UNIVERSITY OF MONTANA
AUTONOMOUS
AERIAL
SYSTEMS OFFICE

Autonomous Aerial Systems Office

Workforce Development: Hands-on experience for students

About Us

Director: Jeremy Crowley (1.0 FTE)
Assistant Director: Bart Bauer (.75 FTE)
Chief Pilot: Patrick Doyle (.49 FTE)
Anna Moser: Pilot/GIS Analyst (.49 FTE)
Jonathan Cordova: Pilot/GIS Analyst (.49 FTE)

Part of Broader Impacts Group (BIG)
    Office of Sponsored Programs

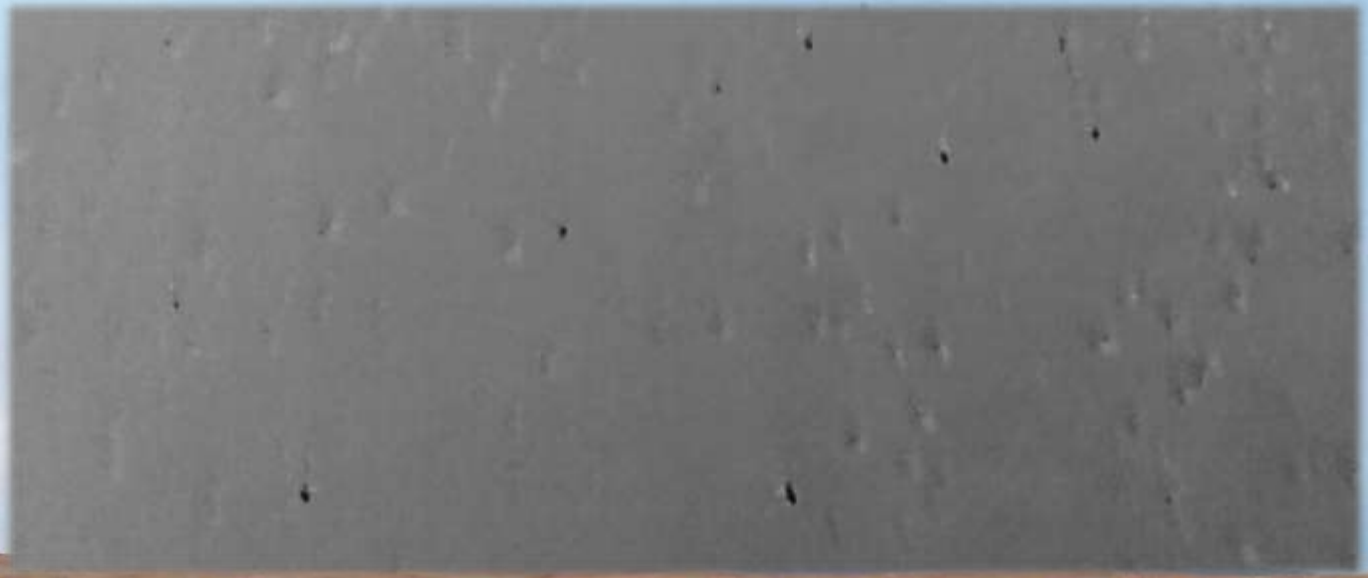
Why does UM have a UAS office?

The Autonomous Aerial Systems Office (AASO) mission is

- Coordinate and guide faculty, staff, and students through the understanding and decision-making process, regarding implementation of UAS in a changing research and regulatory environment
- Establish the infrastructure and resources in order to create sustainable autonomous aerial research
- Stimulate UAS-related innovation, entrepreneurship and workforce development in the state of Montana

AASO Projects - Wildlife

Collaboration with The Nature Conservancy Matador Ranch to improve sage grouse population counts

