



I Could Drone On and On About This Title

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Abstract

The objective of this experiment was to test if an aerial survey system could be more effective and efficient than a ground survey performed by a human. We did this by detecting markers set in a field. Effectiveness is defined as how many markers/targets are found. Efficiency is compared by using time it took to record the data. At the end of the experiment, we found the aerial survey method was better than the ground survey in both aspects. This suggests there is a potential future for using drones to survey fields.

Introduction

The purpose of this research is to investigate and get an idea of what drones are capable of for the benefit of agriculture and in turn the world when it comes to global food systems. This research is just a small portion of the larger image in development and implementation of drone technologies. This experiment is a comparison between the abilities of the human eye vs the eye of a machine. My hypothesis is that the drone will be better in nearly every measurable aspect.

Questions, Hypotheses, and Predictions

Question: Can a drone survey system find more targets in a shorter amount of time than a human, ground survey?

Hypothesis: 1. The Drone Mavic, will be more effective at finding targets than the ground survey.

2. The drone Mavic, will be more efficient at finding targets than the ground survey.

Study System

DJI Mavic Pro 4K Camera Quadcopter Drone 2



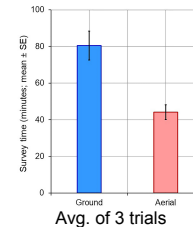
Fig 1. Small unmanned vehicle Mavic Pro used in the study

Methods and Experimental Design

For this experiment, we placed markers in a defined field and I surveyed the field for these markers. These targets were a size slightly larger than a dinner plate and were produced using a software named Agisoft Photoscan. This software allowed the computer and drone to recognize the marker. The surveyor was not told how many markers were in the field. We then took as much time as needed to search, find, and take pictures of markers until we felt we had captured them all. Then the drone pilot flew Mavic over the field and it captured images of the markers from the air. We then took the images from Mavic and the ground survey to collect data regarding which markers we found and how many. The time was recorded for each trial. We then performed a t-test for each variable and a descriptive analysis to determine if there was a significant difference in modes of surveying. The results were then put into charts, pictured below. Field 1 was much larger than field 2, and the graphs and data have been adjusted to scale

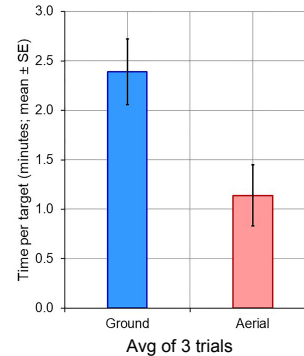
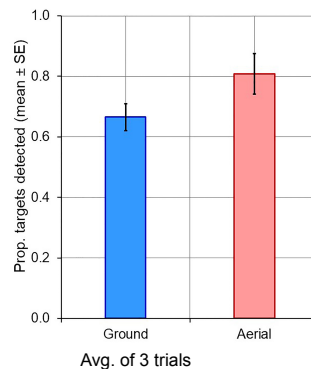


A marker placed in the field



Results

Although statistically non-significant, aerial survey using sUAV detected 14% more targets than the ground survey ($t_2 = 1.68$, $P = 0.24$, Figure X). However, aerial survey took only half the amount of time to detect a target compared to ground survey ($t_2 = 4.71$, $P = 0.042$, Figure X). Use of sUAV reduced the total survey time by 45% ($t_2 = 4.40$, $P = 0.047$, Figure X).



Conclusions

Based on the results of this research, it's not unrealistic to predict that a drone survey system can be better than a person in locating and assessing the condition of a field and certain crops within it. This work is significant because it is a small sample of data that would be consistent with larger experiments.



Test Field #2 North part of Manhattan

Future Directions

Moving forward with this research there would have to be many more trials to determine if a drone survey system can be preferable to conventional routes. This is experiment was also just a small litmus test into that idea. More tests will have to be done with more advanced technology to determine whether or not it is easy to identify pests and other issues that may be present with crops. Another area untouched by this research is the labor that would be involved in order to make this a viable business practice. How much time does it take to analyze these photos and make decisions based on them? How much is this person paid? Is this more cost effective than having someone manually go in and survey? There are many questions left to be asked and answered to develop a better assessment tool for agriculture.

References

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