UAV-Based Monitoring to Track Deer Overpopulation in Upstate New York

Joseph Won, Caitlin Tucker, Melissa Torchio, Connor Townes, Peter Vailakis,
Abigail Lily, Alex Nikulin, Timothy S. De Smet

First-year Research Immersion Program, Binghamton University, Binghamton NY 13902

Introduction

- The white-tailed deer population has become severely overpopulated across the northeastern United States
- Associated public health/environmental problems:
  - Understory depletion
  - Vehicular accidents
  - Lyme disease spread
  - Disruption of natural ecosystems
- We believe that deer play a crucial role in controlling tick populations, the main vector for Lyme disease
- UAV imaging can be used to gain an accurate representation of mammalian population such as a deer
- Ticks require three blood-meals to reach maturity
  - Each blood-meal equates to one life-stage transition
- Lyme Disease is caused by the *Borrelia burgdorferi* Bacterium
  - Spread through blood-to-saliva transfer

Methods

March 2020 Data Collection

- DJI Matrice 600 hexacopter was used to collect thermal images over 285 acres (1.5 km²) of undeveloped land in the Binghamton Nature Preserve at 100 m AGL at 10 m/s
  - The camera used was the FLIR Vue Pro R 13mm
  - 4 separate flights collected a total of 80,000 frames of thermal image data
- Manually counted deer using Thermoviewer
  - Deer were noted as vibrant white "hot" dots seen moving during a given flight / group of images
- Thermal images were processed using pix4D
  - An orthomosaic was created using the images
  - Mapped out where deer populations are located in the nature preserve
- Used data to determine the extent of the deer overpopulation crisis within the Binghamton University Nature Preserve
  - Can be extrapolated to the greater Binghamton / Broome County Area

Flight Path

Figure 1. Path of the four flights + local landmarks
This is the path of the four flights on March 14th, 2020. All the flights were conducted in the early morning between 5:21 - 6:29 AM in order to effectively visualize a deer's thermal signature and when all the trees leaves have fallen in order to reduce the effect of canopy cover on our study.

Preliminary Results

- 74 deer found within 1.15 km²
  - 64 deer/km²
  - Estimated 185 - 205 deer in whole preserve as of March 2020
  - In the undeveloped land there is an estimated 194 deer
- Plan to use the deer density and spread to estimate correlations with biodiversity and forest health
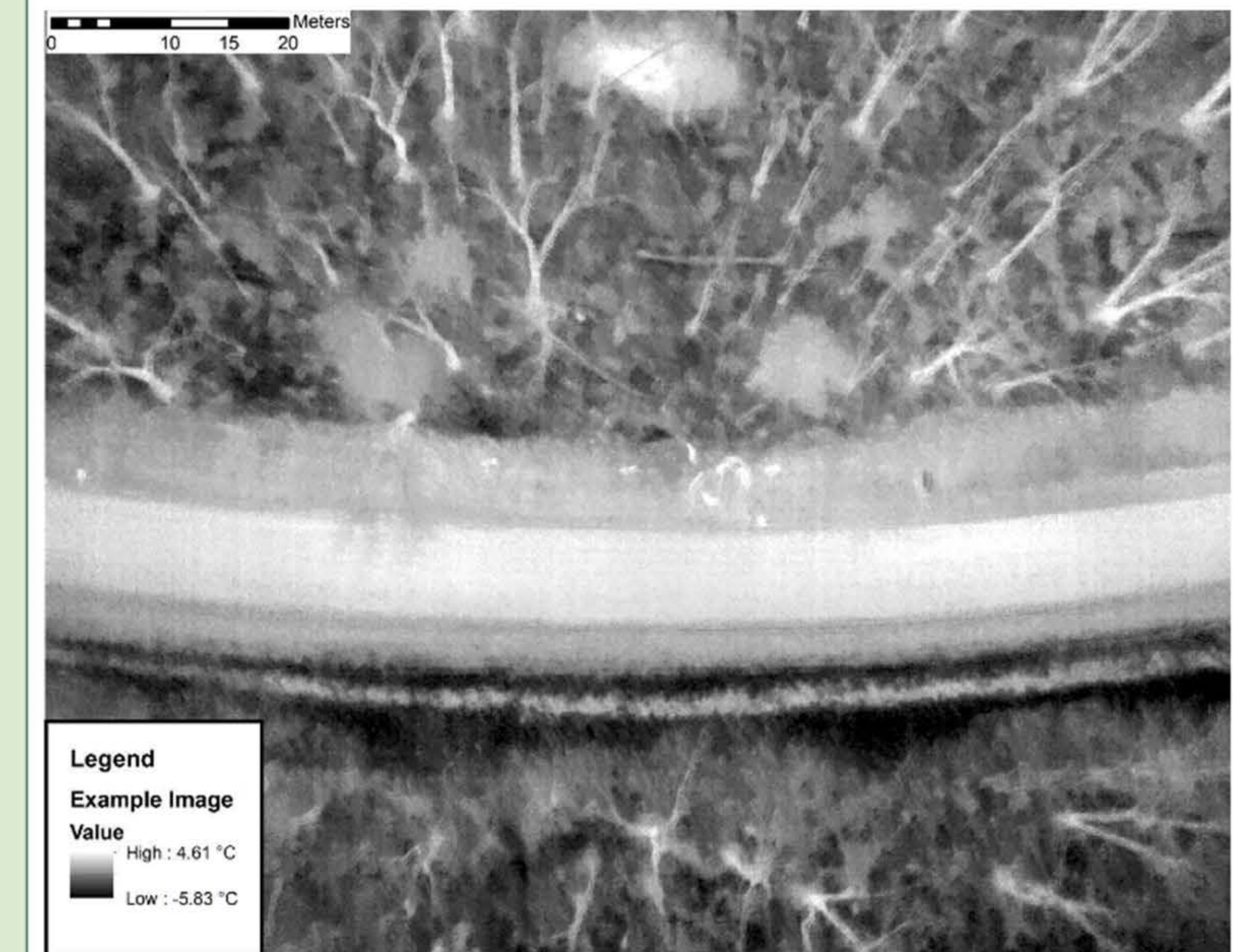
Thermal Images

Figure 2. Example of a single thermal IR image used to count the deer in the nature preserve
This thermal image was processed in Thermoviewer and constructed through ArcGIS.

Future Work

- When trees in the nature preserve abcise in mid November, we plan on conducting another four flights with the exact same methods we used in March 2020
- We intend to use this second bulk of data to build more models within the nature preserve
- We plan to compare the new set of data collected to the first collected set in order to search for increased severity of white-tailed deer overpopulation.

References

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