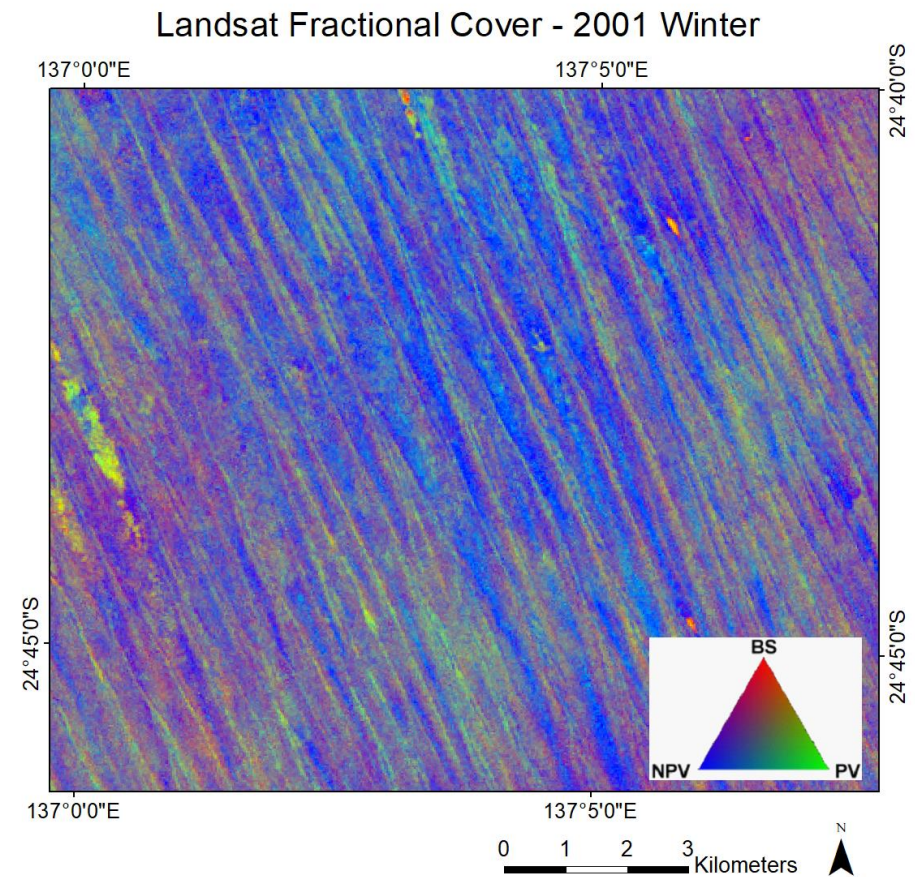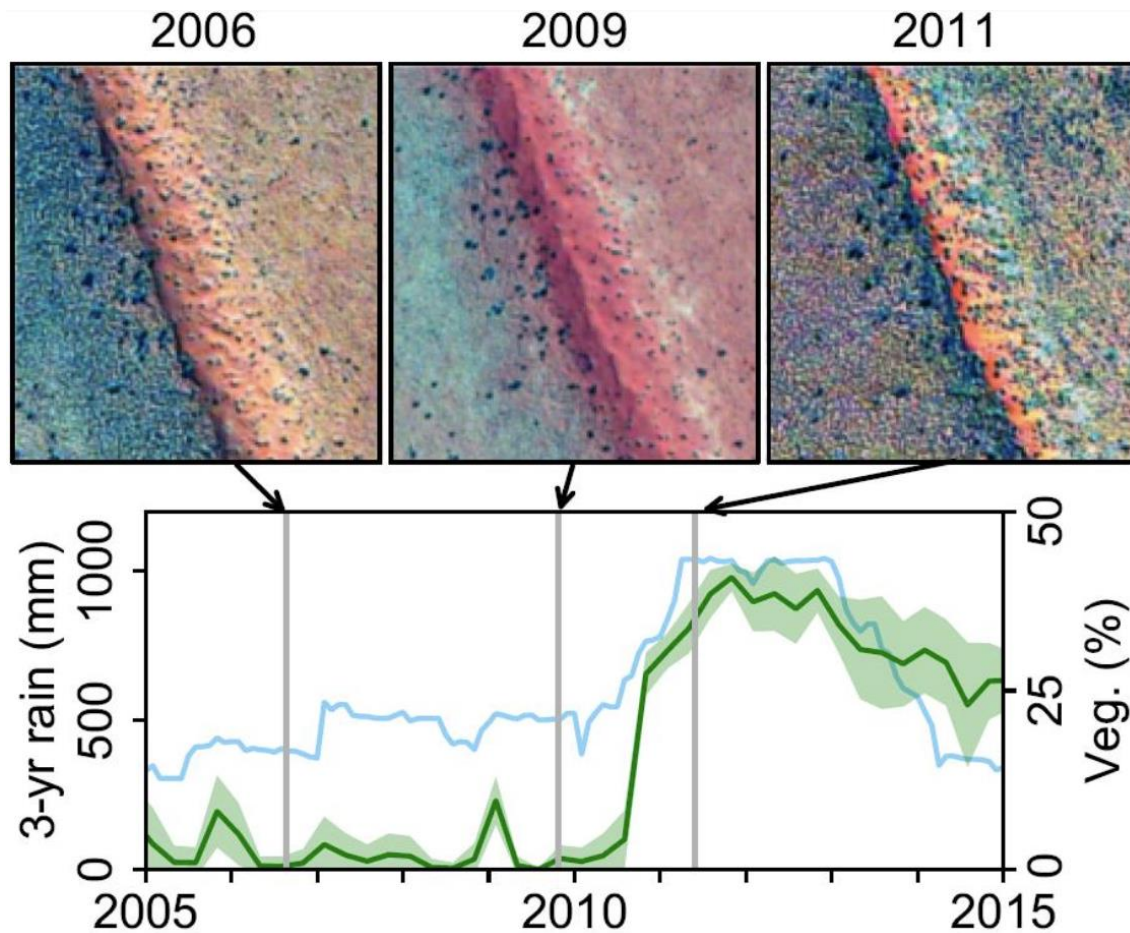# Drone and satellite data for monitoring desert ground cover