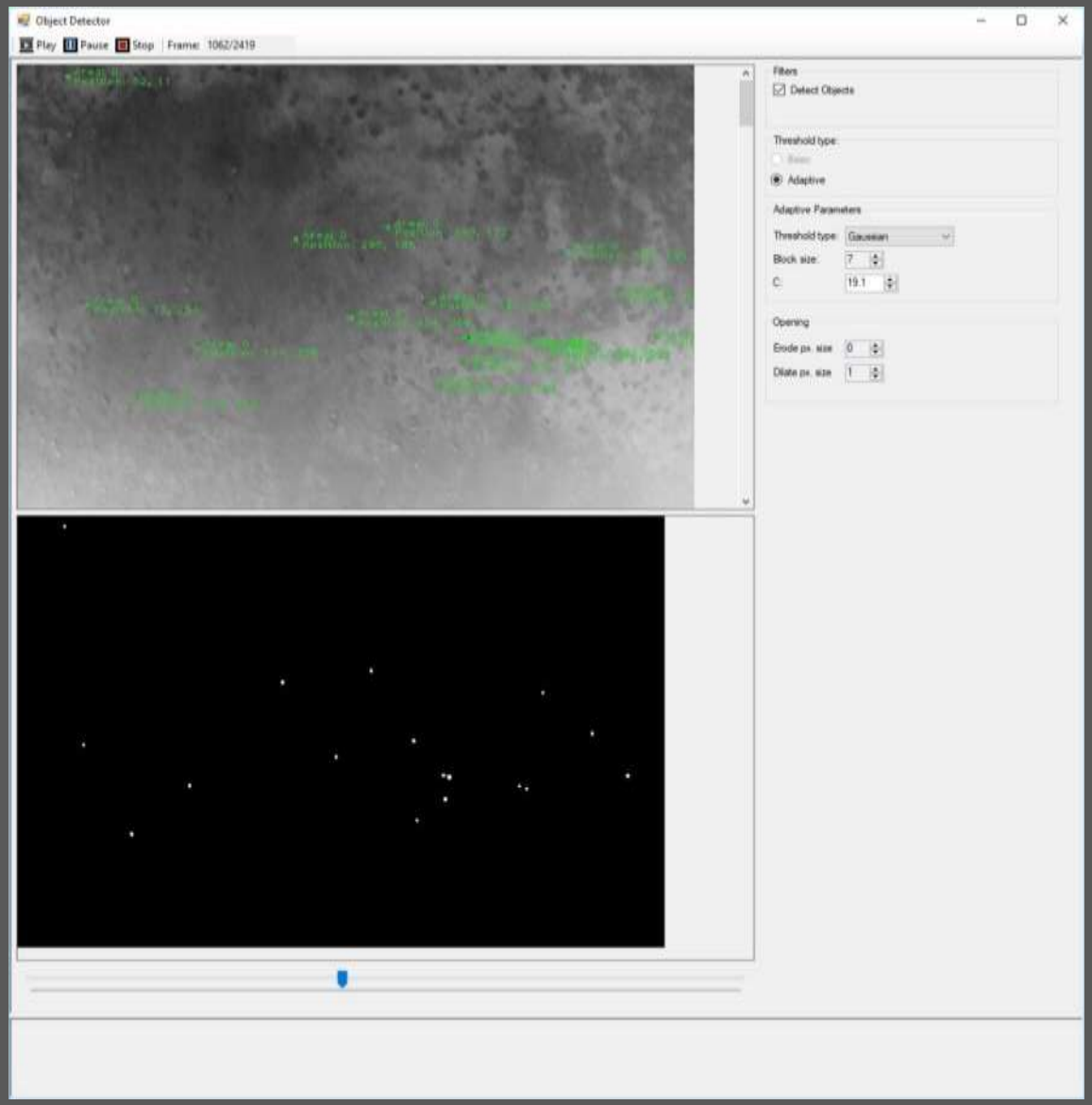


AASO used nighttime IR imagery to detect both males and female sage grouse.

2021 field campaign with sage grouse involves night vision imagery to assist with gender differentiation.

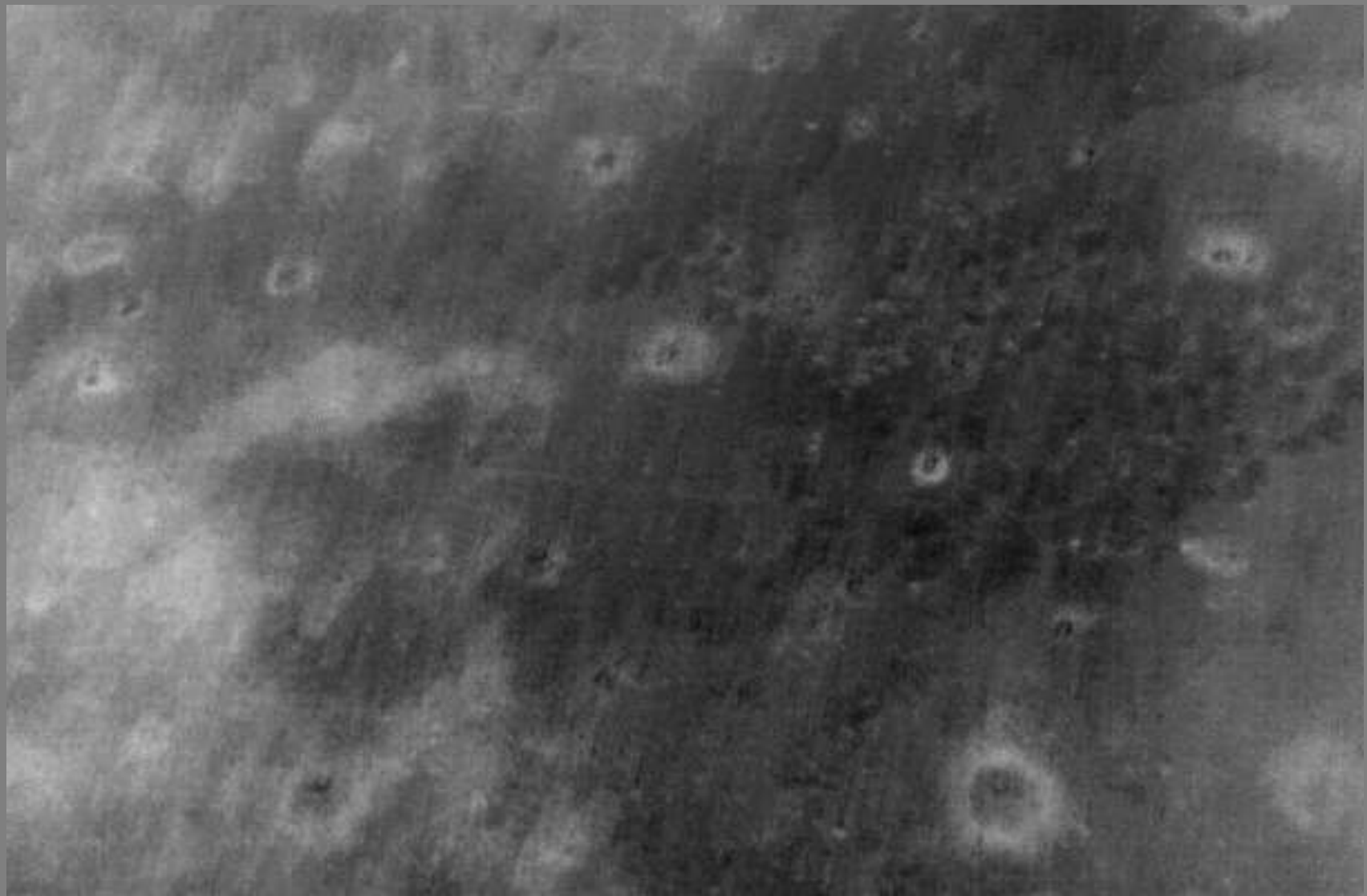
PVS-14 A

Preliminary work with machine learning algorithms are being done to detect the grouse automatically from the aerial imagery.



