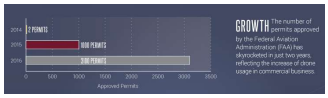
Drone Research for Disturbance and Habitat Monitoring

UF/IFAS RANGE CATTLE RESEARCH AND EDUCATION CENTER, ONA, FL

RANGELAND WILDLIFE AND ECOSYSTEMS PROGRAM

Drone Technology: History

- Nikola Tesla "Father of Unmanned Vehicle Technology" – 1898 radio controlled boat
- 1800's to present day – Various military applications
- 2013 drone technology advanced rapidly



Drone Technology: Multiple Platforms

- Large areas covered fast.
- Longer flight times.
- Some issues with image blur from speed.
- Only directly down (NiDar) imagery.

- Better for accuracy and resolution.
- Shorter flight times.
- Stable and high resolution images.
- Gimbal allows multiple angle imagery.

https://www.precisionhawk.com/drones/ https://www.sensefly.com/ https://3dr.com/solo-drone/ https://store.dji.com

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Drone Technology: Multiple Sensors for Multiple Applications

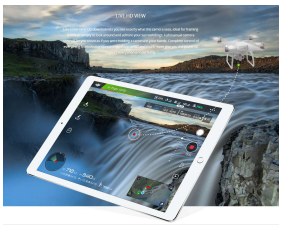
Surveying, plant counting, volume measurements, surveillance, 2D and 3D mapping	Measure surface temperature: heat stress, water use, canopy /plant metabolism.	Measure plant health: nutrient deficiencies, productivity, pest damage.	Measure distances and elevation. Create topographical maps.	Measure plant nutrient status, identify minerals, surface chemical composition.

https://www.precisionhawk.com/ https://sentera.com/ https://store.dji.com, smarter farming package

Our Drone Research: Platform

- DJI Phantom 4
  - Easy to fly - Manual or automated flights
  - 3-axis gimbal and 12 MP camera
  - Up to 20 minute battery life
  - Easy to use Apps for manual and mission planning
  - Built in FPV (first person view)
  - $1,200 (Drone, remote controller, one battery and cables)

Our Drone Research: Flight Apps



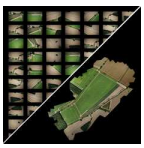
- DJI Go App – Manual Flights
  - Compatible with iPhone/iPad
  - Multiple flight modes (Follow me, course Lock, To Waypoint, Point of Interest)
  - Live video feed

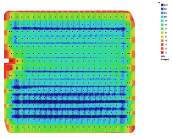
Our Drone Research: Flight Apps

- Map Pilot for DJI App – Autonomous Flights
  - Draw a polygon
  - Set altitude, overlap, speed
  - Save, upload and start mission
  - Live feed of mission progress
  - Returns to home when mission complete
  - Multi-battery flights for large areas

Our Drone Research: Data Pipeline

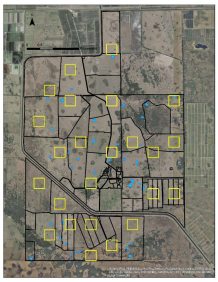
- Create mosaics from raw imagery
  - Maps Made Easy – online aerial map processing site
  - Upload raw images, image GPS EXIF tags used to georeferenced
  - Download mosaic, 2.5 cm ground resolution
  - <100 images = free, 0.015¢/image, 0.38¢/acre
- Other options
  - DroneDeploy.com
  - Pix4DMapper Software
  - ArcGIS Drone2Map Software





Our Drone Research: Feral Swine Rooting Damage

- Assess temporal periods of rooting damage over season and across 3 years
- Buck Island Ranch, Highlands County
  - 36 small seasonal wetlands
  - 25 forty acre pastures

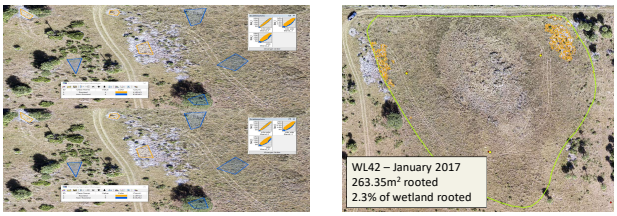


Our Drone Research: Feral Swine Rooting Damage

1) Collect aerial images with drone and create mosaics
2) Georeference images with ground control points

Our Drone Research: Feral Swine Rooting Damage

3) Use ArcGIS software to classify each pixel as rooting or non-rooting
4) Convert to polygons and calculate the total area of rooting