Sam Shumack[1]
Paul Hesse[1]
Adrian Fisher[2,3]

1 – Macquarie University Dept. Earth and Environmental Sciences; 2 – Joint Remote Sensing Research Program; 3 – UNSW School of Biological Earth and Environmental Sciences)
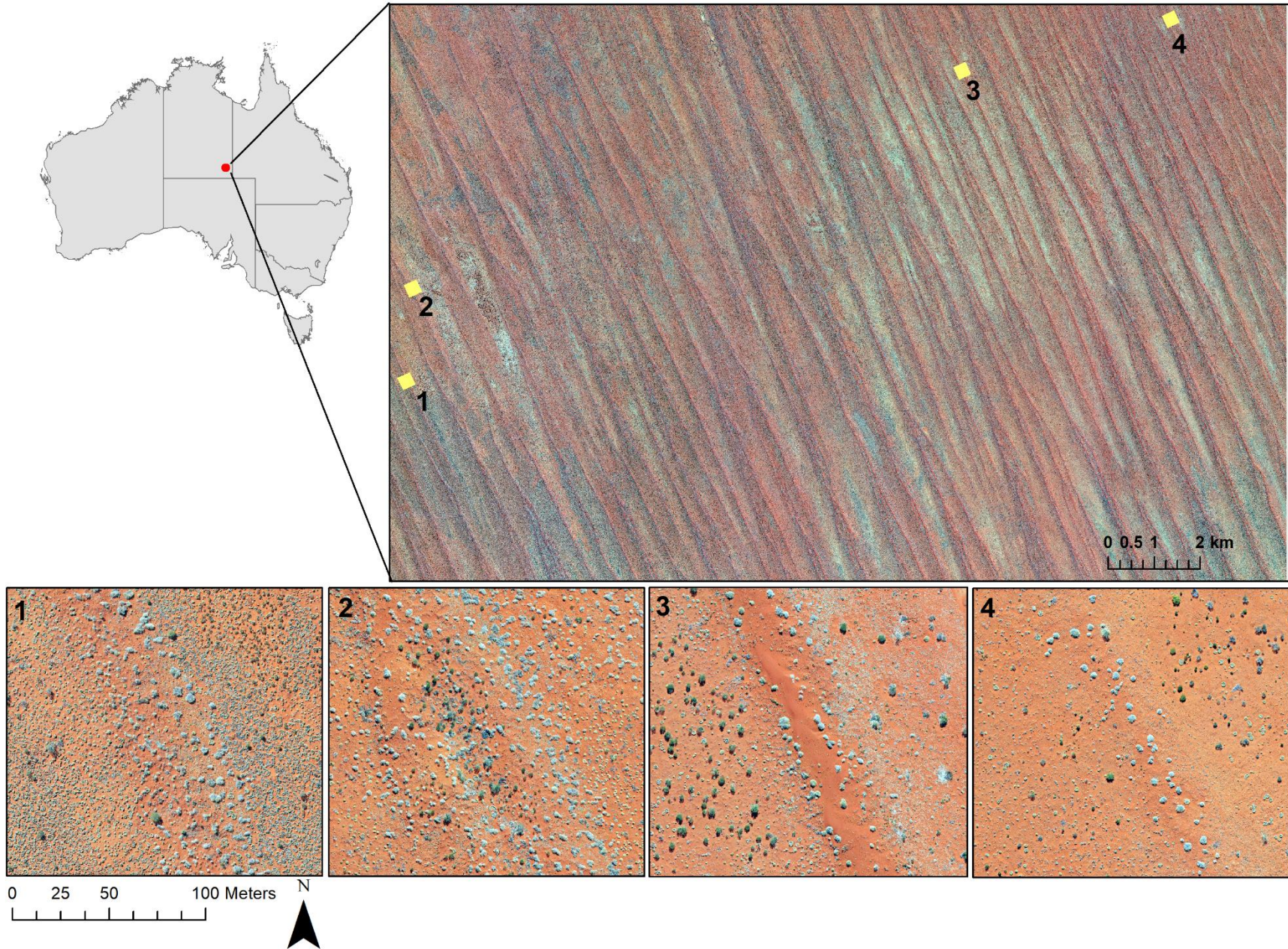
Landsat Fractional Cover - 2001 Winter

