APPLICATIONS FOR UAV AERIAL IMAGERY AND COLOR RECOGNITION

Overview

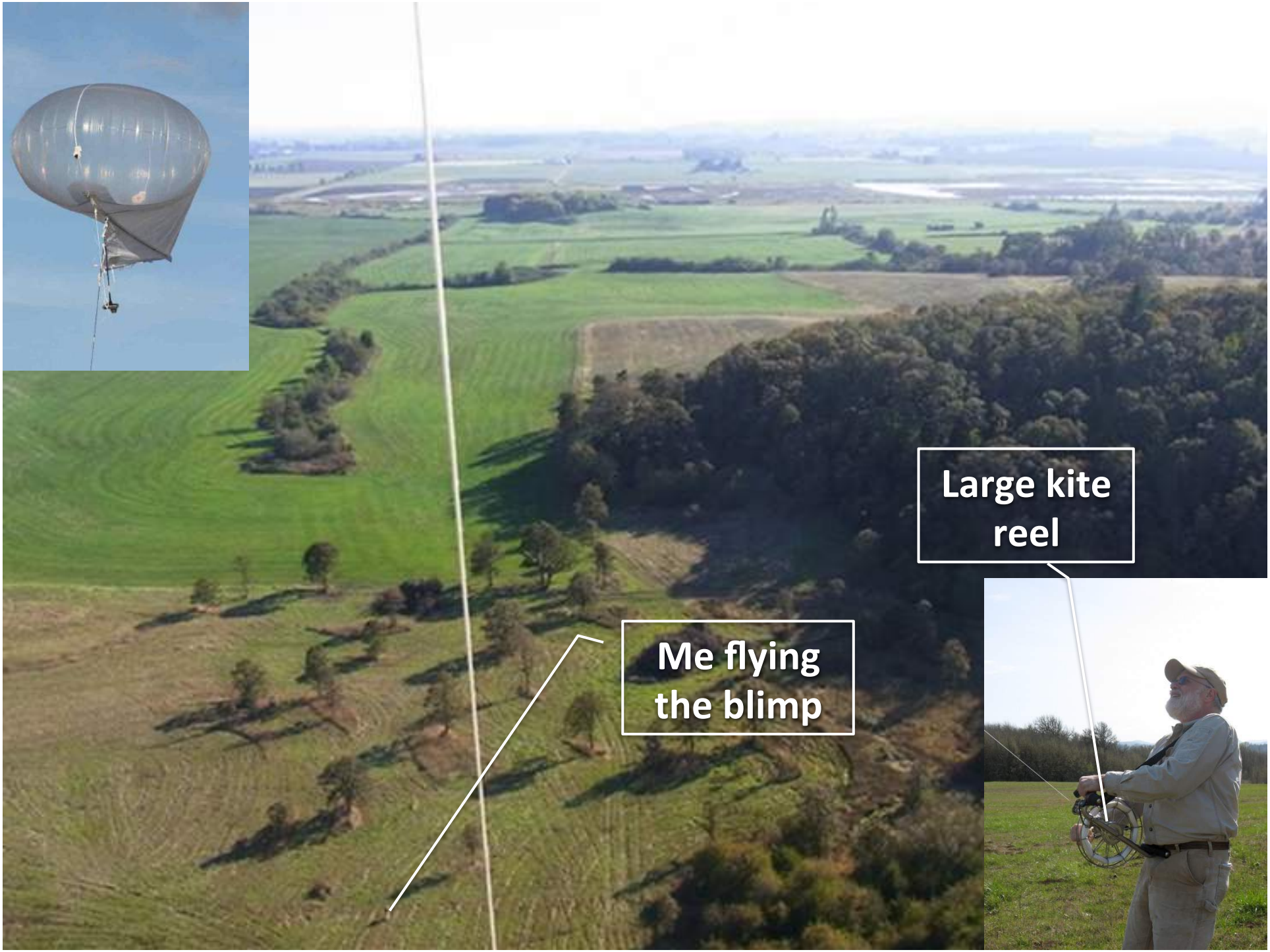
1. Introduction to equipment
2. Why low elevation aerial photography?
3. Using drones for weed surveys
4. Other sources for aerial photos
5. Using color recognition to estimate vegetation cover
6. FAA rules and practical information
7. Future plans

