Remote Survey of Herpetofaunal Habitat in Western Kansas

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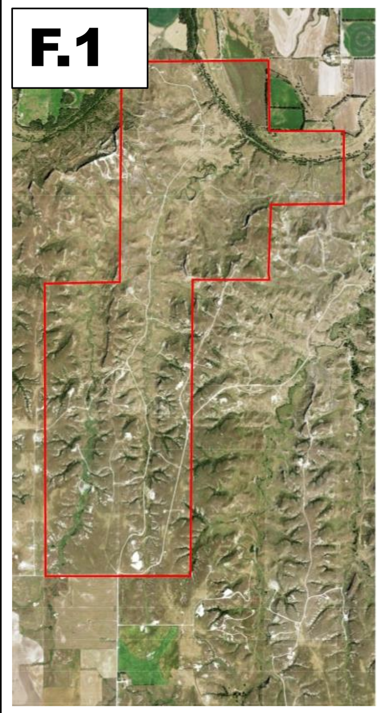
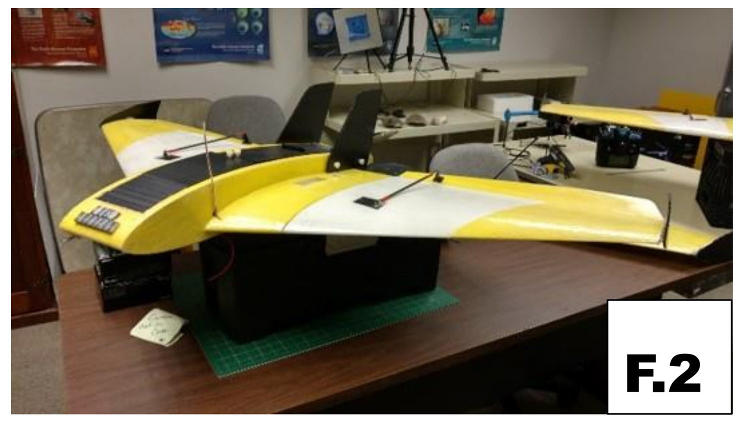
Introduction

Conservation researchers currently rely on satellite-based remote sensing for mapping and monitoring land use change (Broich, et al. 2008), and ground surveys for assessment and monitoring of biodiversity. However, both methods have several disadvantages that compromise accuracy and precision for research. Satellite remote sensing can be expensive, and cheaper alternatives do not have sufficient resolution for accurately detecting and tracking land use change (Koh and Wich, 2012). Ground surveys can be time-consuming, financially expensive, and challenging in remote areas (Gardner, et al., 2008). Neither method is conducted at the frequency required for proper analysis and monitoring of population trends (Meijaard, et. al, 2012). Unmanned aircraft systems (UAS) have the potential to overcome some of these challenges associated with conservation research. This project will focus on developing an inexpensive autonomous vehicle to develop high-resolution and georeferenced vegetation / habitat maps associated with a community of herpetofaunal species in western Kansas. Some species of interest for this project include the Texas Horned Lizard (Phrynosoma cornutum), a Species in Need of Conservation (SINC), and the Lesser Earless lizard (Holbrookia maculata). The Lesser Earless Lizard is abundant throughout the western United States, but population numbers are decreasing throughout Kansas (Kansas Herp Atlas).

Study Site

The study will be conducted at Hadley Ranch in Ellis County, KS. Hadley Ranch is located in the Central Great Plains, a semi-arid prairie ecoregion. Warm season, mixed grasses dominate the vegetation in these areas.





Lesser Earless Lizard

Texas Horned Lizard

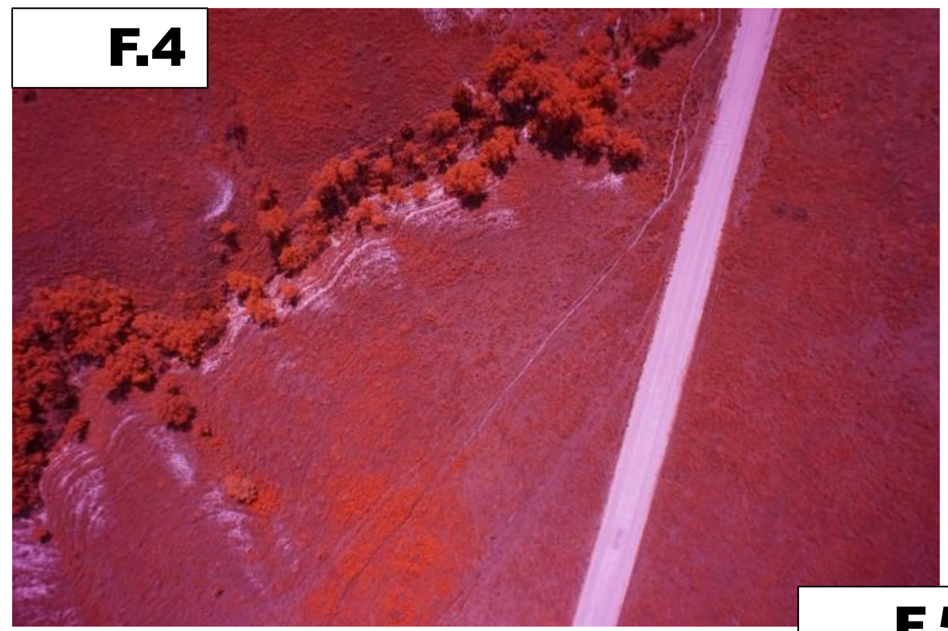
F.1: Map of Hadley Ranch. **F.2**:Unmanned aerial vehicle appropriate for this study.