Fractional cover (%):
Bare, PV, NPV

Fisher and Hesse (2019, *Earth Surf. Process. Landforms*)

Joint Remote Sensing Research Program
(JRSRP) product - Guerschman et al. (2015, *Remote Sensing of Environment*)

Study area:

Data sources

Source	Spatial Res (m)	n bands (vis-NIR)	2017 July	2019 July
JRSRP Landsat fractional cover	30	-	✓	✓
JRSRP Landsat surface reflectance	30	6	✓	✓
JRSRP Sentinel2 fractional cover	10	-	✓	✓
JRSRP Sentinel2 surface reflectance	10	6	✓	✓
WorldView3*	0.3	8	✓	
UAS**	~0.02	RGB		✓
Ground vegetation surveys	-		✓	
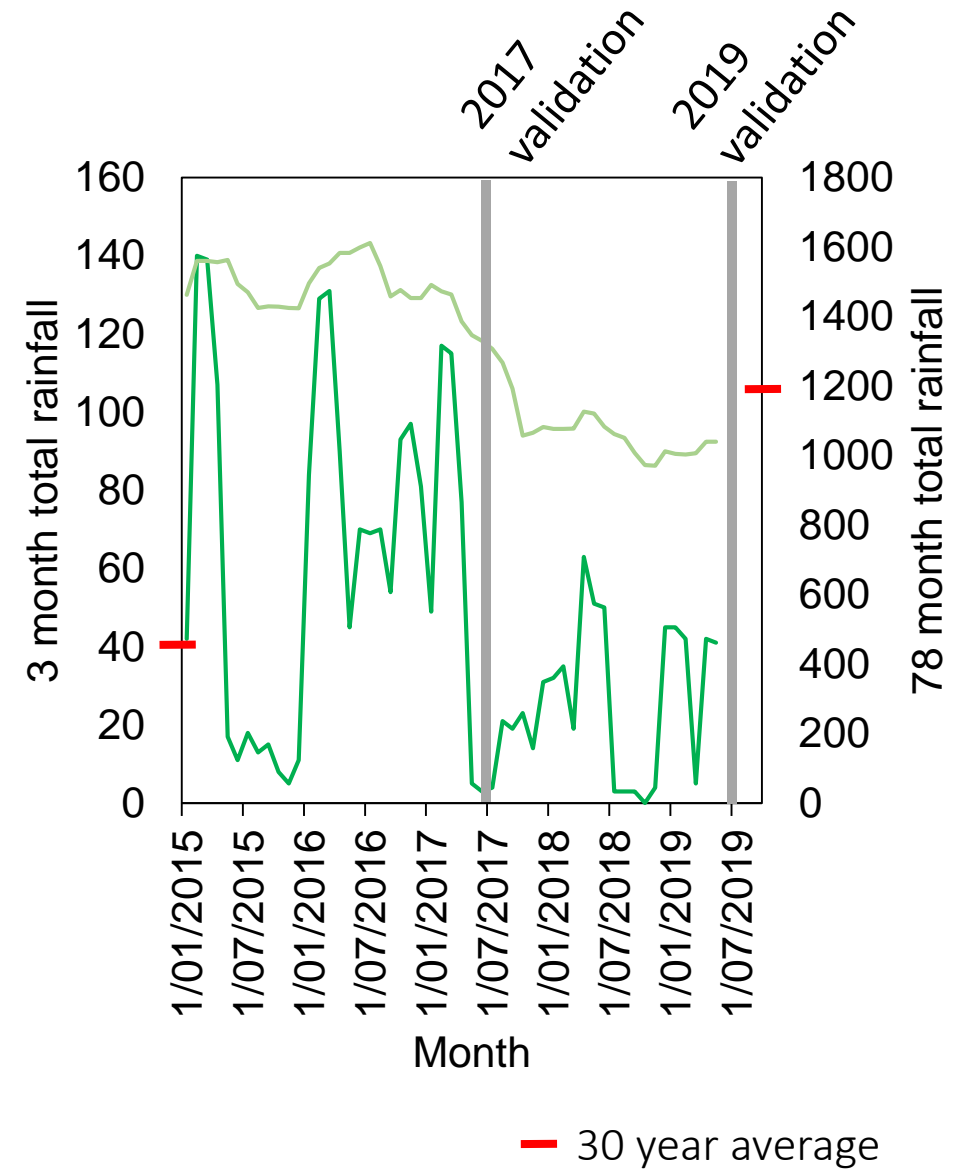
*Courtesy of the DigitalGlobe Foundation, calibrated to surface reflectance, pan-sharpened to 0.3 m
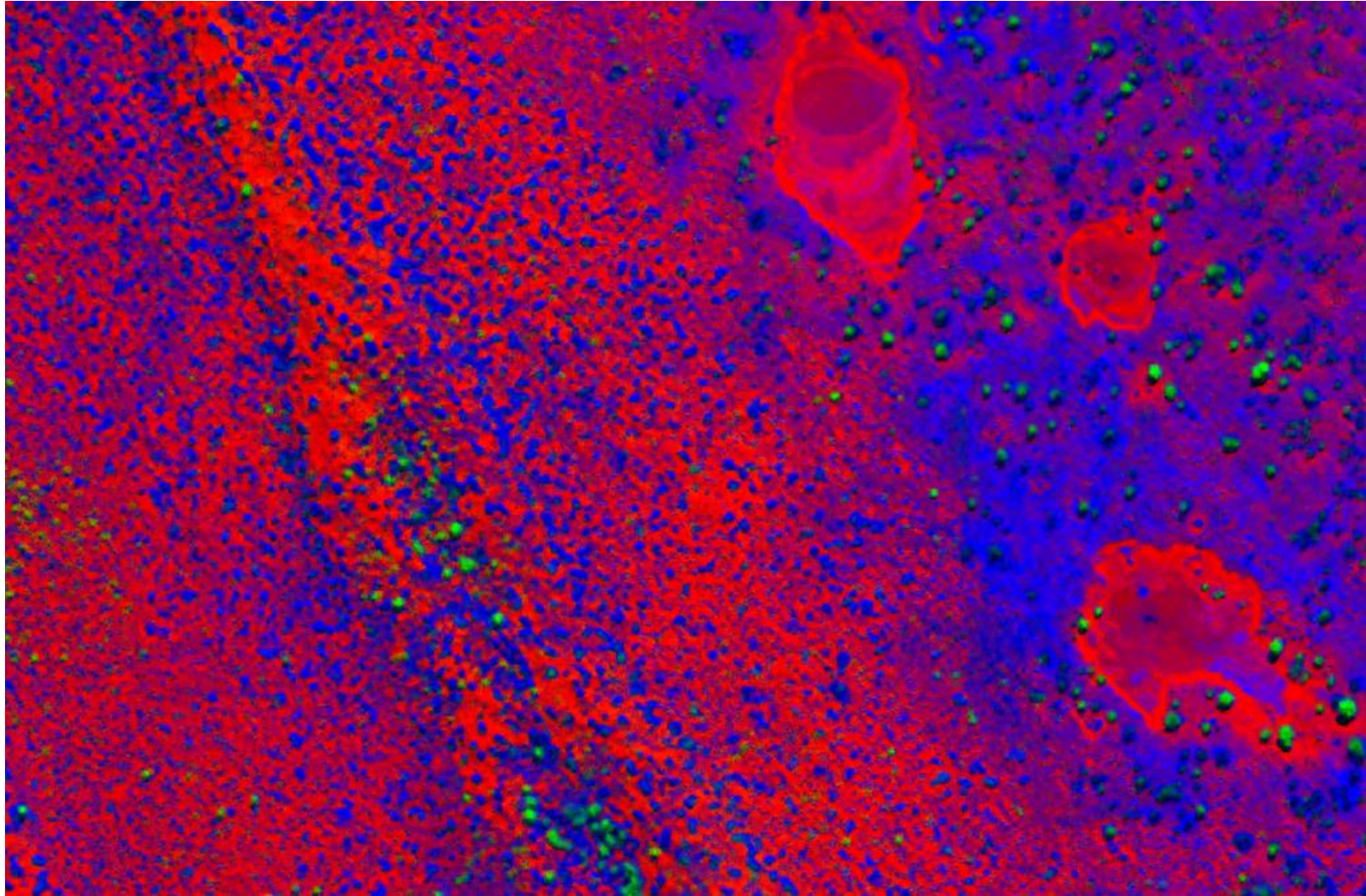**DJI Mavic2 pro

