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DETECTING VOLE DAMAGE IN TALL FESCUE SEED CROPS WITH AERIAL IMAGERY



Oregon State
University

Unmanned Aerial Systems (UAS Or Drones) – Emerging Technology in Agriculture

- Collect aerial imagery for
 - Yield estimation
 - Fertilizer decision support
 - Plant counts
 - Weed mapping
 - Disease detection
 - Water stress monitoring
- Pesticide applications
 - Improved field access
 - Precision application
- Seed crop specific research is needed

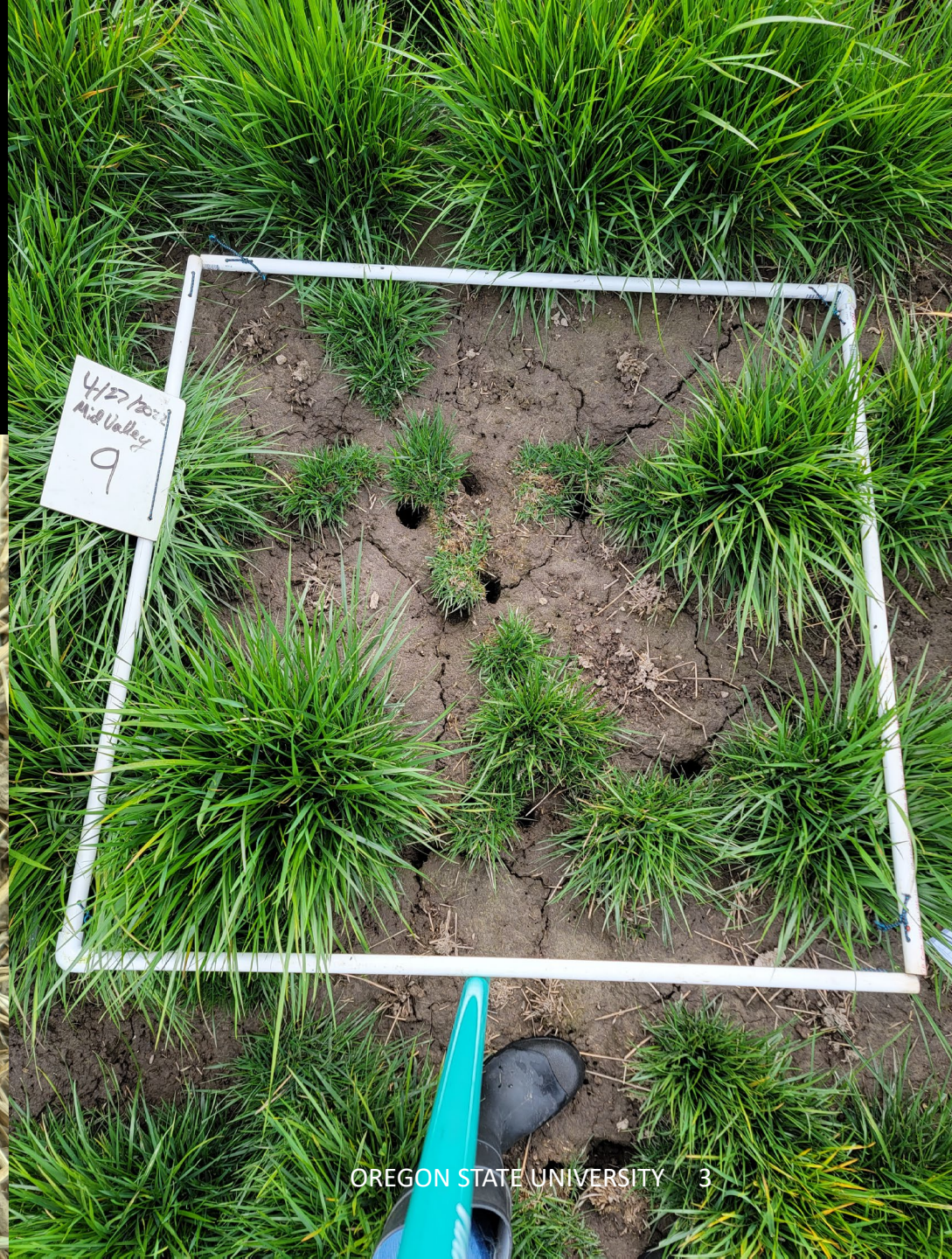


Gray-tailed voles are
a pest of seed
production systems
in Western Oregon



Severe Defoliation

- Damaged areas are grazed repeatedly



Tillers Cut Before Seed Harvest



Vole Damage can cause 30-50% yield losses
in infested fields



Control options

- Zinc phosphide bait
 - Labor intensive application rules
 - Decreased effectiveness
- Tillage/crop rotation
 - Early removal of perennial crop
 - Voles move to near-by fields
- Biological control/predators
 - Helps, but not enough



An aerial photograph of a grass seed field. The field is composed of numerous small, irregular patches of green grass separated by areas of bare, brown soil. The overall appearance is one of sparse vegetation, which is characteristic of vole damage in a seed field. The text is overlaid on a semi-transparent rectangular box in the center of the image.

Research Question:

Can aerial imagery collected
with a drone be used to
quantify vole damage in grass
seed fields?

Why Measure Damage?

- Research tool
 - Test control methods
 - Watch how damage changes over time
 - Detect spatial patterns
- Scouting tool
 - Treat infested areas
 - Save labor

Field Sites

- Established tall fescue seed production fields
- Heavy vole damage
- Young Field
 - 3 year old field
 - Turf type
 - Clear rows
- Old Field
 - 8 year old field
 - Forage type
 - No rows

Drone Flights



- Flights in late March and late April
 - Spring growth period
- Drone with two cameras
 - Multispectral (includes colors we can't see)
 - High Resolution natural color (RGB)

