey (*Meleagris gallopavo*) populations over large spatial scales remains elusive despite the importance of wild turkeys as a game species. Accurate population estimation would allow the Texas Parks and Wildlife Department (TPWD) to manage the resource more effectively. This may be important in the face of current restoration activities in east Texas, potential impacts to wild turkey donor sites, post-restoration changes in demographic parameters that have been observed in recent years, and for monitoring populations at the ecoregion scale (Byrne et al. 2015).

During the winter of 2019, TPWD staff flew an unmanned aerial vehicle (UAV) equipped with forward looking infrared (FLIR) imaging technology over GPS-marked wild turkeys in several locations across the Oaks and Prairies Bird Conservation Region (BCR). The goal of this effort was to assess the ability of UAV-mounted FLIR to detect roosted wild turkeys. Results showed that the technique was effective in this landscape for detecting roosted Rio Grande wild turkeys. TPWD staff are currently under a contract with researchers at the University of Missouri to determine if automated machine-learning software can accurately detect and count wild turkey FLIR images recorded by TPWD staff. In addition, the University of Missouri will identify the conditions that optimize the detection probability of roosting wild turkeys, accounting for variables such as time of night, time of year, weather conditions and flight altitude. Results to date have been promising.

Based on the early success of this pilot study, TPWD staff are proposing additional research on the potential for this technology to monitor wild turkey populations in the Central Mixed Grass Prairie, Oaks and Prairies, West Gulf Coast Plains, and Tamaulipan Brushlands Bird Conservation Regions in Texas. Specifically, researchers will be asked to assess the following questions: 1) Are UAV-FLIR surveys feasible at the local scale (10,000 to 50,000-acre landscape) and ecoregion scale utilizing both quad copters and fixed winged UAVs, and 2) What level of survey effort is necessary to detect a 10 to 25% population change at multiple scales (Ranch/WMA, County, Ecoregion) over a specific timeframe (1 to 5 years)?



Figure 1. UAV-FLIR survey image showing roosted wild turkeys captured during a 2019 pilot study.

## Justification

This research project will address several goals listed in the TPWD Land and Water Resources Conservation and Recreation Plan and the TPWD Upland Game Bird Strategic Plan. Specifically from the Land and Water Resources Conservation and Recreation Plan this project will address:

- **Goal 1. Practice, Encourage, and Enable Science-based Stewardship of Natural and Cultural Resources**
  - The restoration of wild turkeys to their historic range in east Texas holds promise for restoring a charismatic and iconic forest game species
  - This research will help TPWD maintain the highest level of scientific validity and credibility by expanding and improving scientific methodologies

From the Upland Game Bird Strategic Plan, this project will address:

- **Goal 1. Promote on-the-ground habitat restoration and conservation of upland game birds and their habitats using sound science and proven management techniques**
- **Goal 4. Promote the hunting heritage of Texas and associated outdoor activities.**

- Eastern wild turkeys once occupied 12 million hectares in east Texas. Research that leads to the restoration of wild turkeys in east Texas will have a direct impact on Texas' hunting heritage by providing increased hunting opportunities

This is also a national issue with the Southeast Wild Turkey Working Group, the Western Turkey Workshop working group, and the National Wild Turkey National Technical Committee have all identifying large-scale monitoring as a key research priority. This work will address the recognized need for better monitoring of the wild turkey across its range.

## **Research Objectives**

The purpose of this project is to assess the ability of UAV-mounted FLIR technology to detect roosting wild turkeys in the Central Mixed Grass Prairie, Oaks and Prairies, West Gulf Coast Plains, and Tamaulipan Brushlands Bird Conservation Regions in Texas and determine if the UAV surveys can be utilized to assess population densities at large spatial scales. Based on the early success of the UAV- FLIR pilot study surveys at detecting roosted wild turkey, TPWD staff would like to expand the research to assess the potential for this technology to monitor wild turkey populations at both the local and ecoregion scale.