WV3 processing

- Endmembers ('pure pixels') selected using some drone images collected within a couple of weeks

- Fully constrained linear spectral unmixing (Heinz et al., 1999, *IEEE*)
  - Bare
  - PV
  - NPV

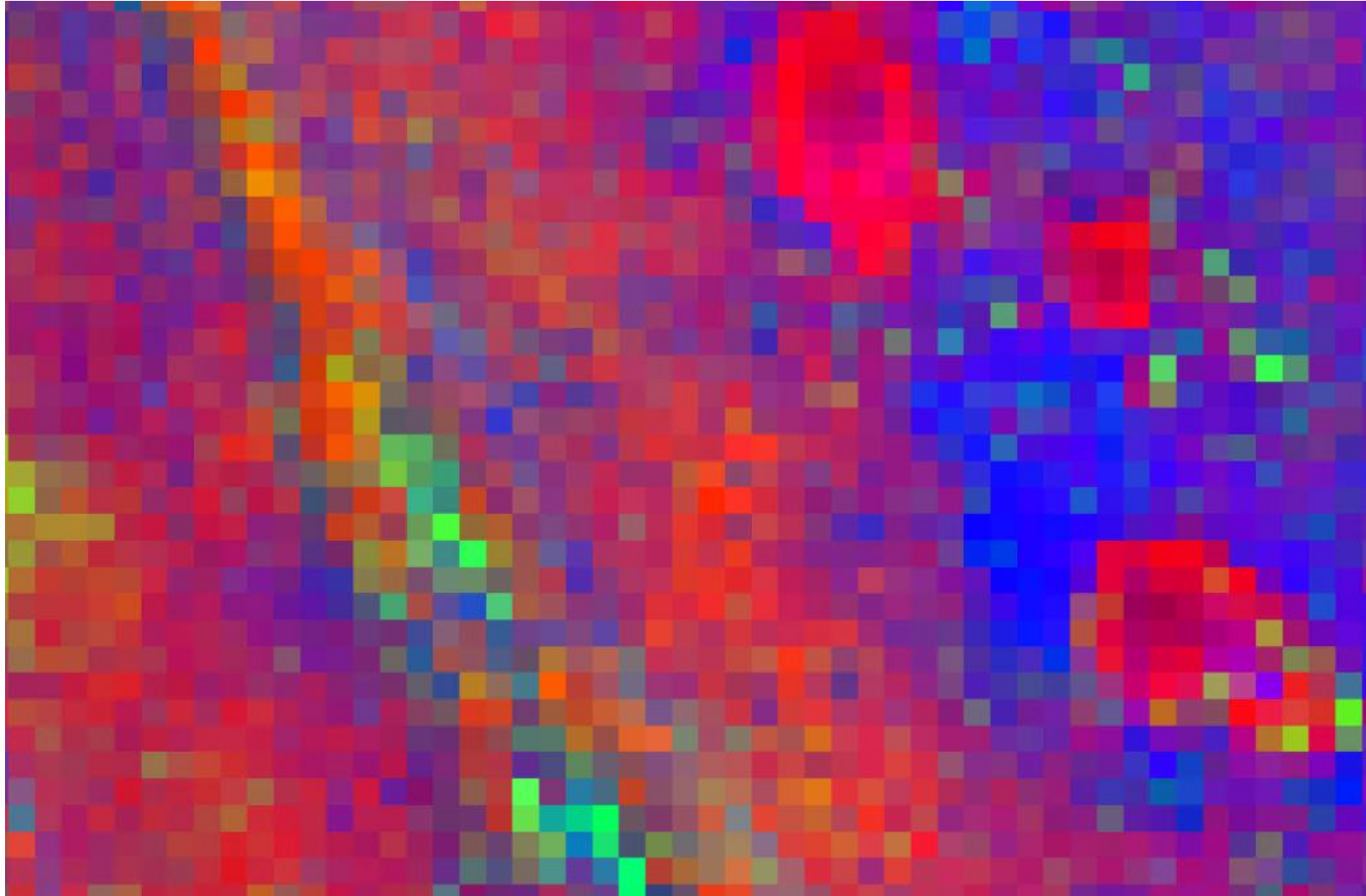- Aggregate to Sentinel2 and Landsat grid size