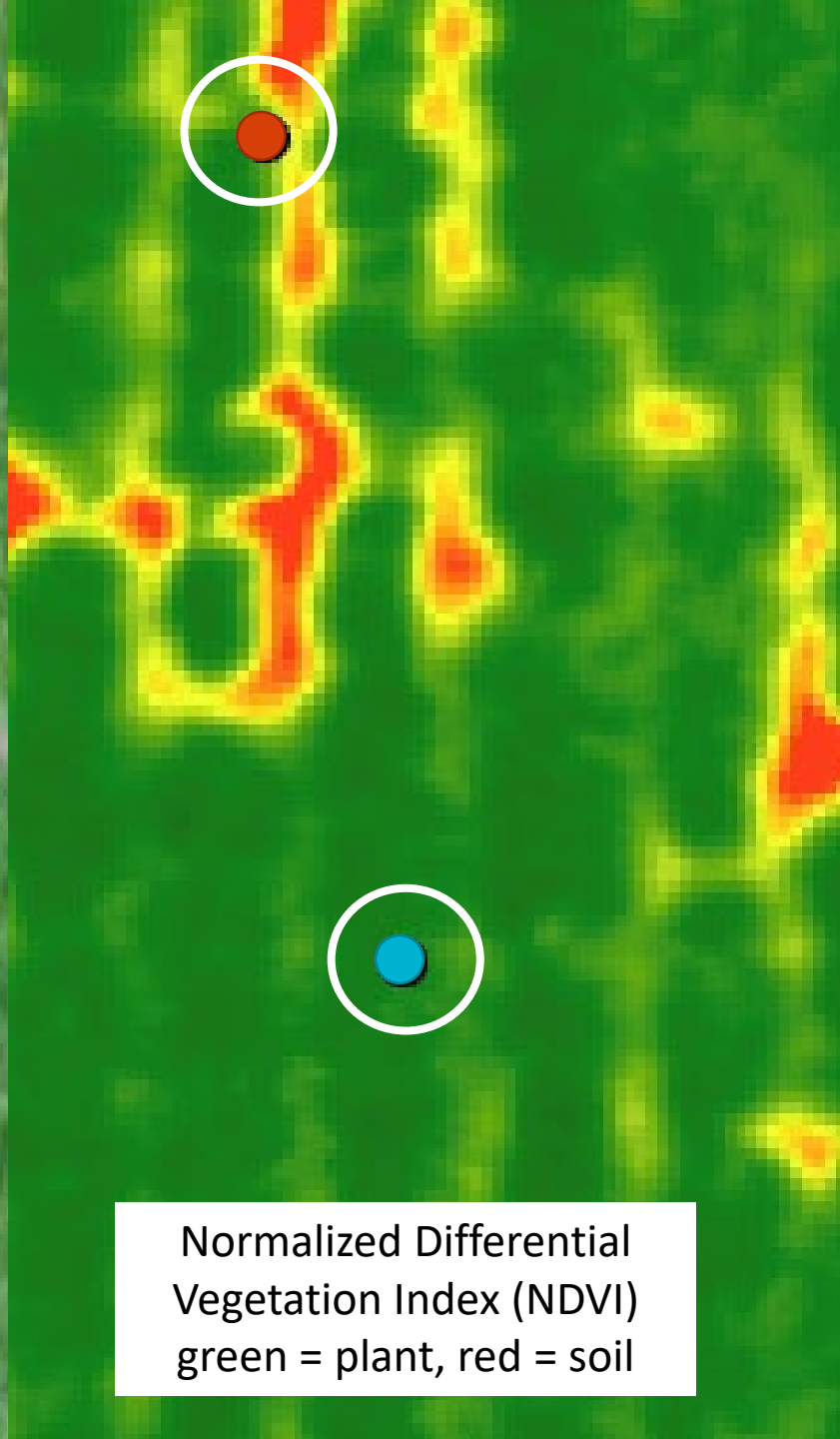
Ground Truth Data

- Locations of damaged and healthy plants were recorded
 - 40 points per flight
- Accurate location information
 - Accuracy \pm 3-7 cm
 - Ground control points