IR imagery can also be used for prairie dog town assessment, i.e. growth and collapse of colonies

The Nature Conservancy
Montana



Development of workflows and algorithms to increase fire management effectiveness.

https://www.umt.edu/aaso/DroneFire/default.php

Roaring Lion Fire, MT 2016

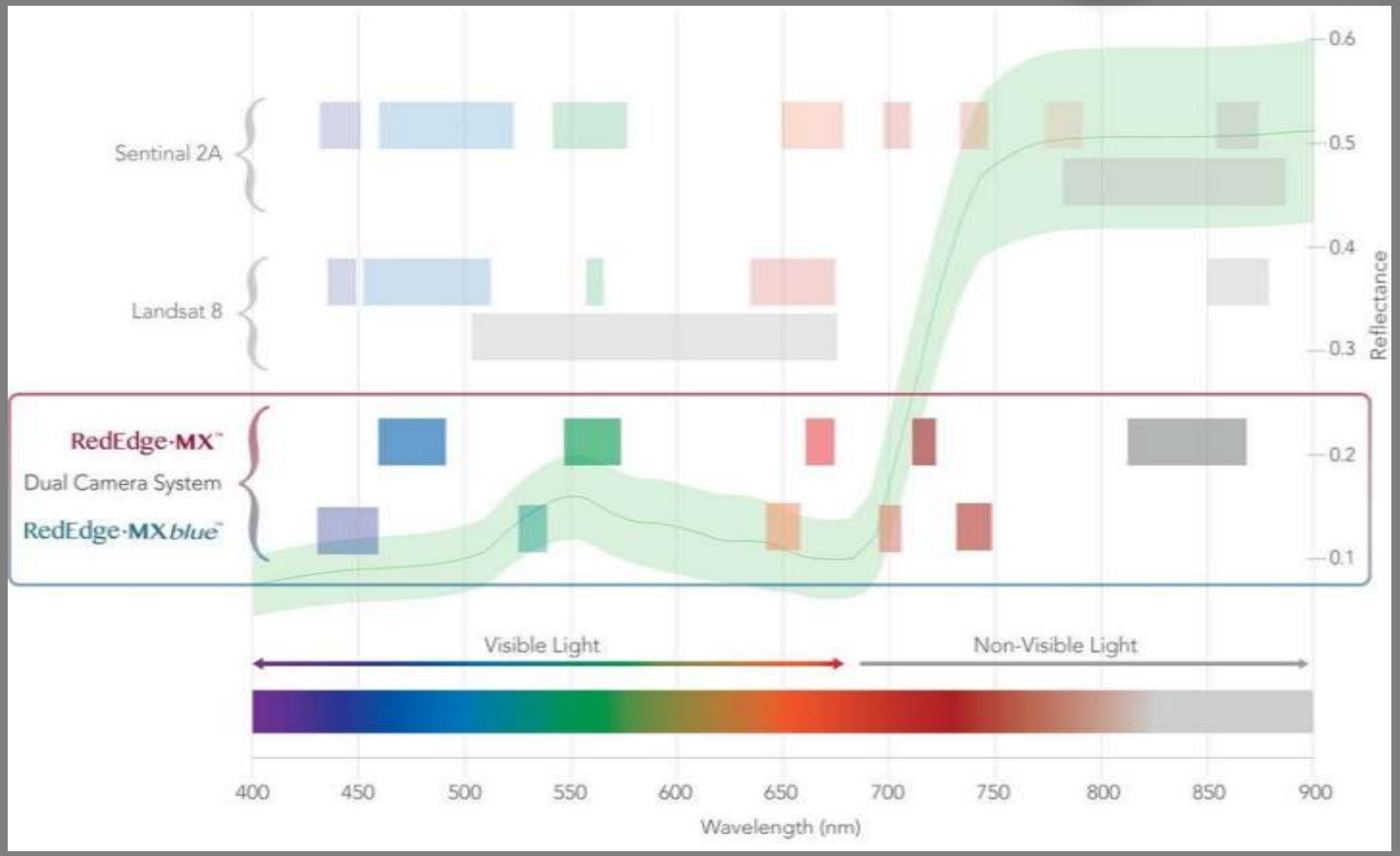
Post burn assessment with UM's Fire Center

Atmospheric Sounding Studies using multiple platforms

This flight went to 9,500 feet (2900 m) MSL in a comparison test with balloon-borne radiosondes.