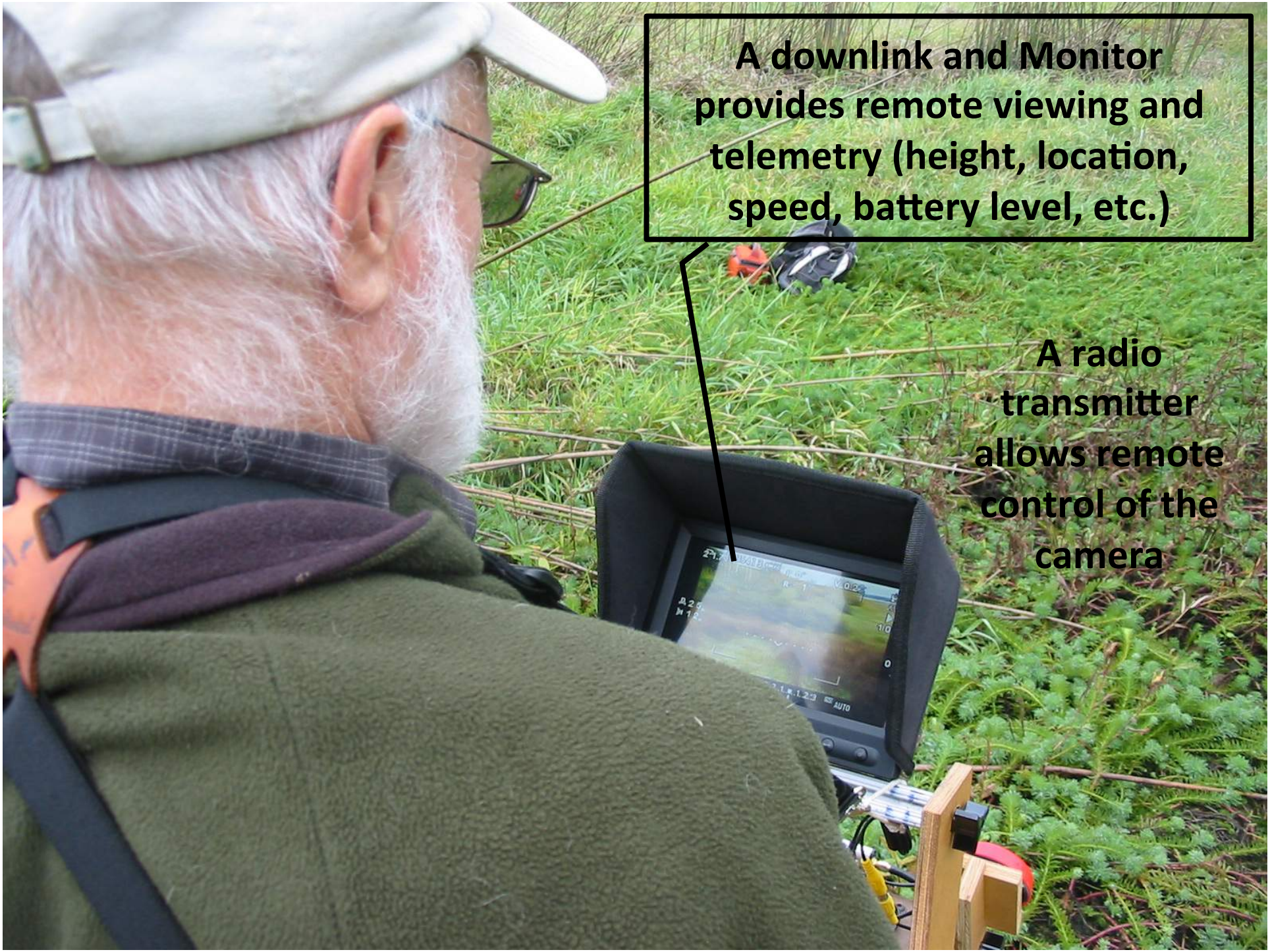
Balloons/kites

-Less expensive
-Less risky
-Wind is a problem
-Difficult to take photos from same location

Drones

-More expensive
-More risky
-Can fly in windy conditions
-More easily take photos at precise locations

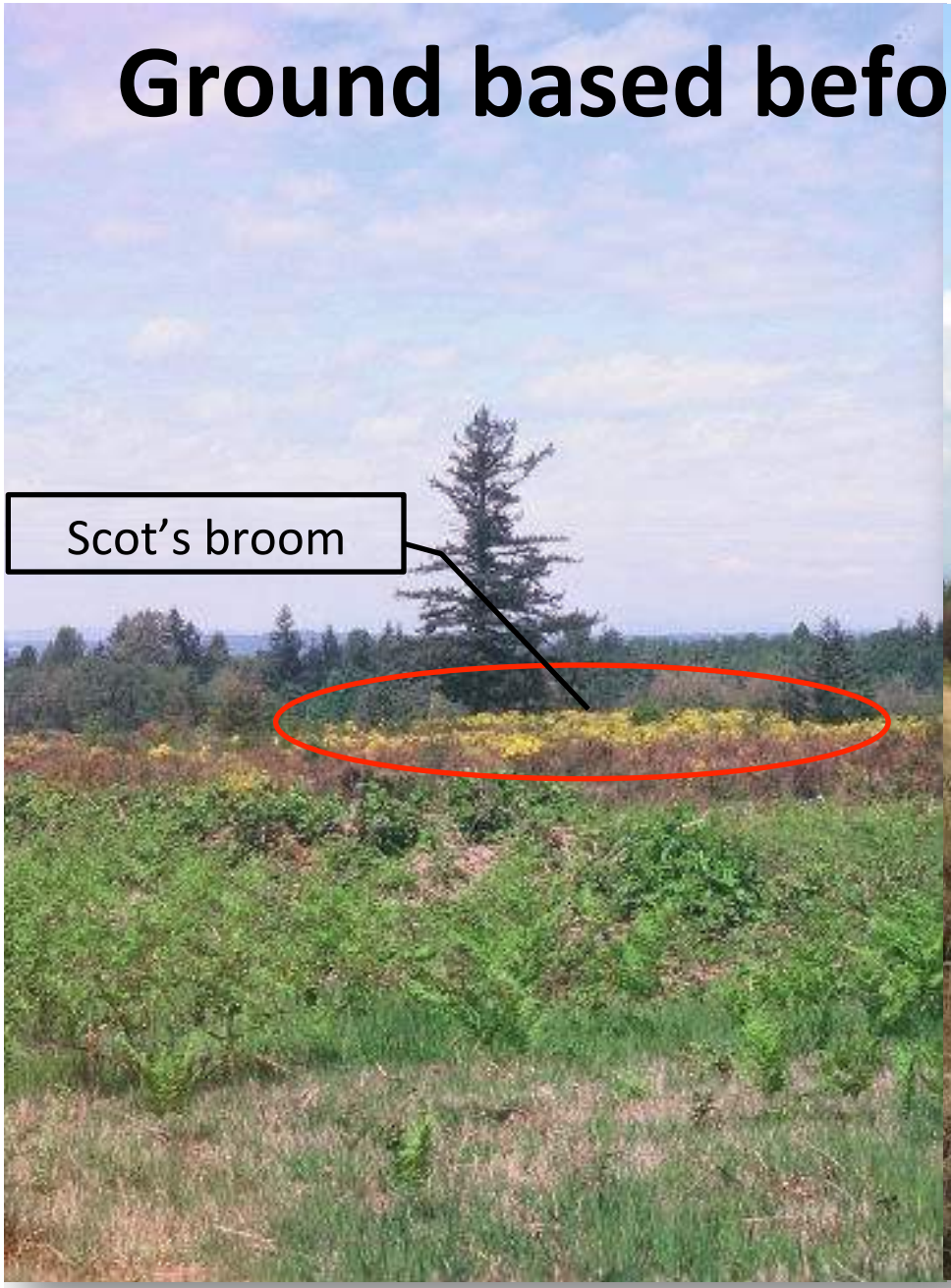

Large kite reel
Me flying the blimp


A downlink and Monitor provides remote viewing and telemetry (height, location, speed, battery level, etc.)
A radio transmitter allows remote control of the camera

Yikes—this was not supposed to happen!!!