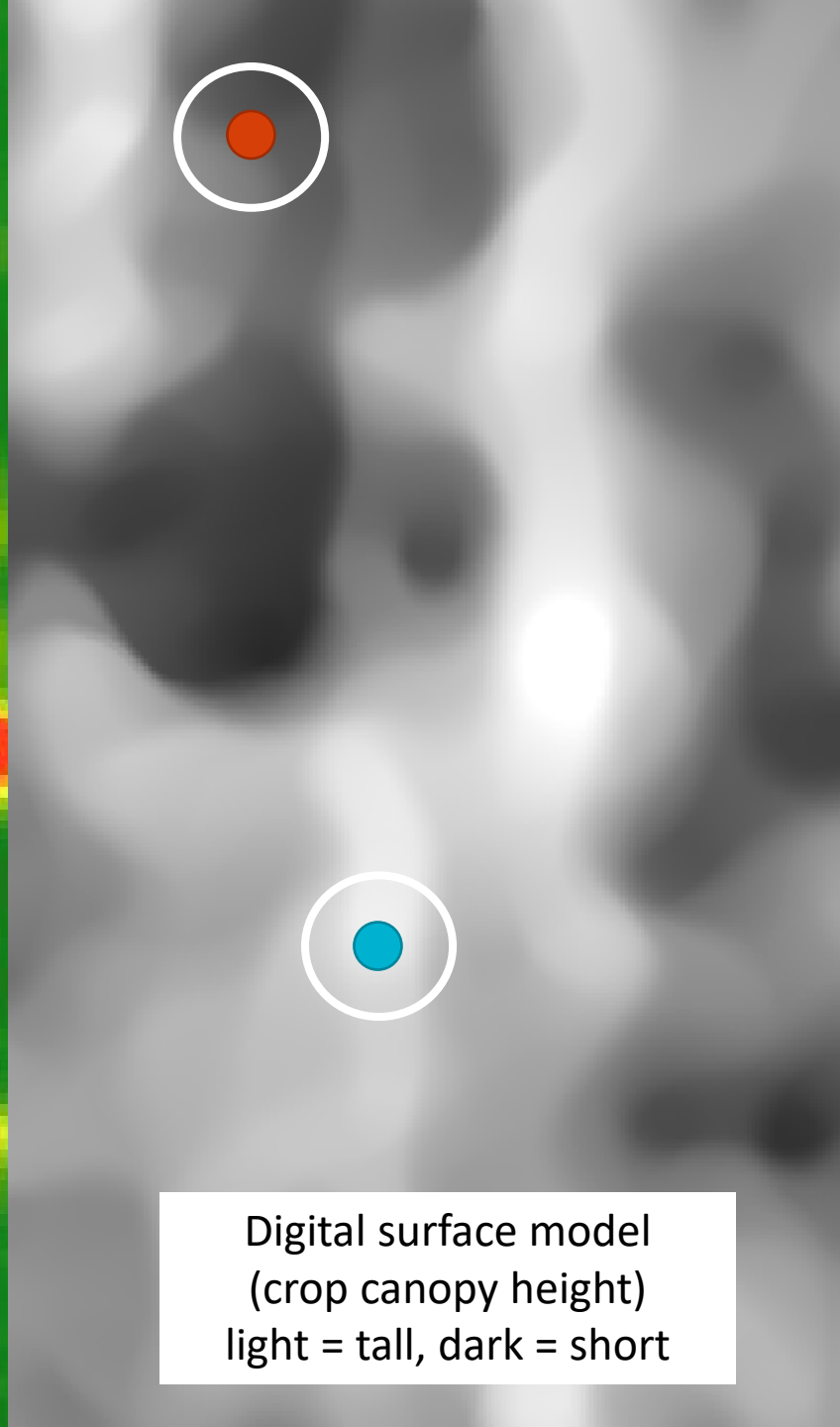




Natural color
(RGB)