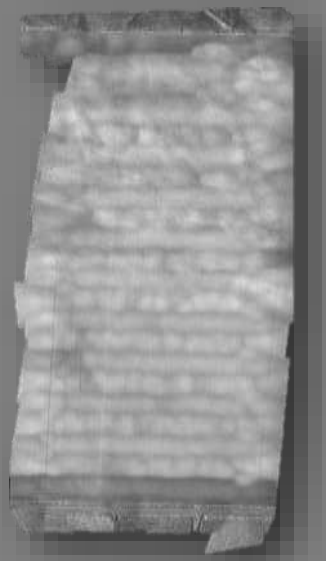
Multispectral Studies

10 Band multispectral 444-842nm, GSD 8cm/px at 400ft AGL

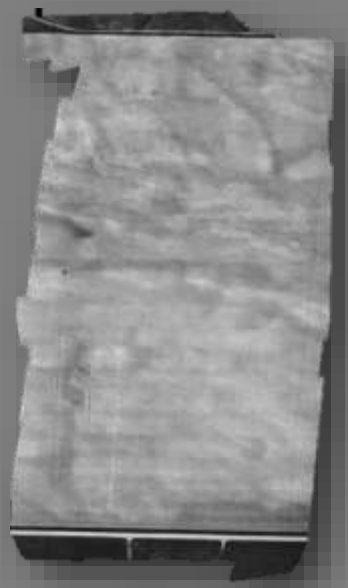


Agriculture Studies

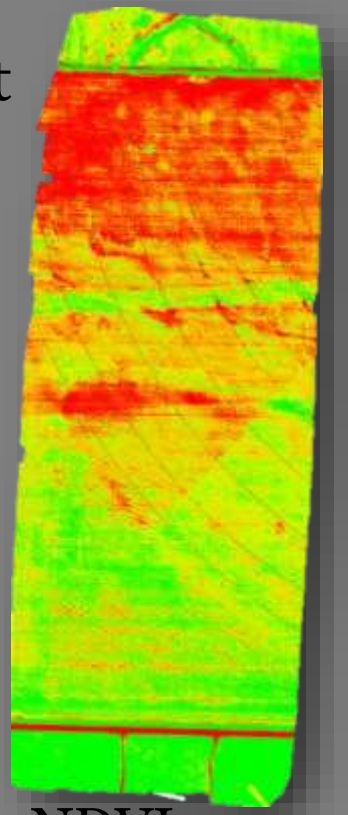
These images come from a multispectral camera analysis of the effectiveness of different irrigation practices in collaboration with the Montana State Prison.