WHY I STARTED DOING AERIAL PHOTOGRAPHY

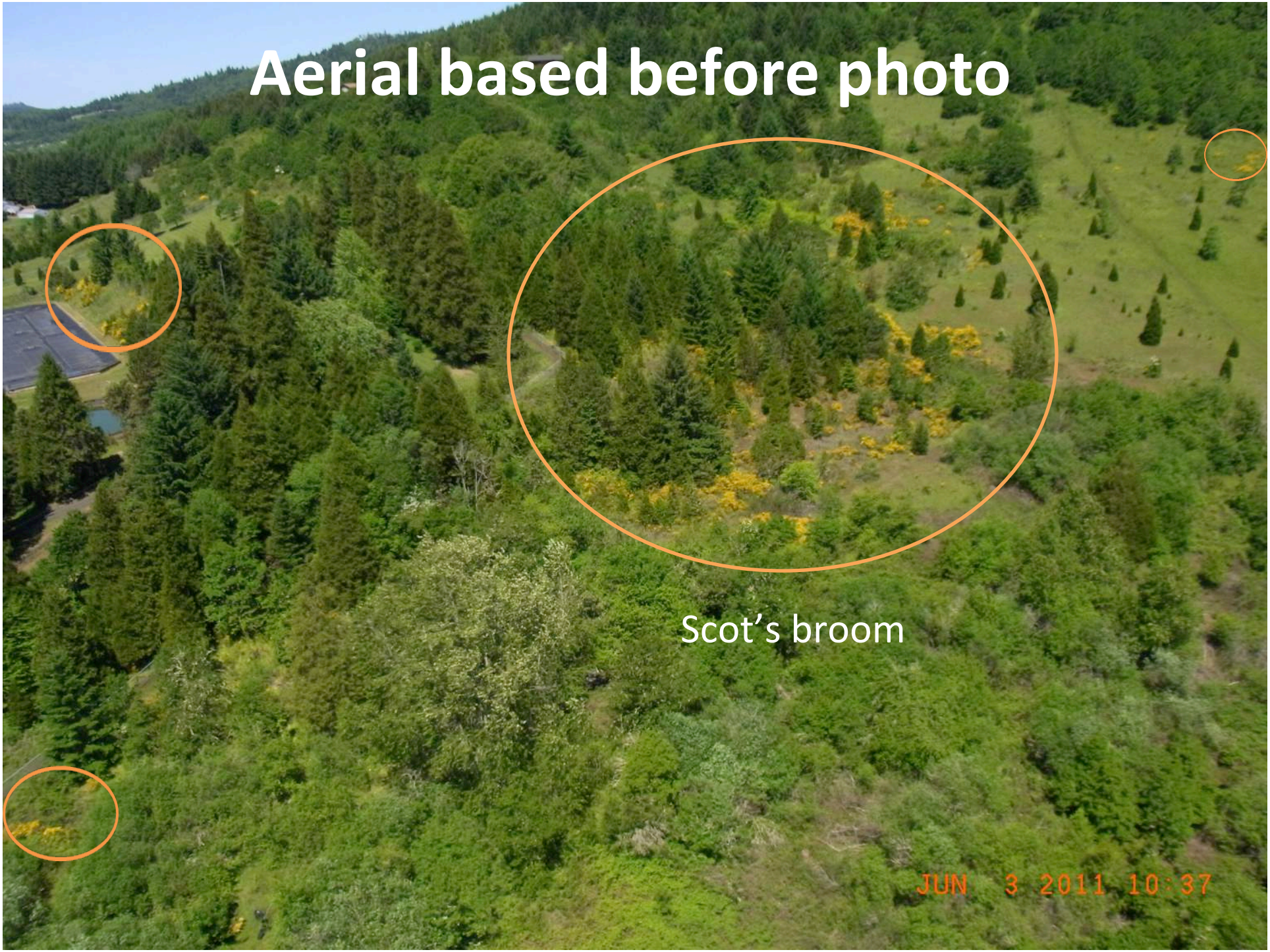
Ground based before and after photos



Before Scot's broom removal

After treatment

Aerial based before photo



Aerial based before and after photos

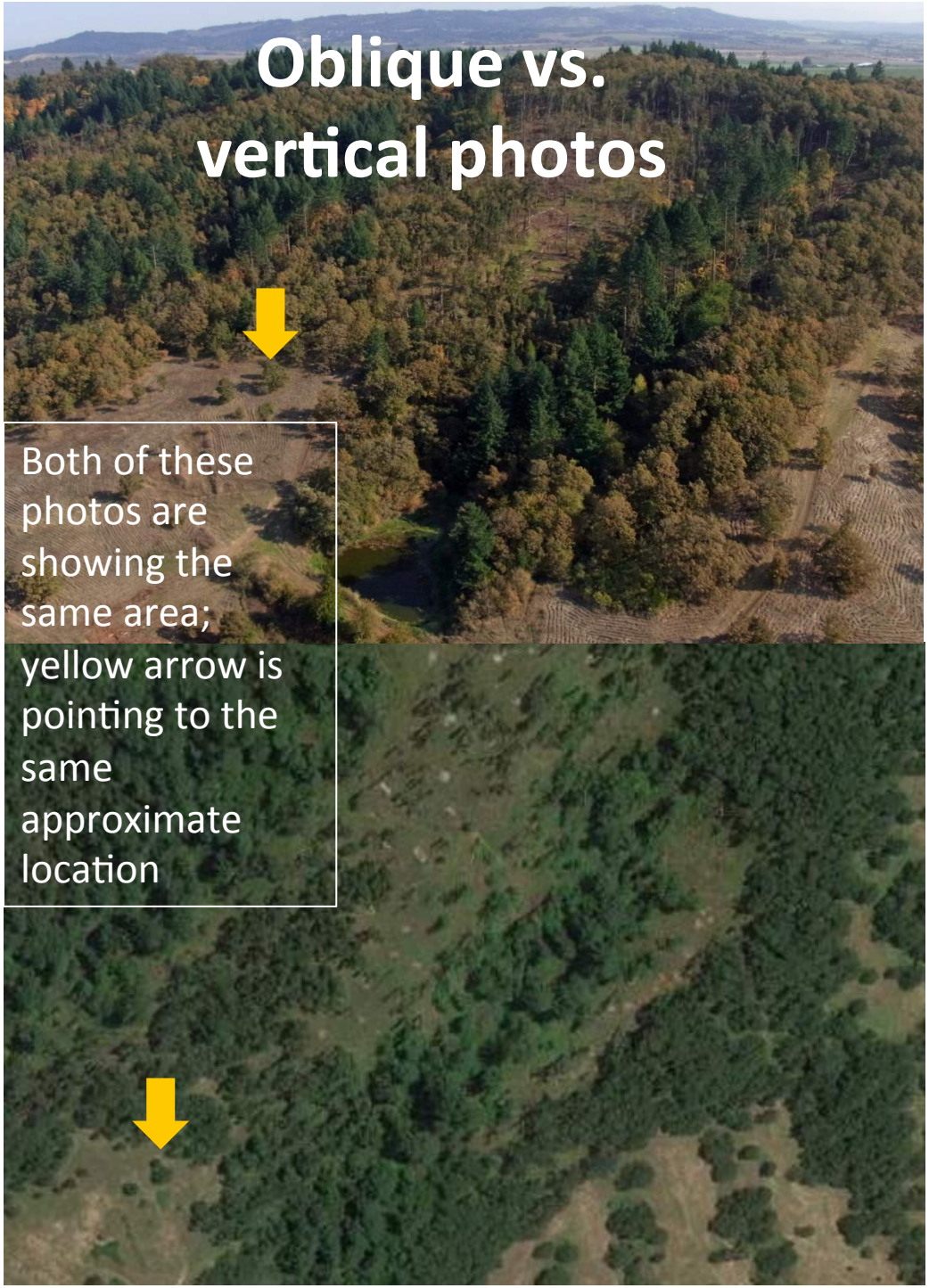
Pre-treatment photo taken in August 2011

Post-treatment photo taken in October 2011

Aerial vs. ground based photos

Aerial photos make it is easier to:

- See large projects with just a few photos
- Use photos for planning a project
  - Location and extent of weed problem
  - Estimate crew size
- Monitor changes over time for large projects



Oblique photos

Advantages:

- Easily interpreted by non-specialists
- Topographic cues are retained
- Easier to distinguish plant species
- Fewer photos are needed to show large projects

Disadvantages

- Difficult to estimate area or cover
- Can't overlay on top of maps; use GIS, etc.