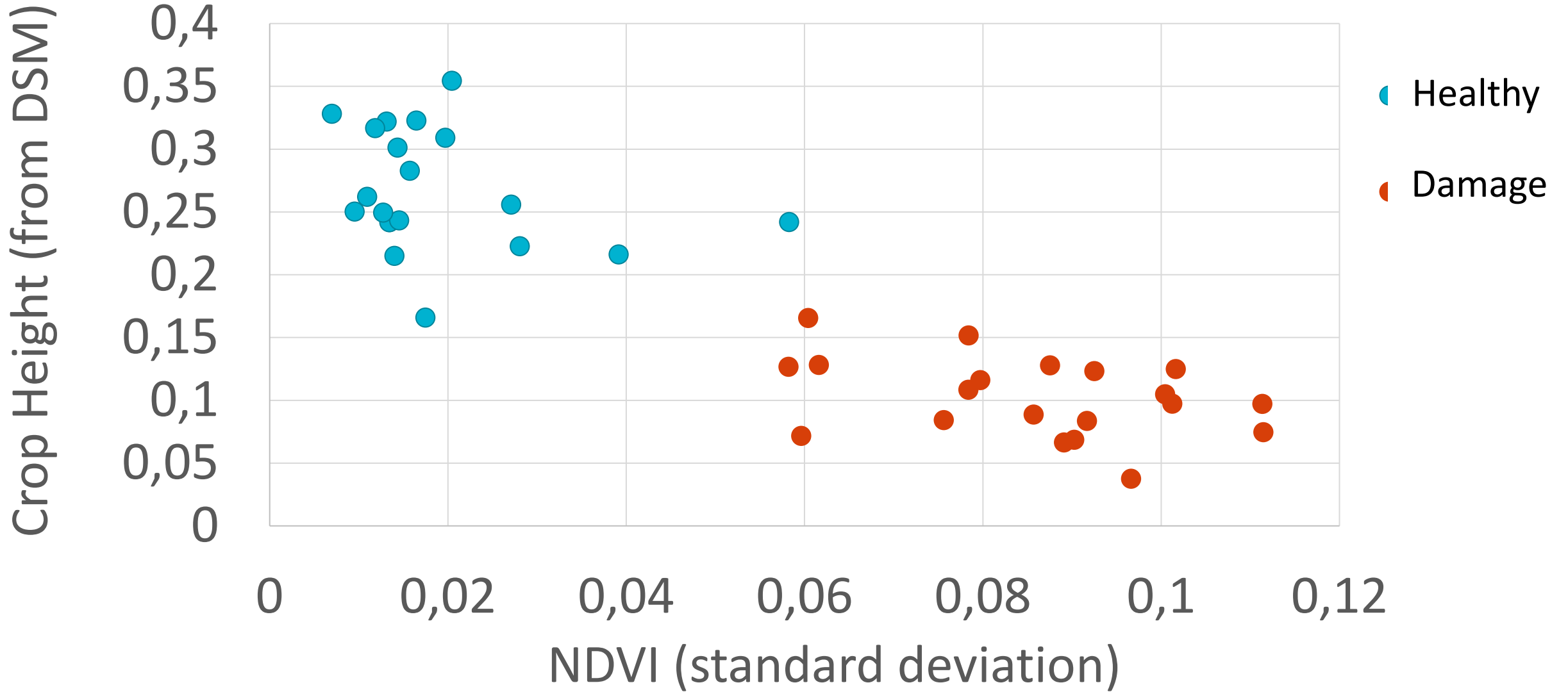


Normalized Differential
Vegetation Index (NDVI)
green = plant, red = soil



Digital surface model