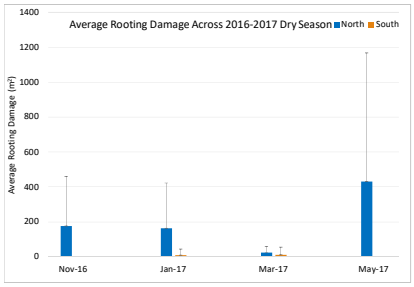


Our Drone Research: Feral Swine Rooting Damage

- Preliminary Analyses:
  - Difference in rooting damage between north and south wetlands post swine removal?
  - Difference in rooting damage in wetlands in improved and semi-native pastures?
- Fall 2016 – Removed 95 pigs from the south
- Analyzed rooting from four rounds of flights across 2016-2017 dry season
  - 11 wetlands in south (all semi-native)
  - 10 wetlands in north (5 in improved and 5 in semi-native pastures)

Our Drone Research: Feral Swine Rooting Damage

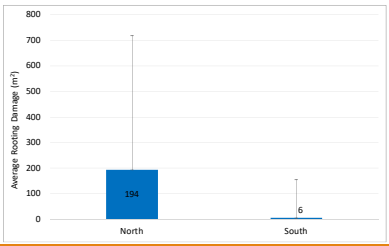
- Preliminary Results:
  - North rooting increased over time, peaked in May
  - South rooting only detected in January and March



Error bars represent SD

Our Drone Research: Feral Swine Rooting Damage

- Preliminary Results:
  - North wetlands had greater rooting damage then southern wetlands



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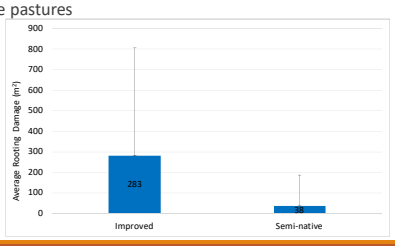
Our Drone Research: Feral Swine Rooting Damage

- Preliminary Results:
  - Wetlands in improved pastures had greater rooting than wetlands in semi-native pastures



Error bars represent SD

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Our Drone Research: Feral Swine Rooting Damage

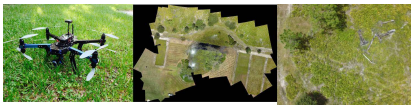
- Future analyses:
  - Examine seasonal and annual variation in rooting damage
    - Incorporate pig population density
    - Compare against pasture imagery
  - Examine impacts on wetland fauna
    - Community assemblages
    - Salamander occupancy of wetlands
    - Growth and stress levels of tadpoles

Our Drone Research: Future Research

- Pre and post prescribed burns
  - Examine changes in canopy cover and gap development needed for native vegetation and forage grasses to grow
    - Prescribed burn regime should decrease canopy cover and increase gaps needed for native vegetation and forage grasses to grow
    - Impacts to native cattle grazing and wildlife (e.g. Bobwhite quail)

Our Drone Research: Biggest Challenges

- Learning the technology – However huge advancements recently in drone user-friendliness



Our first drone (3DR X8) and successful mosaic

- Data storage – Processing and storing images takes a lot of space
  - Almost 4TB from 3 years of data collection

Archbold Fire Severity Mapping

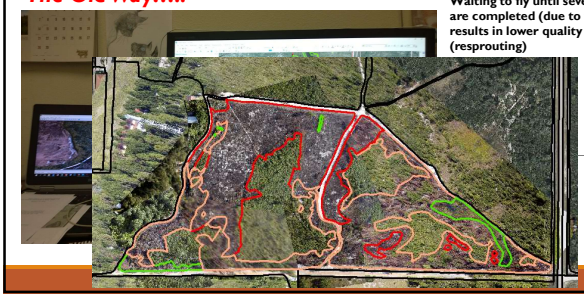
Vivienne Sclater and Kevin Main

Background and Intro

The Old Way…..

Oblique images from fixed-wing aircraft

Waiting to fly until several burns are completed (due to flight cost) results in lower quality images (resprouting)



And now…..