NIR



Red

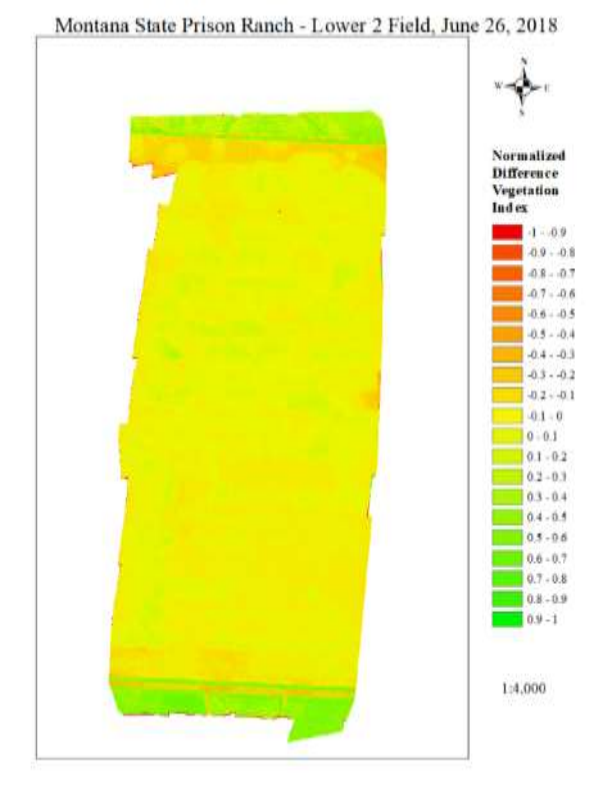


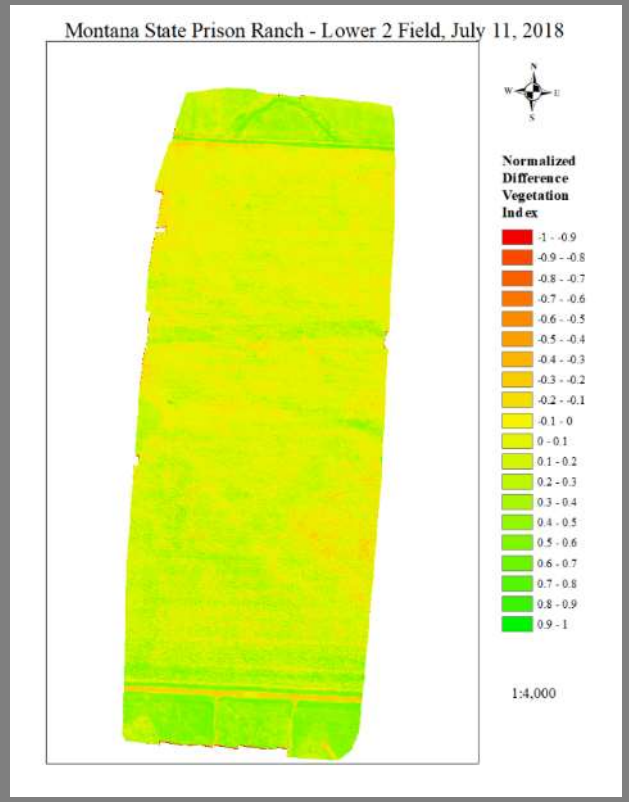
NDVI

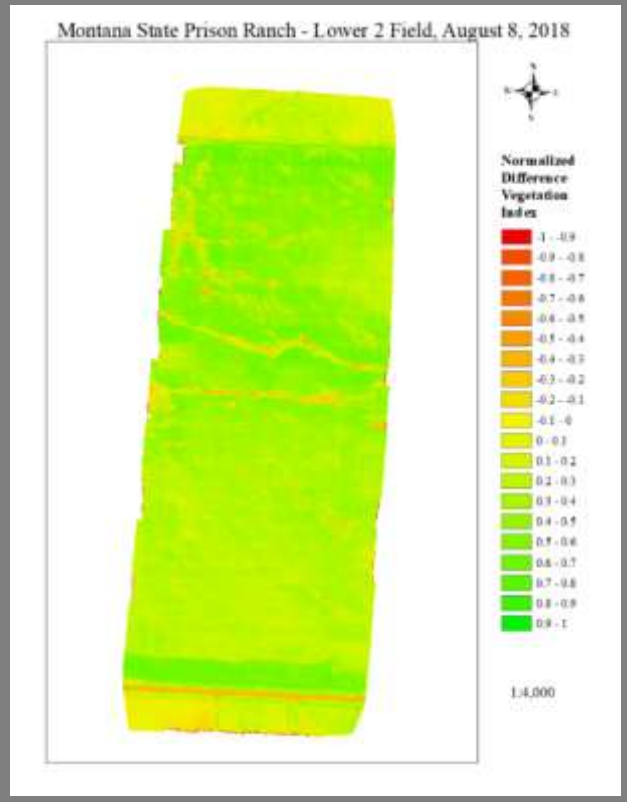
$$NDVI=\frac{(NIR-Red)}{(NIR+Red)}$$

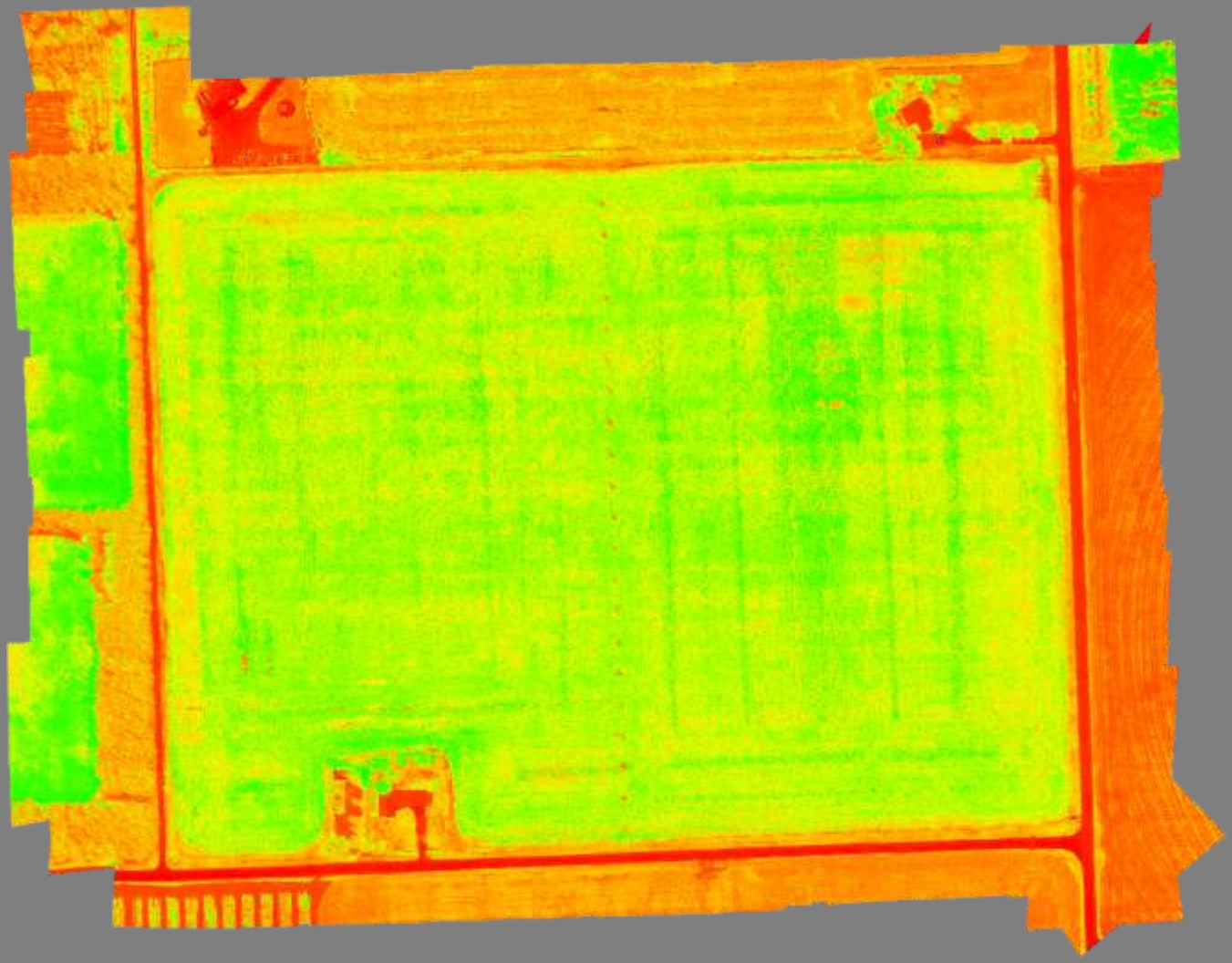
Normalized Difference Vegetation Index

Time Series Analysis









Knapweed
Centaurea nigra

UAS: Mavic 2 Pro
Images: 703
GSD: 1.48 cm/pixel
Area: 0.25 km^2

Classified orthomosaic of knapweed

Knapweed
Centaurea nigra