(crop canopy height)
light = tall, dark = short

Old Field - March



Supervised, Object-Based Image Classification



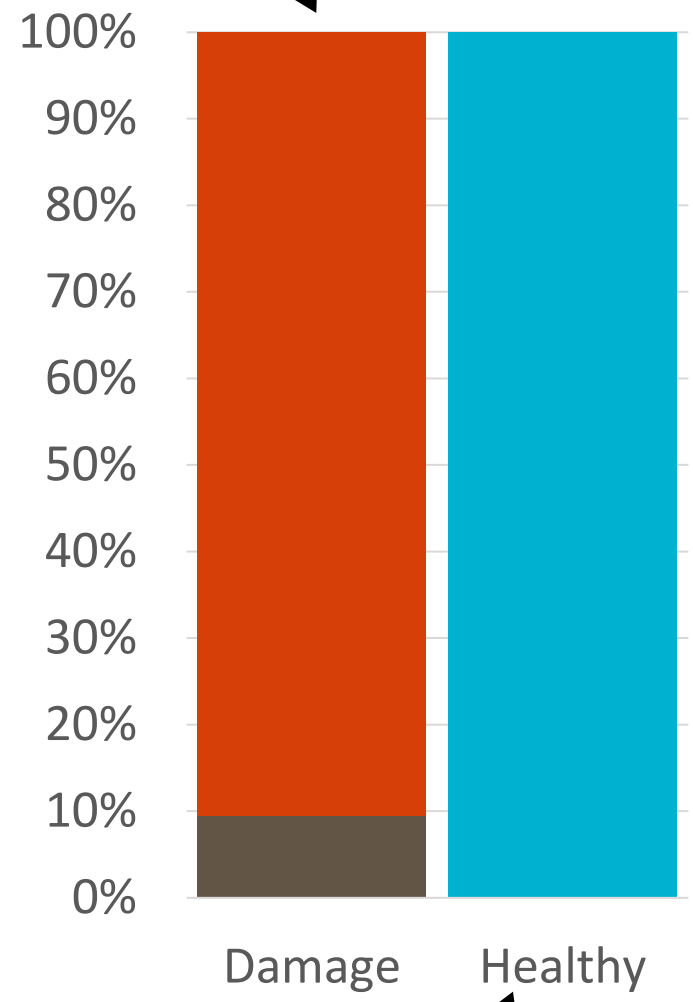