USING DRONES TO SURVEY FOR WEEDS

WEED SURVEY

Scot's broom

WEED SURVEY

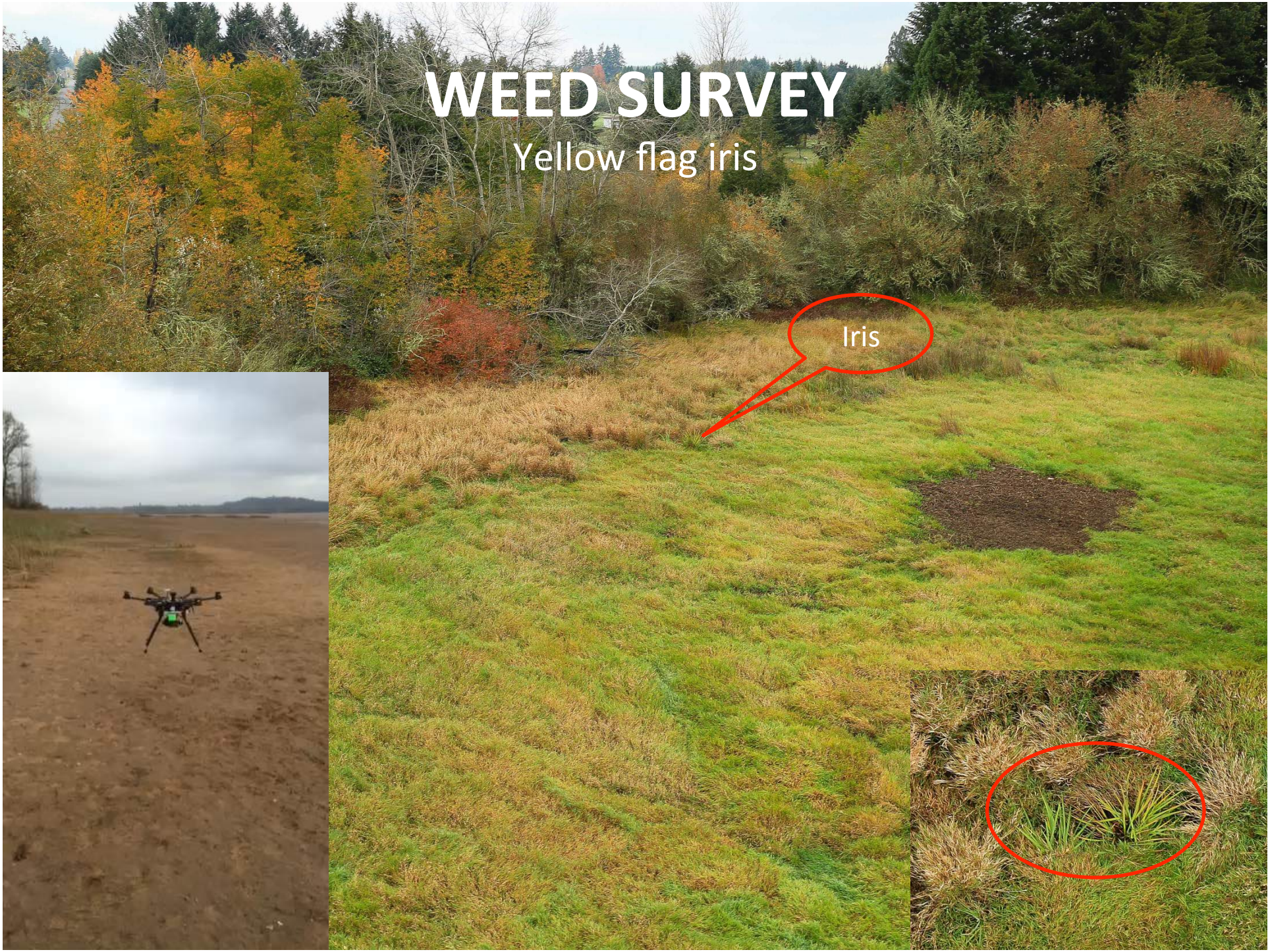
Oxeye daisy

WEED SURVEY

Purple loosestrife

WEED SURVEY

Yellow flag iris

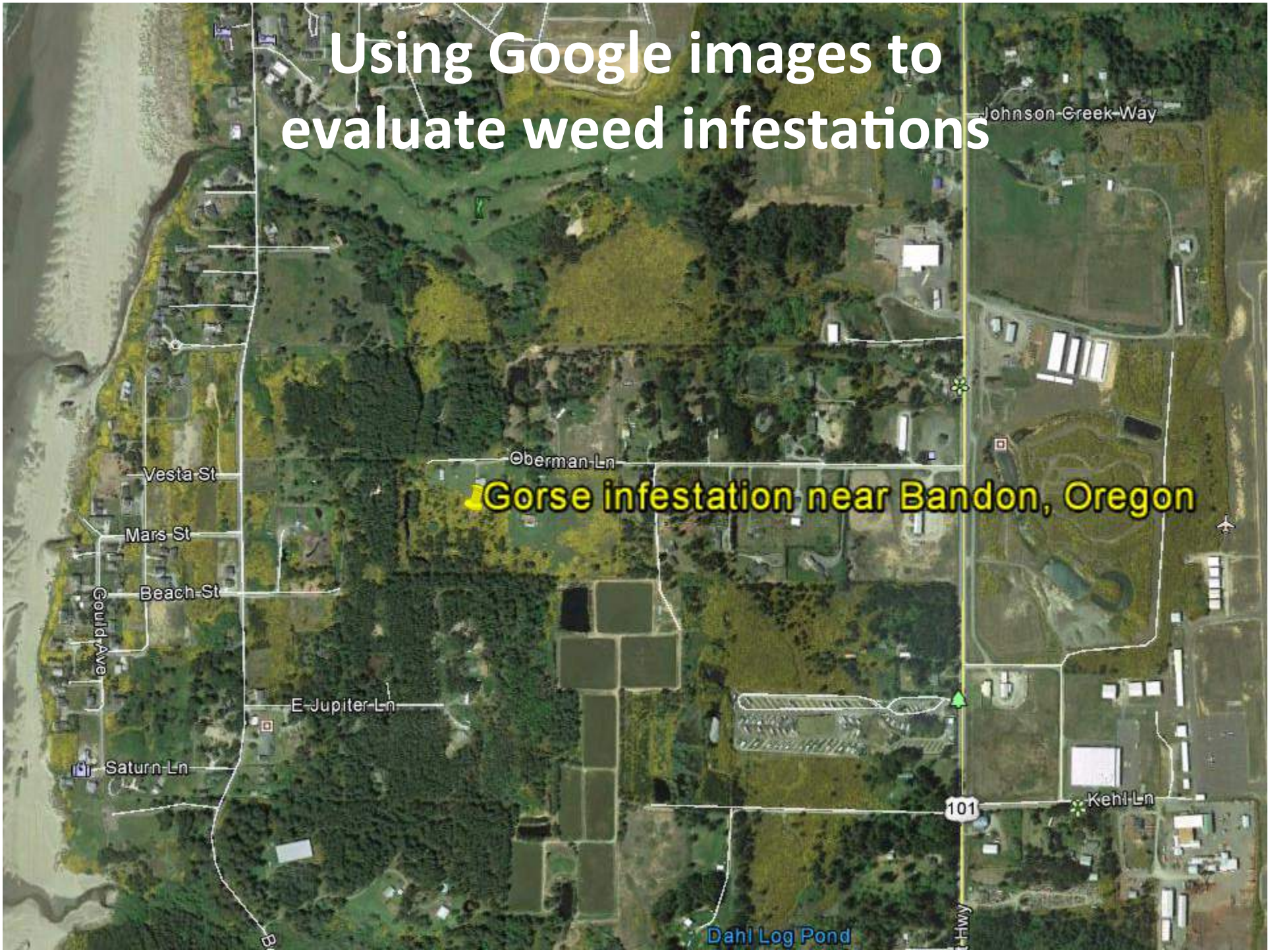


HIGH VEGETATION/WET CONDITIONS
Makes it difficult for doing weed surveys

USING AERIAL PHOTOS FROM OTHER SOURCES

Comparing photos taken from an airplane and my drone

Using Google images to evaluate weed infestations



RESEARCH

Native wetland prairie study

When to use UAVs for aerial imagery

