Flying the Family Farm
UAS & Management-intensive Grazing
INTRODUCTION
Overview

- Is there a role for UAS in pasture-based agriculture?
INTRODUCTION

Significance

- “Testing, not guessing, is the rule to success” John Kempf
- Tradition vs. Technology vs. Time
- Good, Fast or Cheap: Pick Two!

BACKGROUND
Management-intensive Grazing (MiG)

- High Intensity
- Short Duration
- Long Recovery

http://pastureproject.org/pasture-management/rotational-grazing-systems/


http://transterraform.com/permaculture-strategies/intensive-rotational-grazing/
BACKGROUND
MiG: Advantages & Challenges
BACKGROUND

Traditional Ground-Based Monitoring

- Soil Analysis
- Forage Analysis
- Brix Measurements
- Soil Compaction Testing
- Manure Observations
- Animal Movement
- Forage Selection
- Forage Height/Quantity

https://onpasture.com/2017/01/02/troy-bishopps-free-grazing-chart-makes-the-difference-in-drought/
BACKGROUND

UAS & Multispectral Data

https://www.neonscience.org/neon-its-aop-functions-tiles-py


White Oak Pastures – Drone Pasture Monitoring

Google Earth Pro [2019]
BACKGROUND
Multispectral Mathematics

- **NDVI** (Normalized Difference Vegetation Index)
- **NDRE** (Normalized Difference Red Edge) Index
- **NIR** (Near Infra-Red) Reflectance
- **OSAVI** (Optimized Soil-Adjusted Vegetation Index)
- **CIR** Composite (Color Infra-Red) Composite
BACKGROUND

Existing Research

- On-site vs. Remote
- UAS vs. Satellite
- Passive vs. Active

Remotes Sensing, 11(5), 473. doi:10.3390/rs11050473
OBJECTIVES
Identify Best Practices

- **Study Variables**
  - Image Overlap
  - Flying Height
  - GCP Target Size

- **Optional Variables**
  - UAV Speed
  - Solar Angle

[Diagram showing image overlap and frontal overlap]

OBJECTIVES

Correlate Remote & Ground Data

METHODOLOGY

Site Description

- Pasture
- Silvopasture
- Control

https://www.agriland.ie/farming-news/should-more-sheep-farmers-install-a-paddock-grazing-system/
METHODOLOGY
Workflow: MiG
METHODOLOGY
Research Methods & Timeline

- **Initial Monitoring**
  - GCPs
  - Ortho Base Map
  - Soil Compaction
  - Soil Analysis

- **Ongoing Monitoring**
  - Multispectral
  - Forage Analysis
  - Brix Measurements

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METHODOLOGY

Research Control

- Matching Soil, Topography, Prior Management
METHODOLOGY

Accuracy: GNSS Positioning

- Survey Grade GNSS


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METHODOLOGY
UAS Platform & Sensor Package

- DJI Matrice 600 Pro & Micasense RedEdge

- PSU Mobile Geospatial System Group (MGSG)
METHODOLOGY
Data: Multispectral Sensor
OUTCOMES

Anticipated Results

- UAS/Multispectral cannot replace ground measurements
  ----but----
- UAS/Multispectral can bridge the gap between guessing and testing
  ----and----
- UAS/Multispectral can add real value to ground measurements at scale
OUTCOMES
Knowledge Dissemination

Pennsylvania Grazing Lands Coalition
Working together to maintain and improve the Management, Productivity, and Health of the nation’s privately-owned grazing land.

Annual Northwest Pennsylvania Grazing Conference
CITATIONS

- University of Georgia Extension. Forage Use and Grazing Herd Management during a Drought. Circular 914.
- www.micasense.com