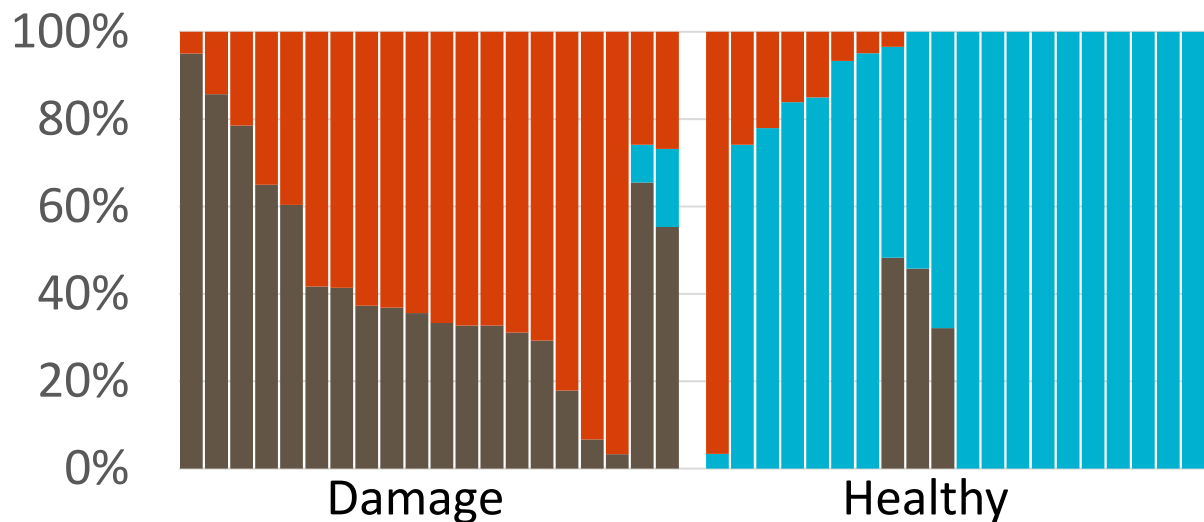


Image classified into:

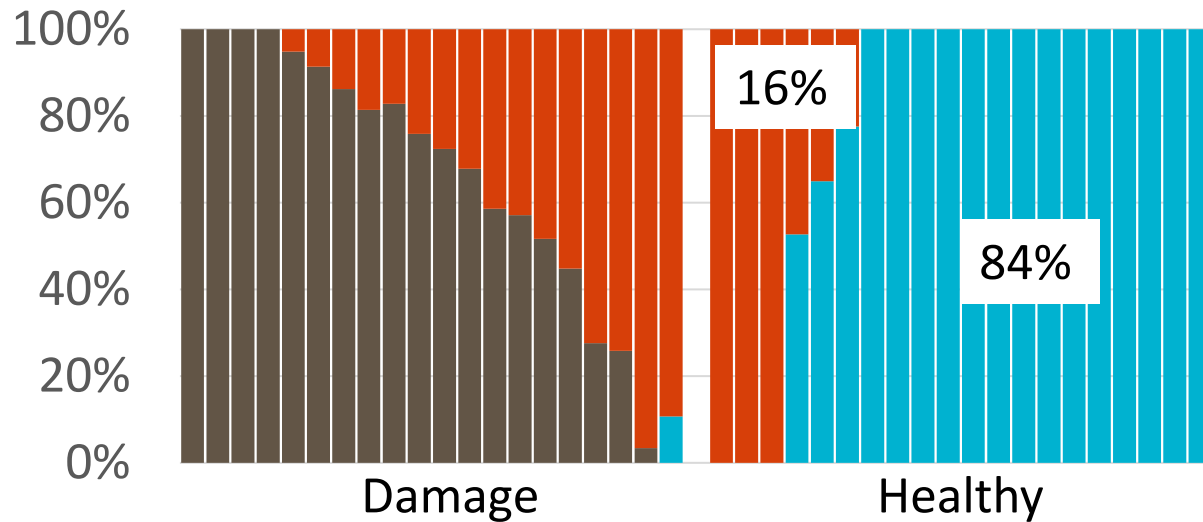
-  Healthy Plant
-  Damaged Plant
-  Soil