- Small to medium sites
- Need for high resolution images
- Before and after photos

USING COLOR RECOGNITION SOFTWARE TO ESTIMATE VEGETATION COVER

(VegMeasure)

Using color recognition (VegMeasure) **to measure changes in vegetation**

Pre-treatment oblique photo

VegMeasure output

Green = woody (61%)
Tan = herbaceous (33%)

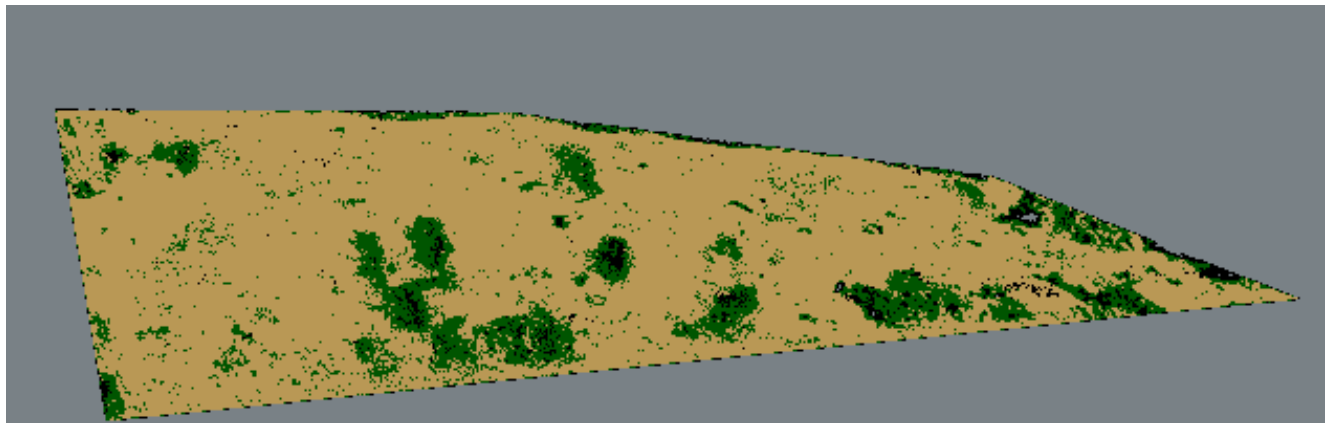
Using color recognition to measure changes in vegetation (cont.)

Post-treatment oblique photo

VegMeasure output

Green = woody (16%) or 74% ⬇

Tan = herbaceous (81%)