WV3 processing

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- **Fully constrained linear spectral unmixing (Heinz et al., 1999, *IEEE*)**
  - Bare
  - PV
  - NPV

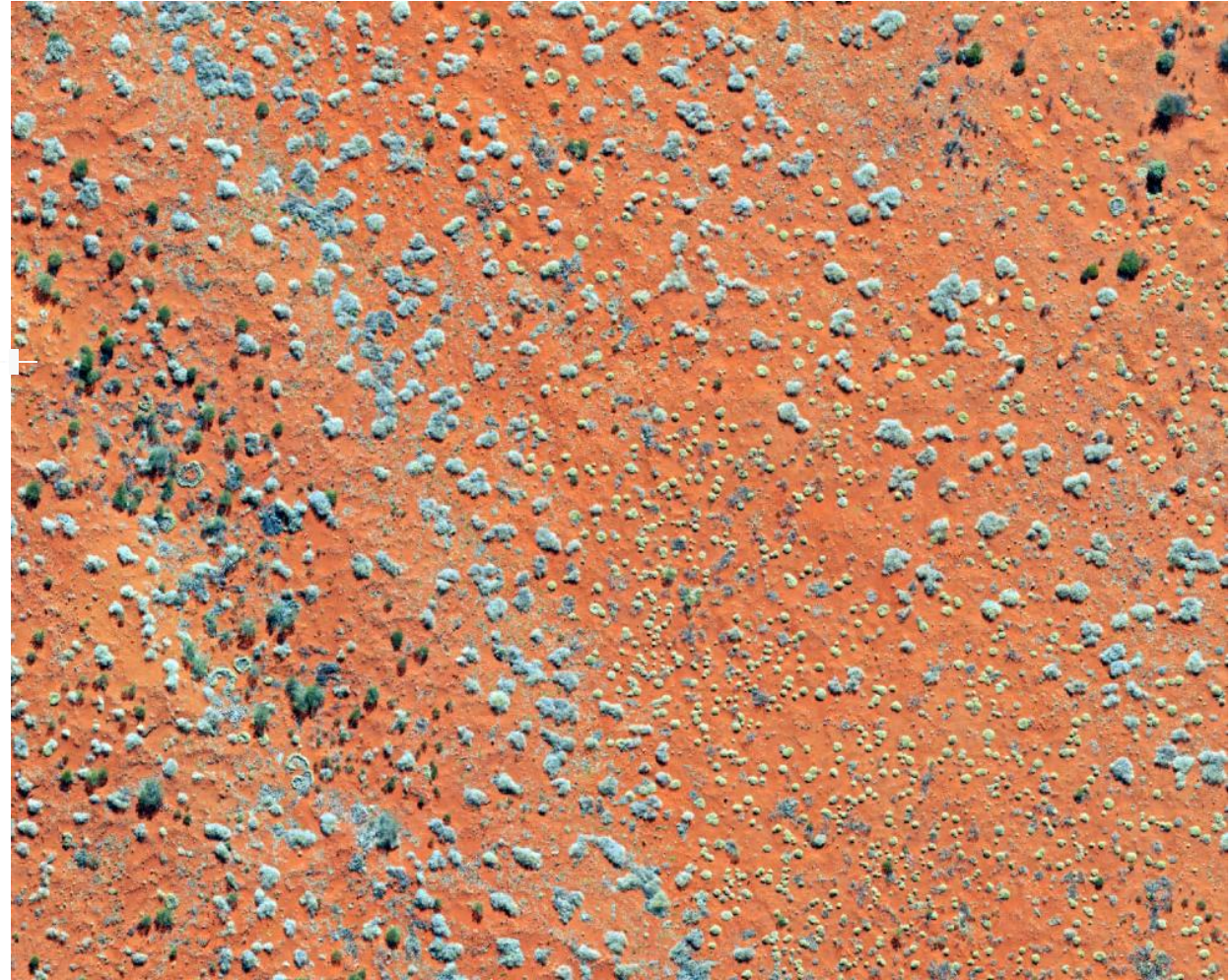- Aggregate to Sentinel2 and Landsat grid size