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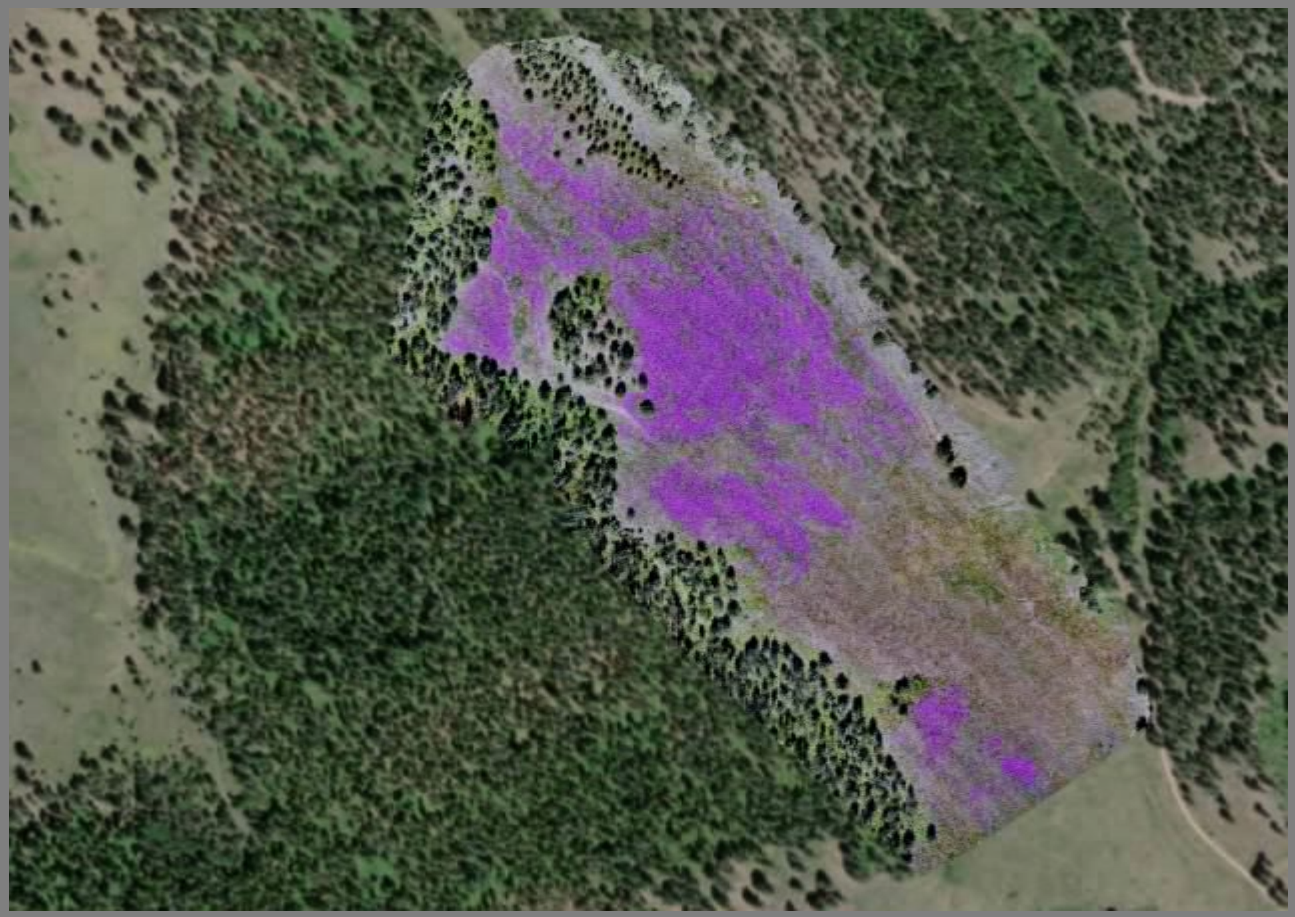


Classified orthomosaic of knapweed

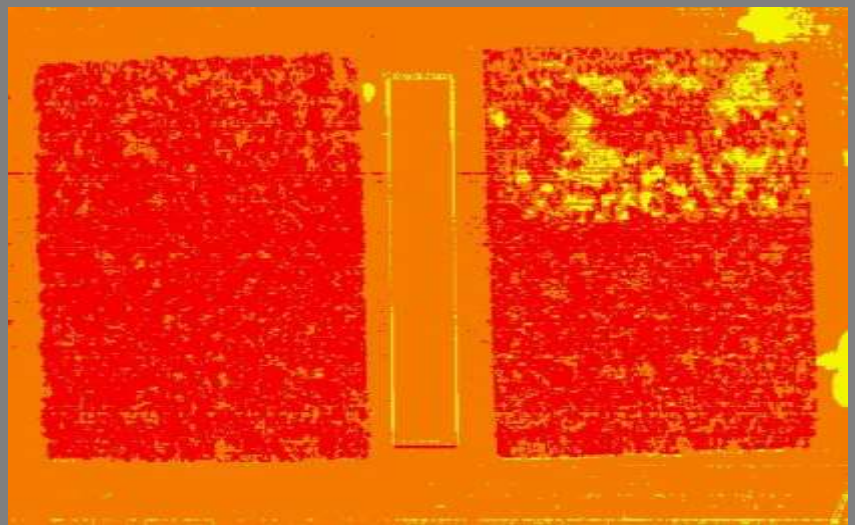
Leafy Spurge
Euphorbia virgata

UAS: Mavic 2 Pro
Images: 1053
GSD: 1.50 cm/pixel
Area: 0.3 km^2

Classified orthomosaic of Leafy Spurge area of interest

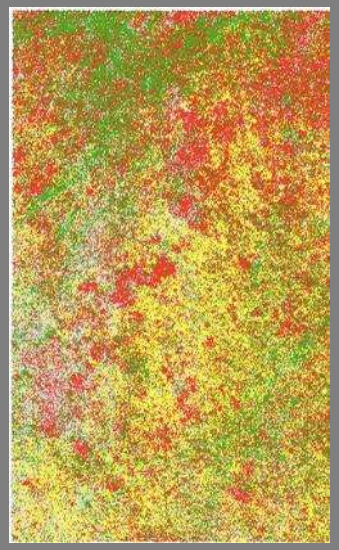
Hyperspectral Studies

This work is to assess the presence of ice on a roadway under a grant with the Montana Department of Transportation.