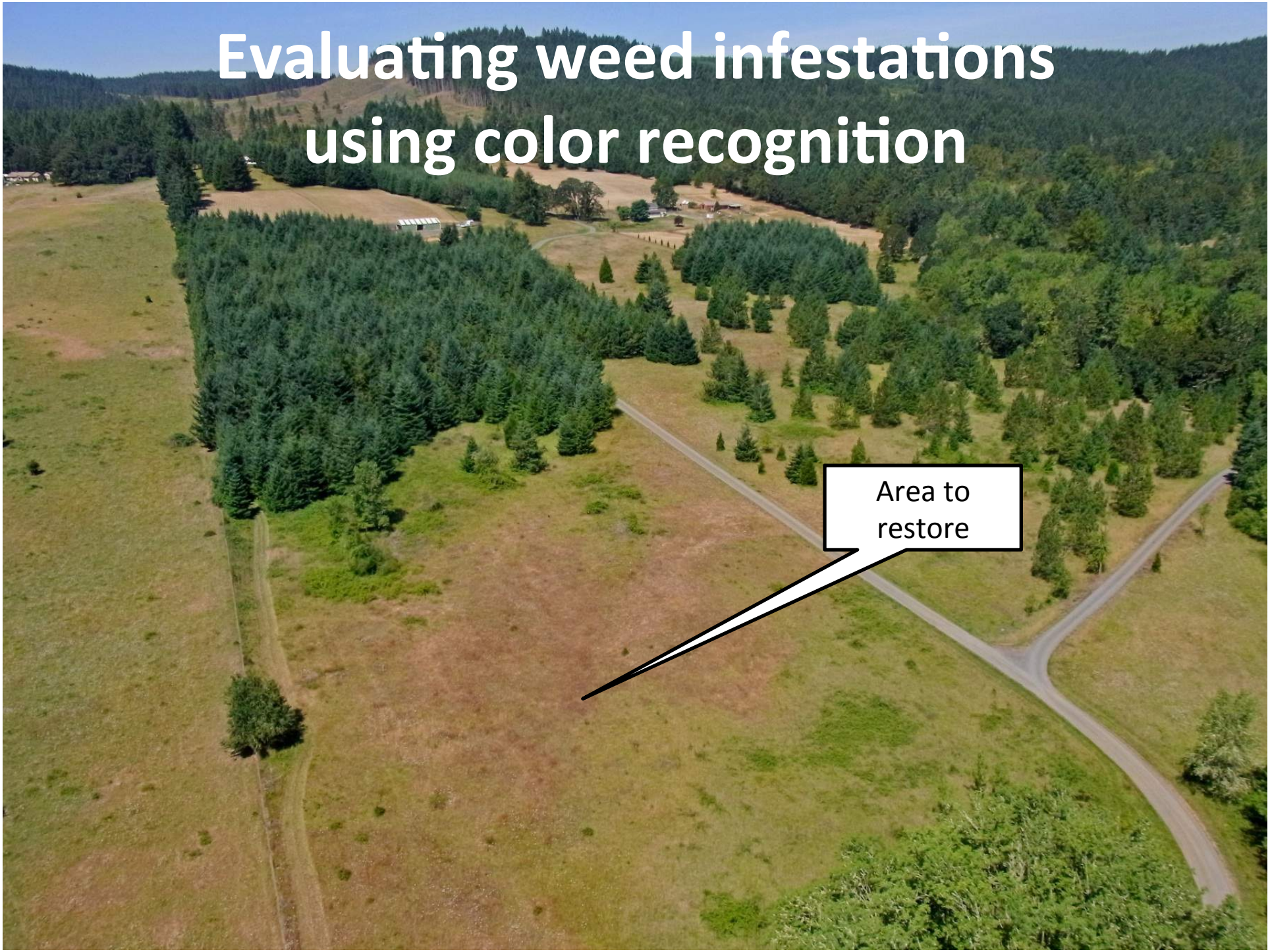
A Caveat:

Cover data from oblique photos is a relative measure

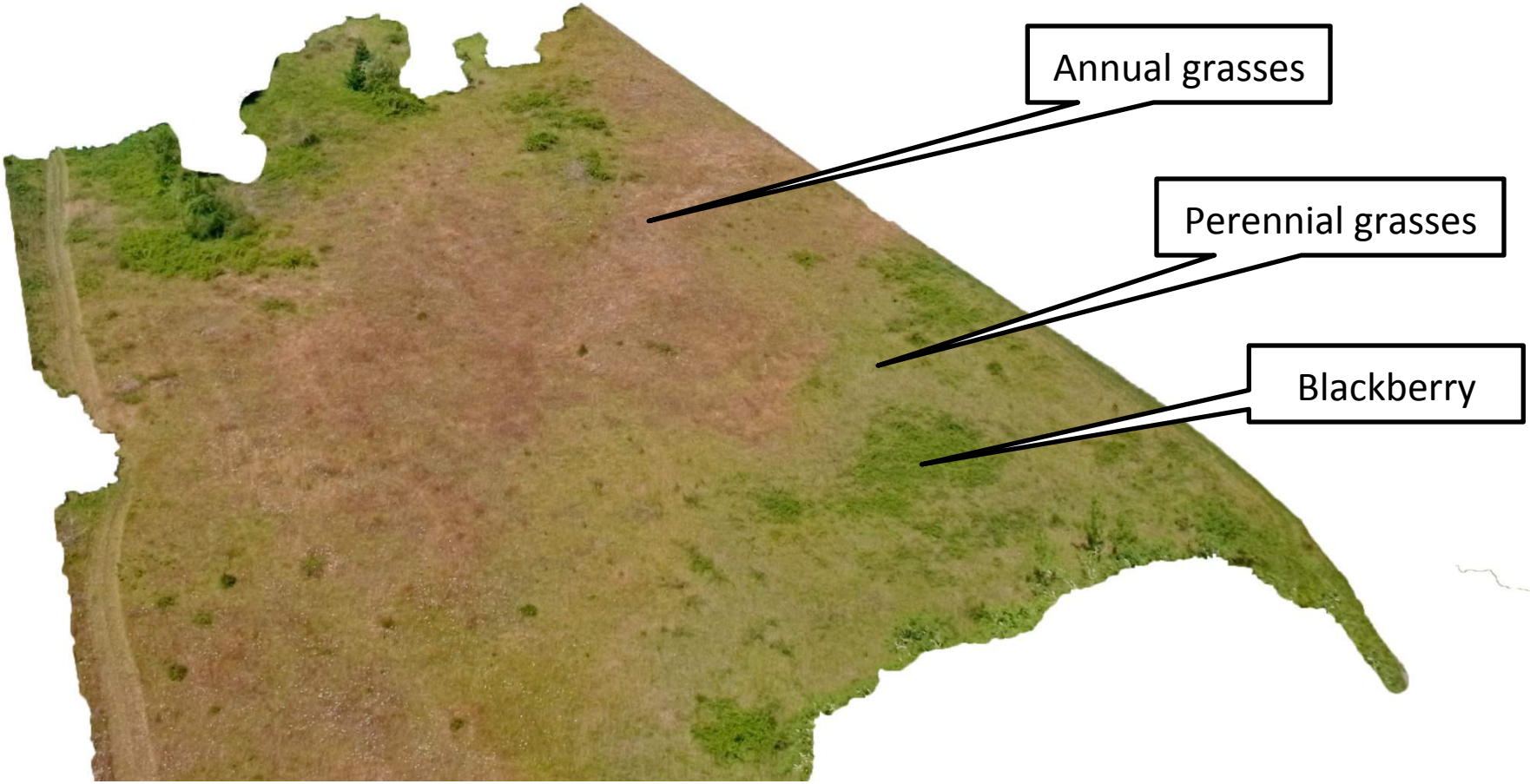
Requires photos be taken from same:

- Location (x,y coordinates)
- Elevation
- Camera angle

Evaluating weed infestations using color recognition

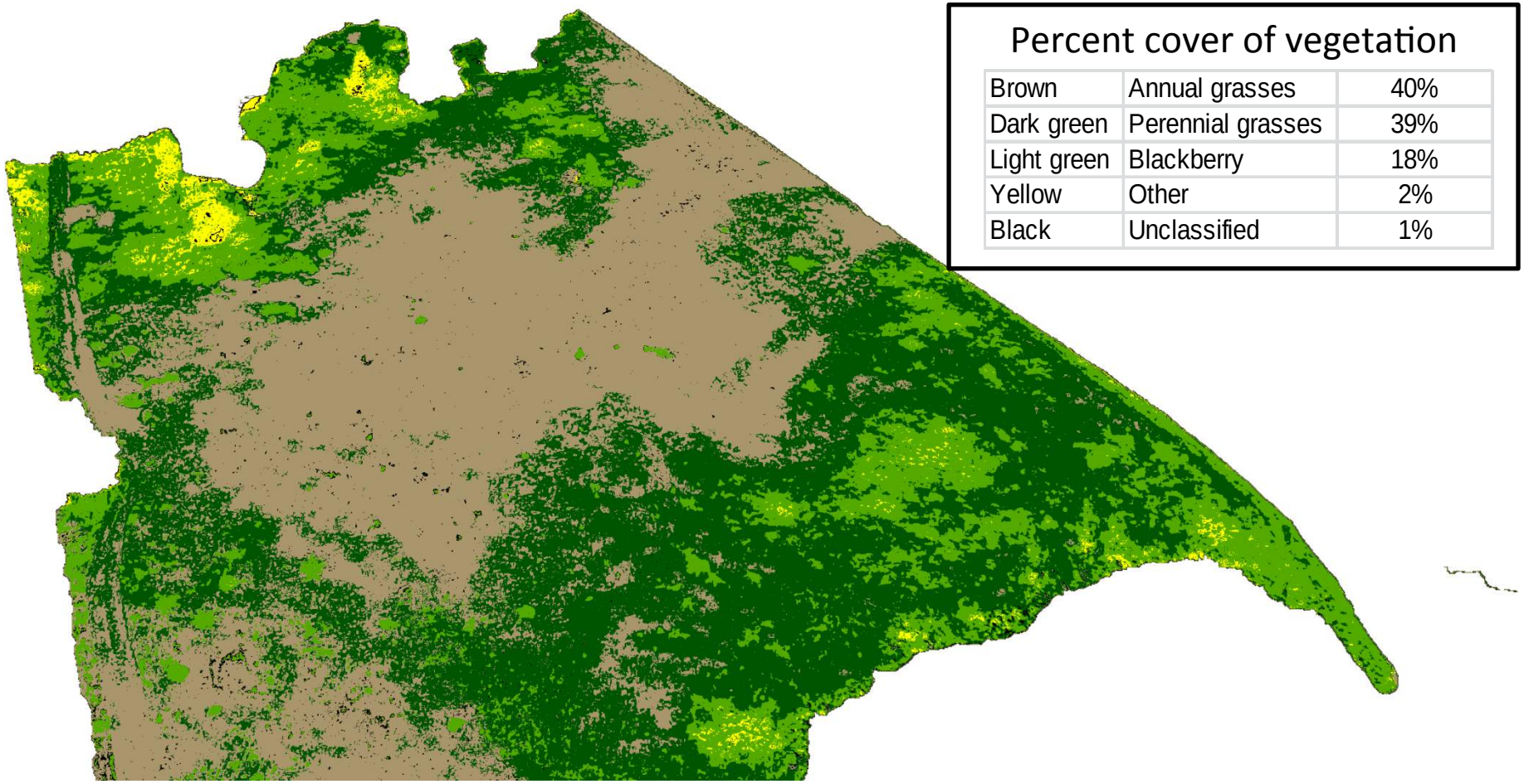


Evaluating weed infestations using color recognition (cont.)



NOTE: For color recognition to work effectively the vegetation needs to have distinct color differences

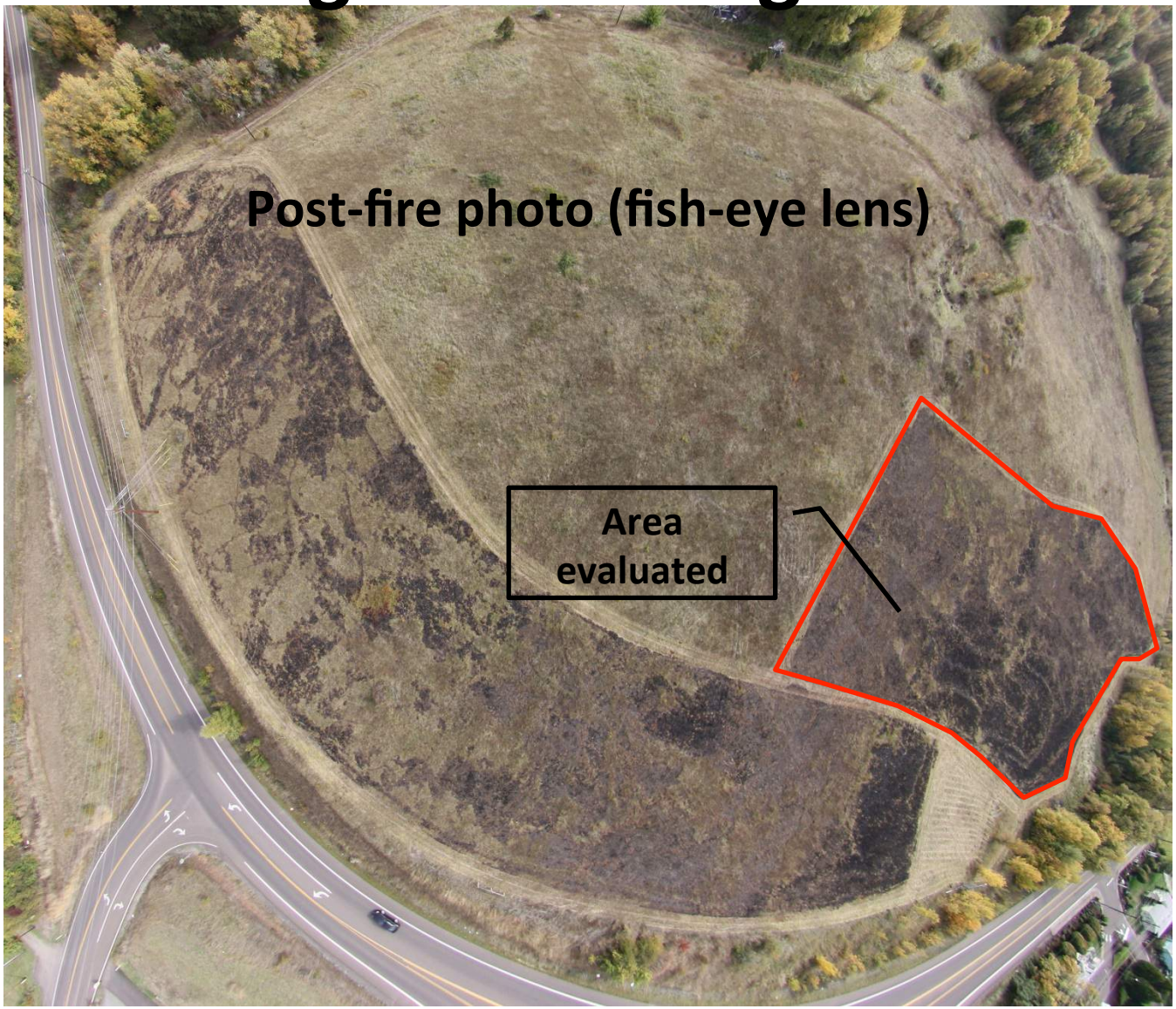
Evaluating weed infestations using color recognition (cont.)