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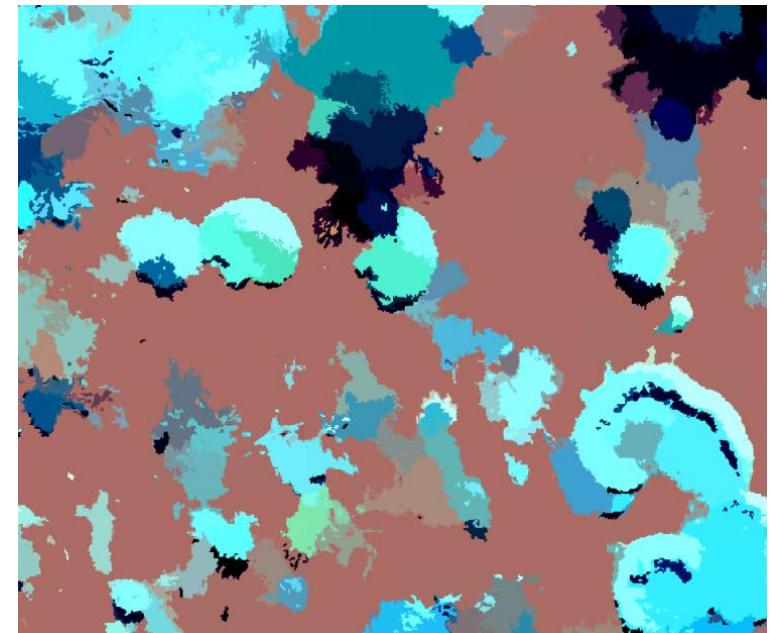 - PV
  - NPV
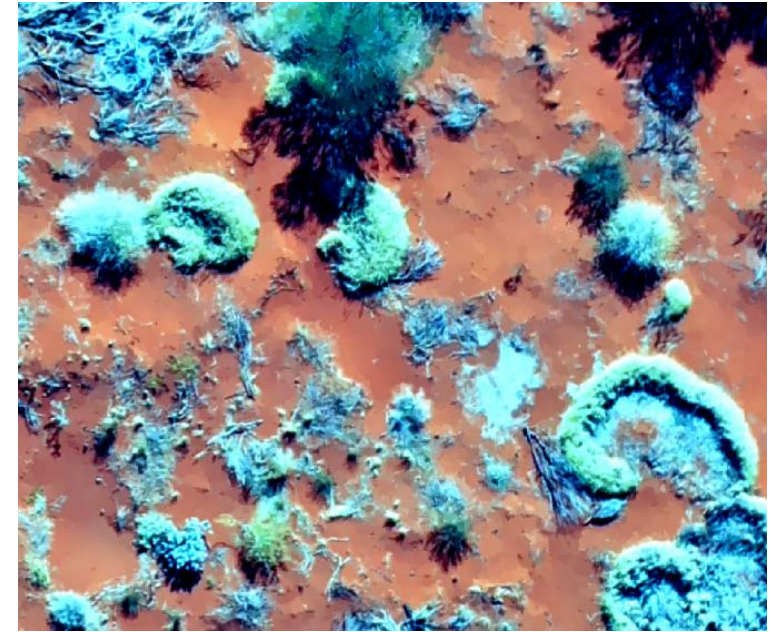- **Aggregate to Sentinel2 and Landsat grid size**