Classification Projects - Vegetation

RGB Composite



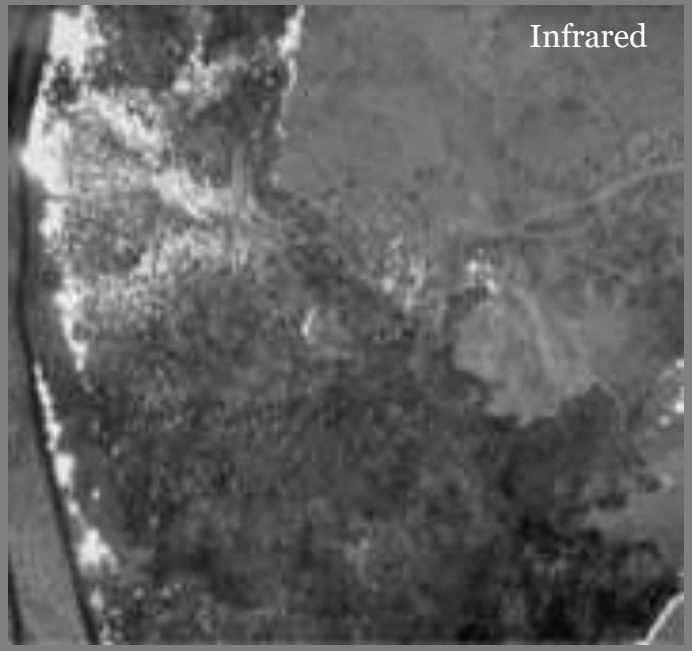
Classification

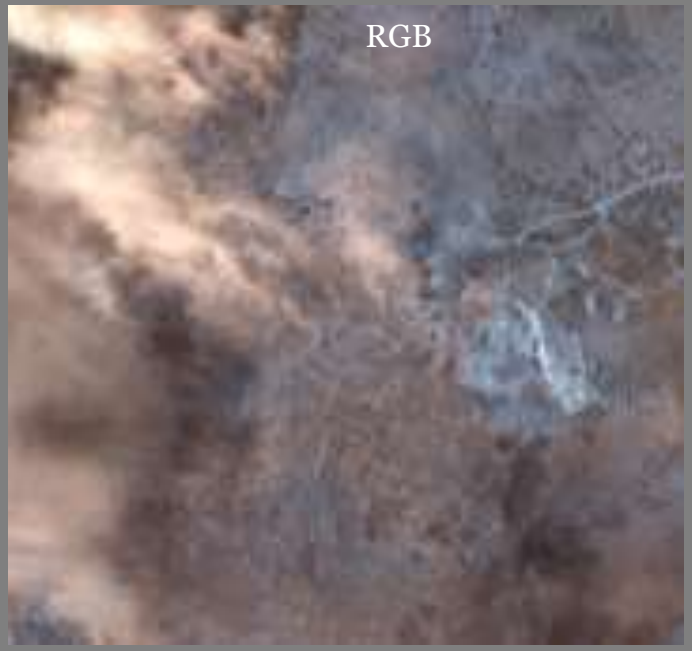
UAS:	Matric 100
Sensor:	RedEdge-M
Study Sites:	10
Images:	17,850
Mapped Acres:	48.7 acres
GTP:	1,200 per site
GSD:	2 cm/pixel
Altitude:	30 meters
Maps Produced:	30
Accuracy Assessment:	96%

Classification Projects - Fire

Data collected from actively piloted aircraft

- EO/RGB
- Short Wave IR
- Mid Wave IR
- AIMMS-20 (weather data)