Specific objectives are:

1. Determine if FLIR technology can accurately discern between wild turkeys and vultures. If FLIR can discern roosted wild turkeys from vultures, then evaluate objectives 2 and 3.
2. Determine if UAV-FLIR surveys are feasible at the local scale (10,000 to 50,000-acre landscape) and ecoregion scale utilizing both fixed wing and quad copter UAVs.
3. Determine what level of survey effort is necessary to detect a 10 to 25% population change over 1 to 5 years at the Ranch, County, and Ecoregion scale.

Surveys are to be conducted during the winter post deciduous leaf-off to increase observability and to capture congregations of wild turkey flocks on their winter range. Wild turkeys will be captured and instrumented with GPS backpacks. TPWD-WMAs including the James E. Daughtrey, Matador, and Gus Engeling WMAs will serve as potential study sites. In addition, if a Super Stocking study site is identified during the field portion of this research, the opportunity will be taken to expand the research to quantify this technology at a TPWD Super Stocking location. Wild turkeys will be marked with GPS backpacks to accurately track locations during UAV flights. Research will concentrate in TPWD-Wildlife Division Districts 2, 3, 5, 6 and 8.

## **Expected Management Implications**

The proposed work will, at a minimum, support an effort to assess the success of recent wild turkey Super Stocking efforts in Texas. If fixed winged UAVs can detect roosted wild turkeys,

this technology, when paired with contract flights (like contract UAV flights currently taking place through the Inland Fisheries Division), may provide TPWD with an affordable and safe means to monitoring wild turkey populations across large landscapes in Texas. Targeted landscapes include TPWD Wildlife Division Districts 2, 3, 5, 6 and 8.

This is critical to TPWD for several reasons:

1. Over the past six years, TPWD has investment significant levels of Upland Game Bird Stamp funds and staff time to wild turkey restocking efforts in Texas. TPWD needs to determine if restocking efforts are proving successful to support continuing with future efforts.
2. TPWD's Small Game Harvest Survey estimates an average of 87,000 turkey hunters in Texas over the past 5 years with an average harvest of 55,000 wild turkeys. This makes wild turkeys one of the most pursued game species in Texas. However, there are no current surveys utilized to monitor wild turkey populations at any scale.

## **Literature Cited**

- Bernatas, S., and L. Nelson. 2004. Sightability model for California bighorn sheep in canyonlands using forward-looking infrared (FLIR). *Wildlife Society Bulletin* 32:638-647.
- Byrne, M.E., M.J. Chamberlain, and B.A Collier. 2015. Potential density dependence in wild turkey productivity in the southeastern United States. *Proceedings of the National Wild Turkey Symposium* 11:319-351
- Gonzalez, L.F., G.A. Montes, E. Puig, S. Johnson, K. Mengersen, and K.J. Gaston. 2016. Unmanned aerial vehicles (UAVs) and artificial intelligence revolutionizing wildlife monitoring and conservation. *Sensors* 97: s16010097
- Locke, S.L., R.R. Lopez, M.J. Peterson, N.J. Silvy, and T.W. Schwertner. 2006. Evaluation of portable infrared cameras for detecting Rio Grande wild turkeys. *Wildlife Society Bulletin* 34:839-844.
- Wakeling, B.F., R.W. Emgel-Wilson, and T.D. Rogers. 2004. Reliability of infrared surveys for detecting and enumerating turkeys within forested habitats in north-central Arizona. Pages 187-192 *in* (C.V. Ripper and K.L. Cole, eds.) *The Colorado Plateau: cultural, biological, and physical research*.
- Witczuk, J., S. Pagacz, A. Zmarz, and M. Cypel. 2017. Exploring the feasibility of unmanned aerial vehicles and thermal imaging for ungulate surveys in forests – preliminary results. *International Journal of Remote Sensing*. DOI: 10.1080/01431161.2017.1390621