 Data extracted from buffer area around ground truth points

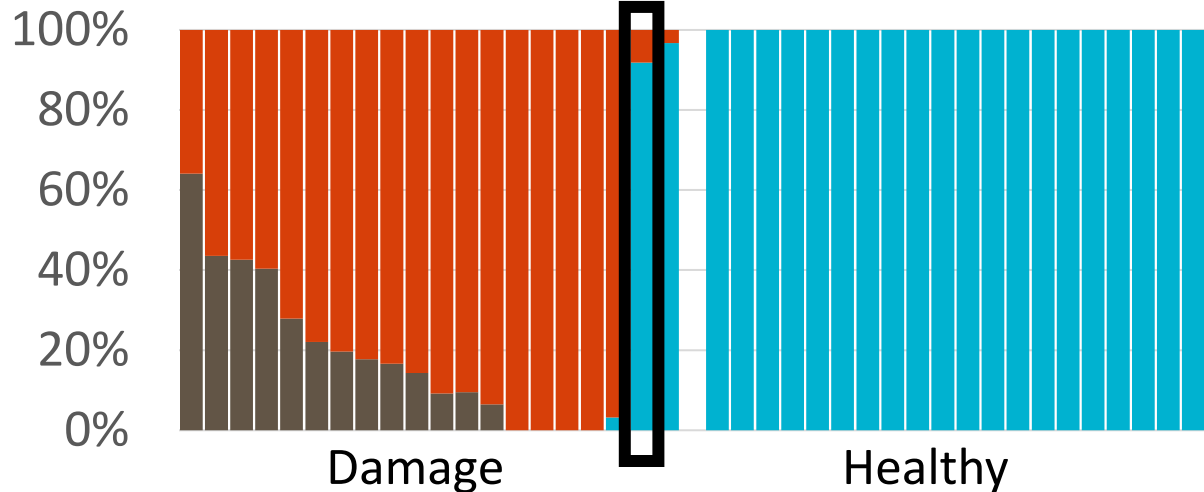
Young Field - March



Old Field - March



Young Field - April



Old Field - April

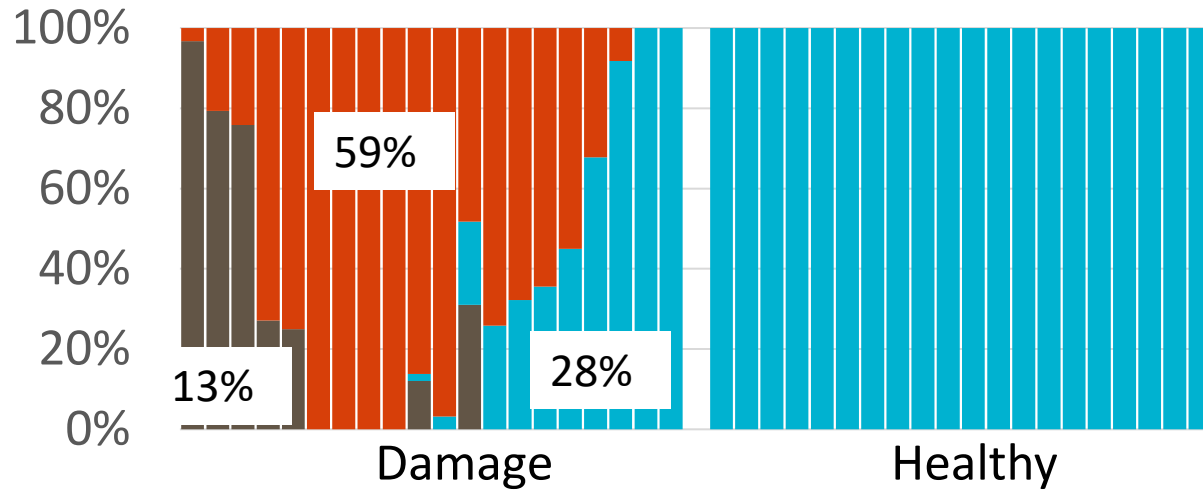


Image classified into:

 Healthy Plants

 Damaged Plants

 Soil

Damage Is Not Always Easily Visible



Classification Accuracy

Ground Classification	Computer Classification		
	Healthy	Damage	Soil
Healthy	91%	7.5%	1.6%
Damage	9.4%	54%	36%

Conclusions

- Areas with vole damage are shorter and show more variability than un-damaged areas
- Image classification detected damage with acceptable accuracy



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