Methods

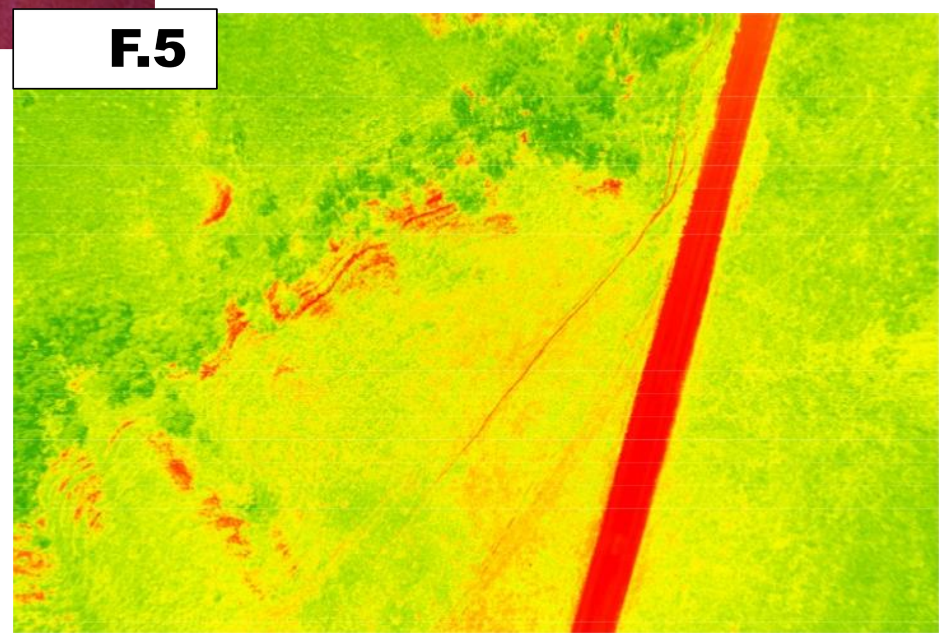
Walking encounter surveys will be used to identify and georeferenced the presence of individuals in habitat space. Time-constrained searches for target species will be used ensure equivalent effort across each area of the study site. The UAS sensor will capture images of the area, guided by software programming (MissionPlanner). The sensor captures light in the near infrared (750 – 2,000 nm), blue (475 nm), and green bands (510 nm). The overlapping and georeferenced images will be aligned to form a mosaic of the study area using Agisoft/Pix4D software. The mosaic will be transferred to ArcGIS for data processing and converting it to create an NDVI index (Normalized Difference Vegetation Index).

$$\text{NDVI} = \frac{\text{NIR} - Blue}{\text{NIR} + Blue}$$

The image captured by the sensor provides information on how much light is reflected from different objects in the data frame. An NDVI index can highlight vegetation densities based reflectance of light in the near-infrared and red light spectrum. Plants in high densities will reflect more light in the near-infrared than sparse vegetation. NDVI can help quantify and characterize habitat patches to observe presence patterns in the landscape and perform appropriate data analysis.
The entire mosaic of Hadley Ranch will be generated so that patterns of habitat use can be discerned.



F.4: Image captured by our sensor, Sony Alpha a- 5100, with modified filter



F.5: Same image in F.4; example of NDVI created through ArcGIS. Areas with dark green coloration have higher NDVI values than areas with red coloration.

Future Possibilities

Goals for the project include creating a tool that can survey a large extent area with fine resolution. This project could potentially produce an alternative technique for habitat assessment using UAS technology, which can be applied to taxa of interest (Herpetofauna). UAS technology can provide further insight into species distributions at variable spatial scales and at convenient or rapidly repeating temporal scales. Utilizing multiple sensors on UAS systems can analyze unique features of a landscape with high resolution. Interpretation of these features can yield quantitative information that can be further evaluated by appropriate data analysis.

Acknowledgements

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