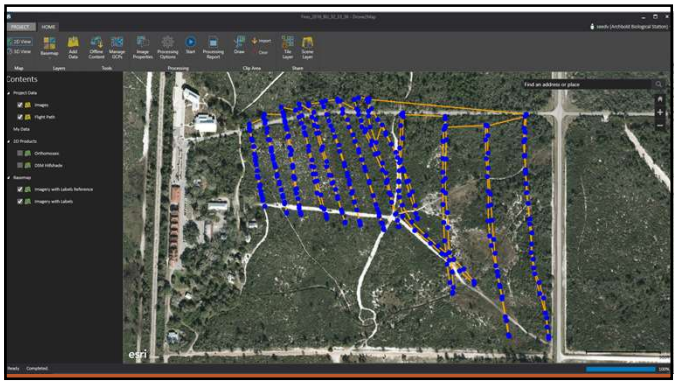
Images straight down from a drone

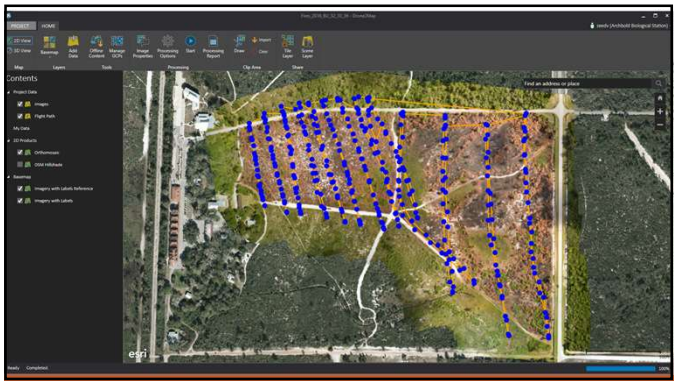
Fly each burn individually – within days of fire

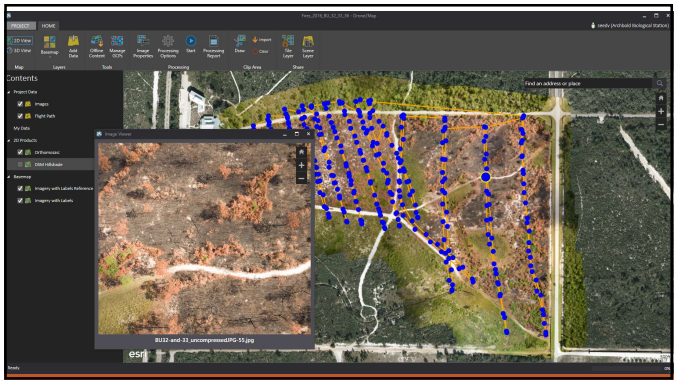
Mosaicked, rectified images used directly in ArcGIS

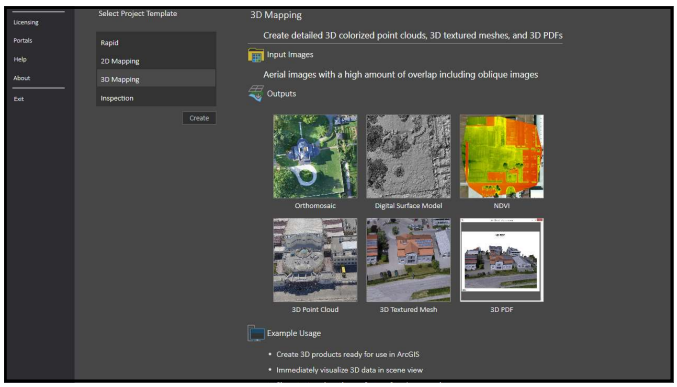
Higher mapping accuracy

Saves time





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Select Project Template
Rapid
2D Mapping
3D Mapping
Inspection
Create
3D Mapping
Create detailed 3D colorized point clouds, 3D textured meshes, and 3D PDFs
Input Images
Aerial images with a high amount of overlap including oblique images
Outputs
Orthomosaic
Digital Surface Model
NDVI
3D Point Cloud
3D Textured Mesh
3D PDF
Example Usage
Create 3D products ready for use in ArcGIS
Immediately visualize 3D data in scene view

Mapping of intensity
Contents
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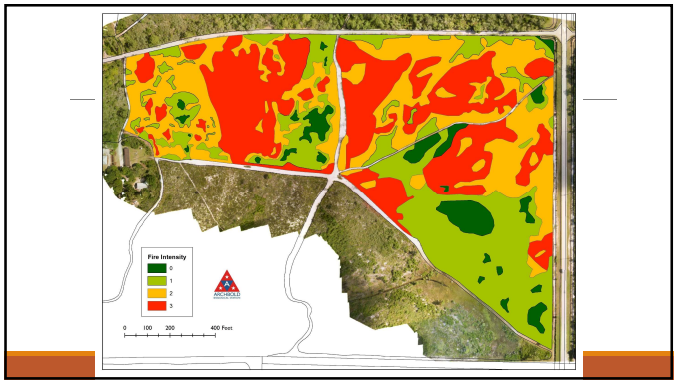
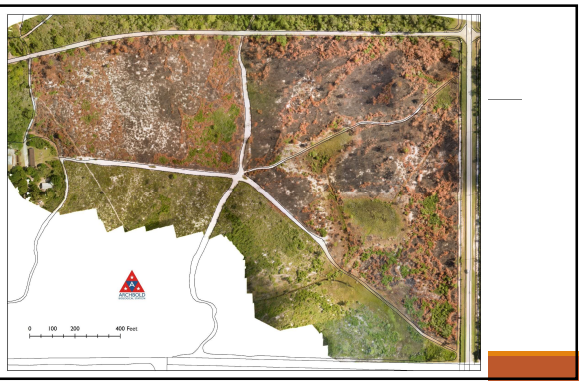

Fire Intensity
0
1
2
3
0
100
200
400 Feet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