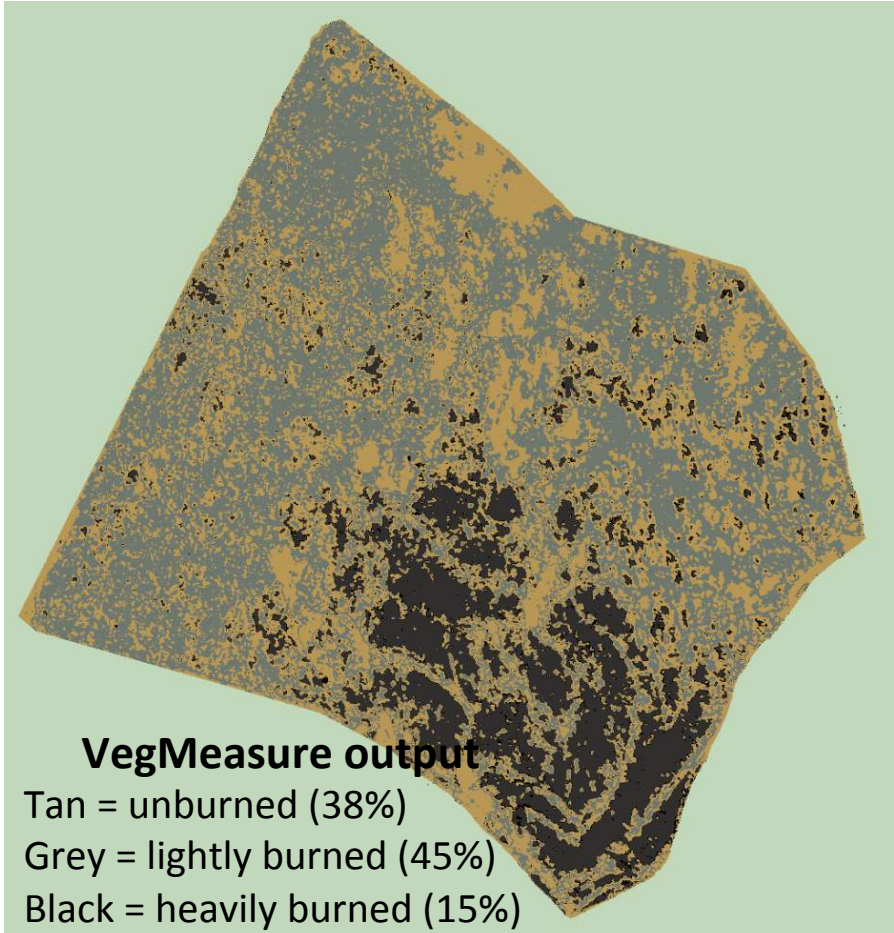
Percent cover of vegetation

Brown	Annual grasses	40%
Dark green	Perennial grasses	39%
Light green	Blackberry	18%
Yellow	Other	2%
Black	Unclassified	1%

Evaluating a prescribed burn using color recognition



Evaluating a prescribed burn using color recognition (cont.)



Abiding by FAA regulations for safety and privacy

- Always maintain line of sight with the aircraft.
- Avoid flying closer than 5 miles to an airport
- Altitude should never exceed 400 ft.
- Avoid flying over property where permission has not been granted.
- Avoid flying over crowds.

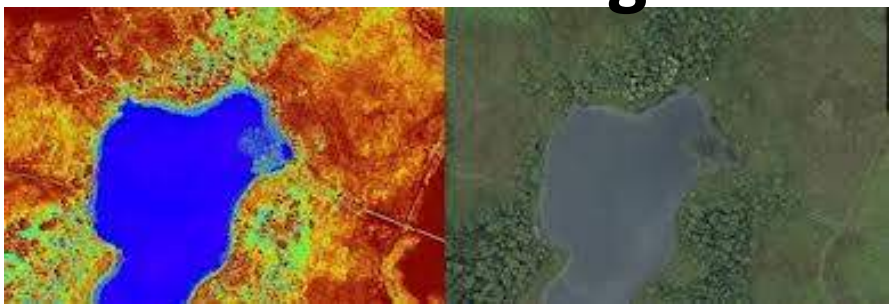
Practical information

- Payload: 3 lbs
- Max. Wind: 15-20 mph
- Flight time: 10-12 minutes
- Camera: Canon OES-M mirror-less (18 mp)
- Cost for UAV system: $4000-$6000
- Cost for aerial imagery: $1600/photoshoot

Future plans

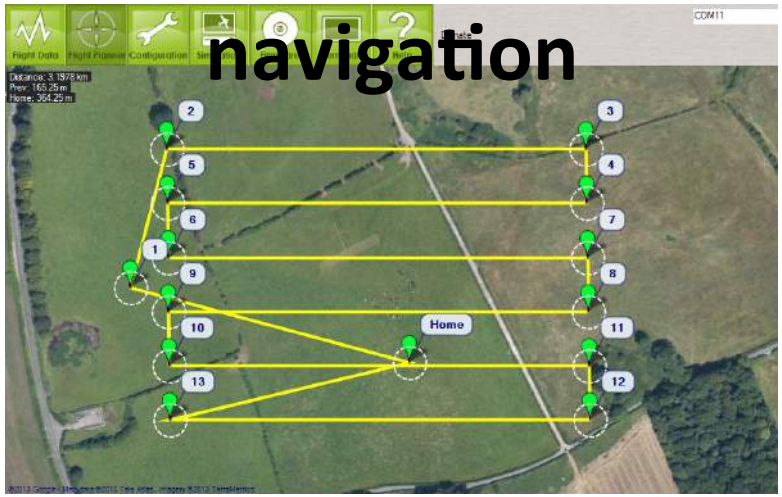
Infrared images

Using a near infrared camera to help further classify vegetation



Waypoint navigation

- Navigation software allows autonomous flight
- Take off and land without input
- Can fly parallel transects or a grid for better image coverage and mapping
- Can increases precision for taking post-treatment photos
- Can capture photos to create 3D images



Future uses of UAVs

A Yamaha UAV shown with a herbicide application sprayer.

Image courtesy of Yamaha Motor Australia.

QUESTIONS?