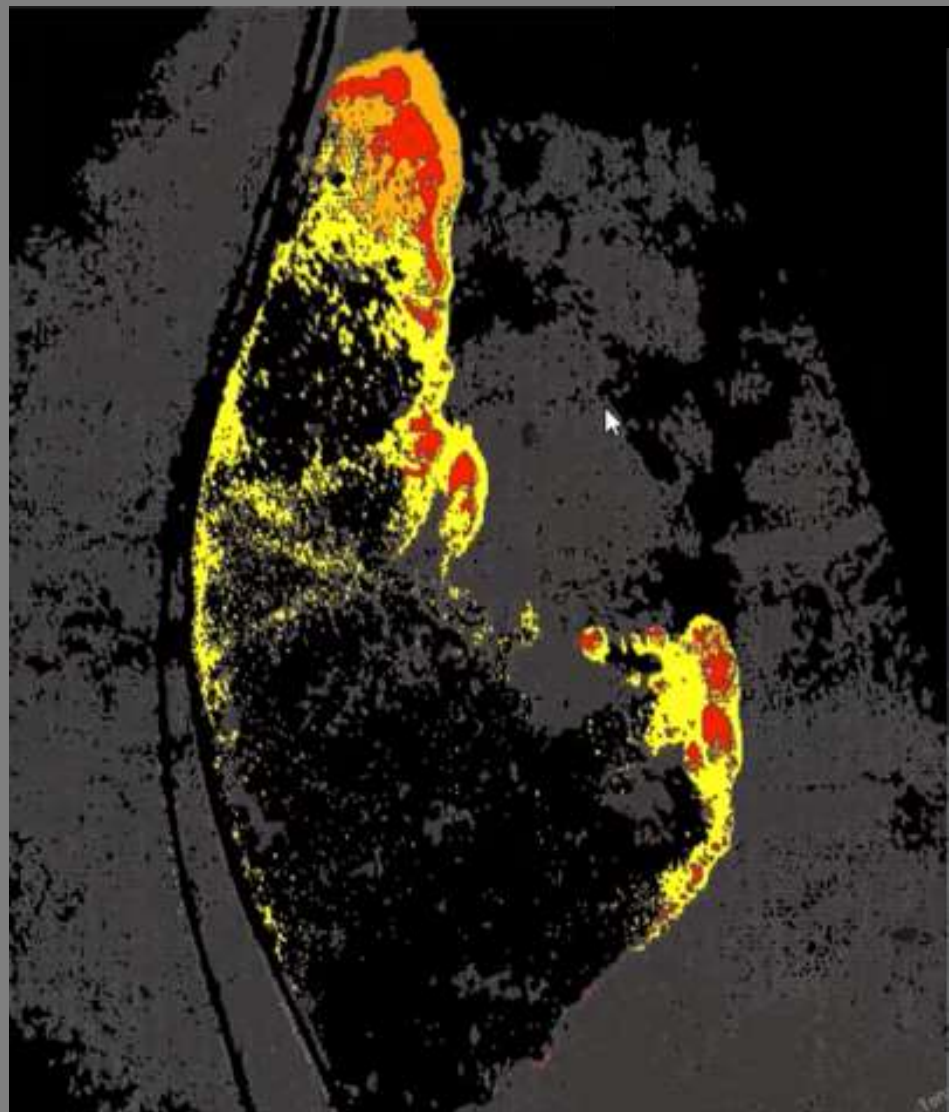
Classification Projects - Fire

Active Burning (orange)

Intense Heat (red)

Smoldering (yellow)

Burnt (black)



Landslide Monitoring

3D point cloud imagery to define weaknesses in retaining wall. This project led to over $1 million in funding for infrastructure repair.

Site Assessment

Log Deck, Weeds, Erosion

Volumetric

Log deck assessment

3D Modeling of US Forest Service Historic Structures

These projects help maintain forest service inventory of historic structures and lay the ground work for 3D printing of the models.

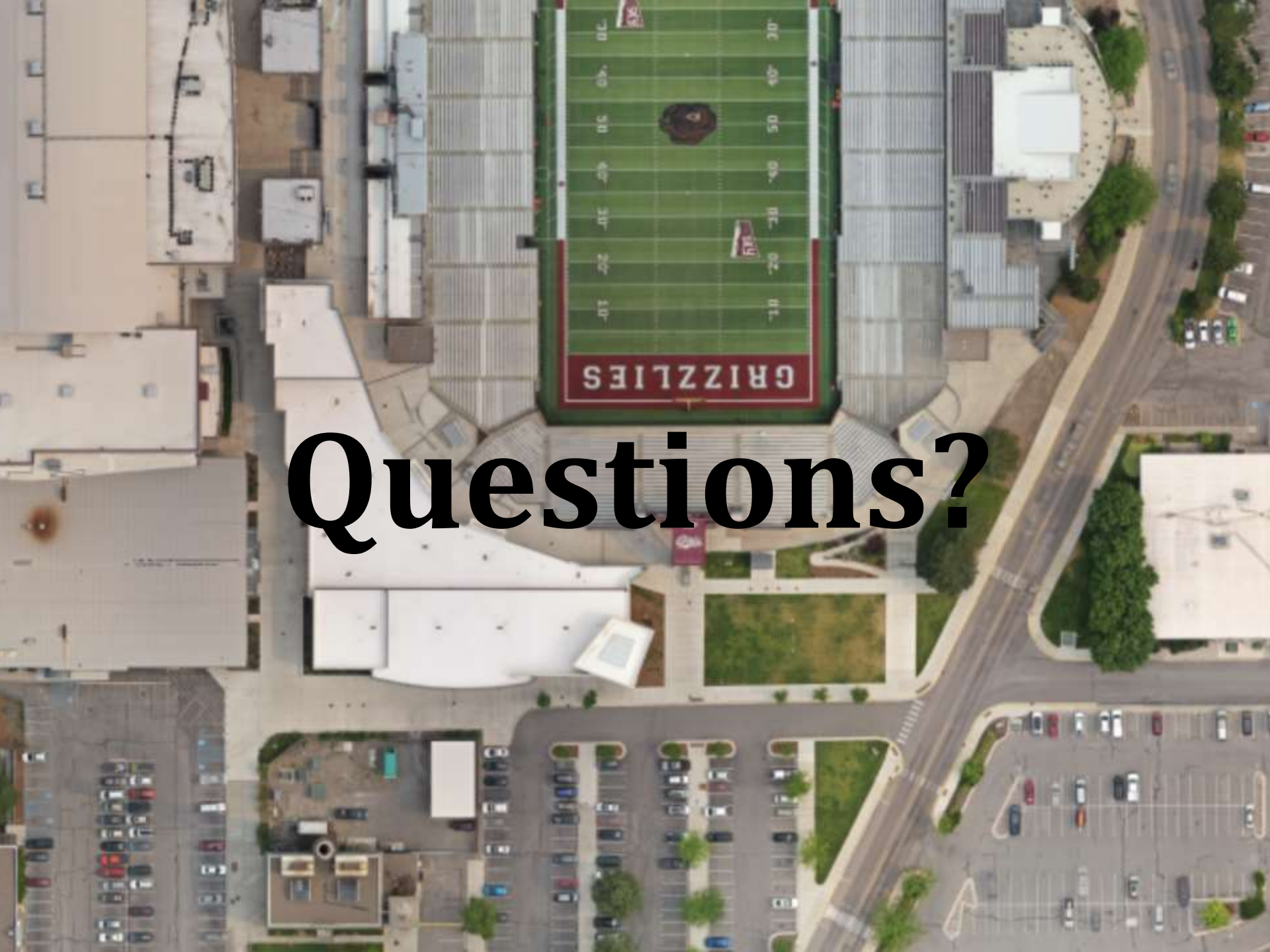
MSU-Lighting Evaluation

Future Projects

Assessment of USFS dams and mines structure

Assessment of snow and water resources, fire management and abandoned oil well monitoring. Unreal Engine SfM.

Integrate autonomous terrestrial vehicle with aerial data towards the goal of a vertical, tactical platform stack.



Questions?