Drone processing

- **Orthomosaic and surface model produced in Pix4D**
- Segment (fine and coarse scale)
- Classify ground cover at fine scale
- Mask vegetation from surface model
- Interpolate bare earth elevation and subtract from surface to produce canopy height
- Classify functional plant groups from larger segments (incl. veg height) – Random Forest classifier
- Combine fine and coarse scale classifications
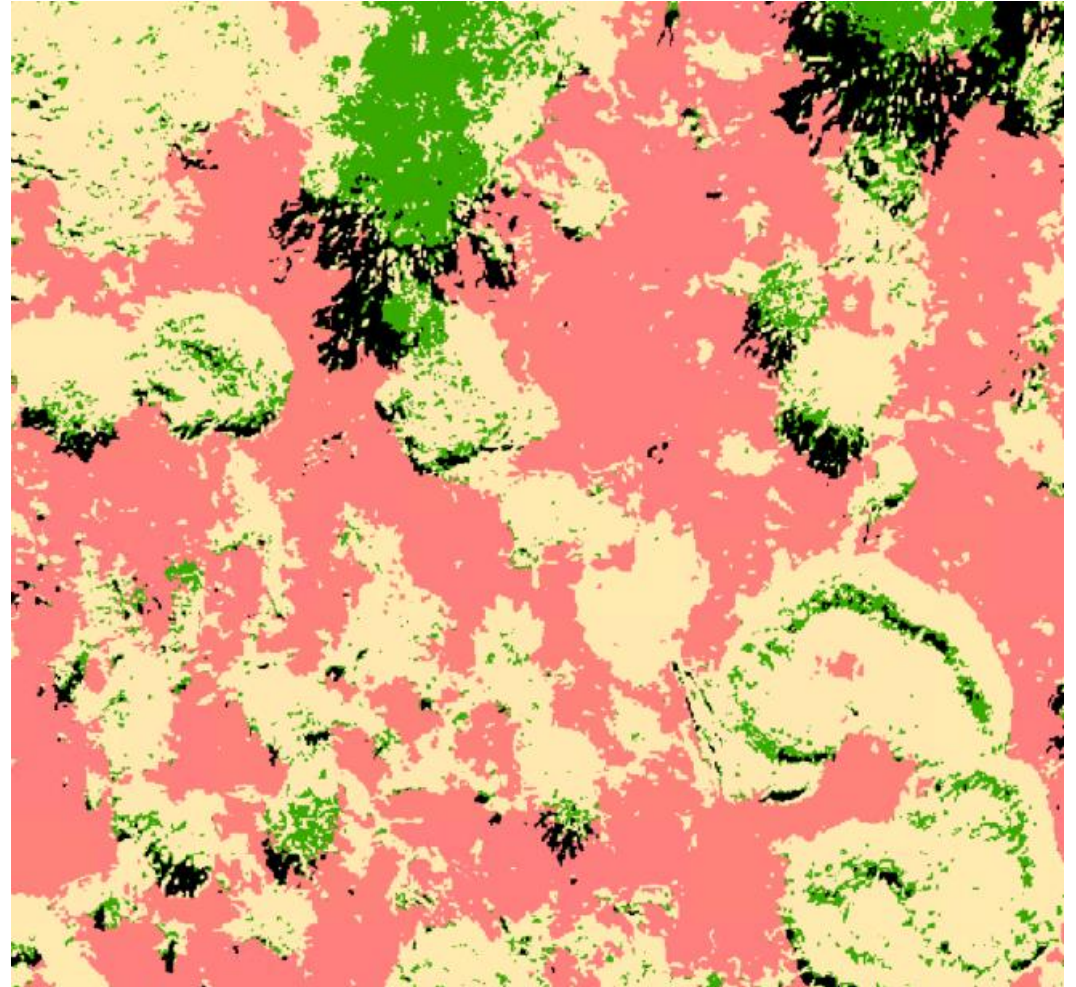- Aggregate classes to Landsat and Sentinel resolutions

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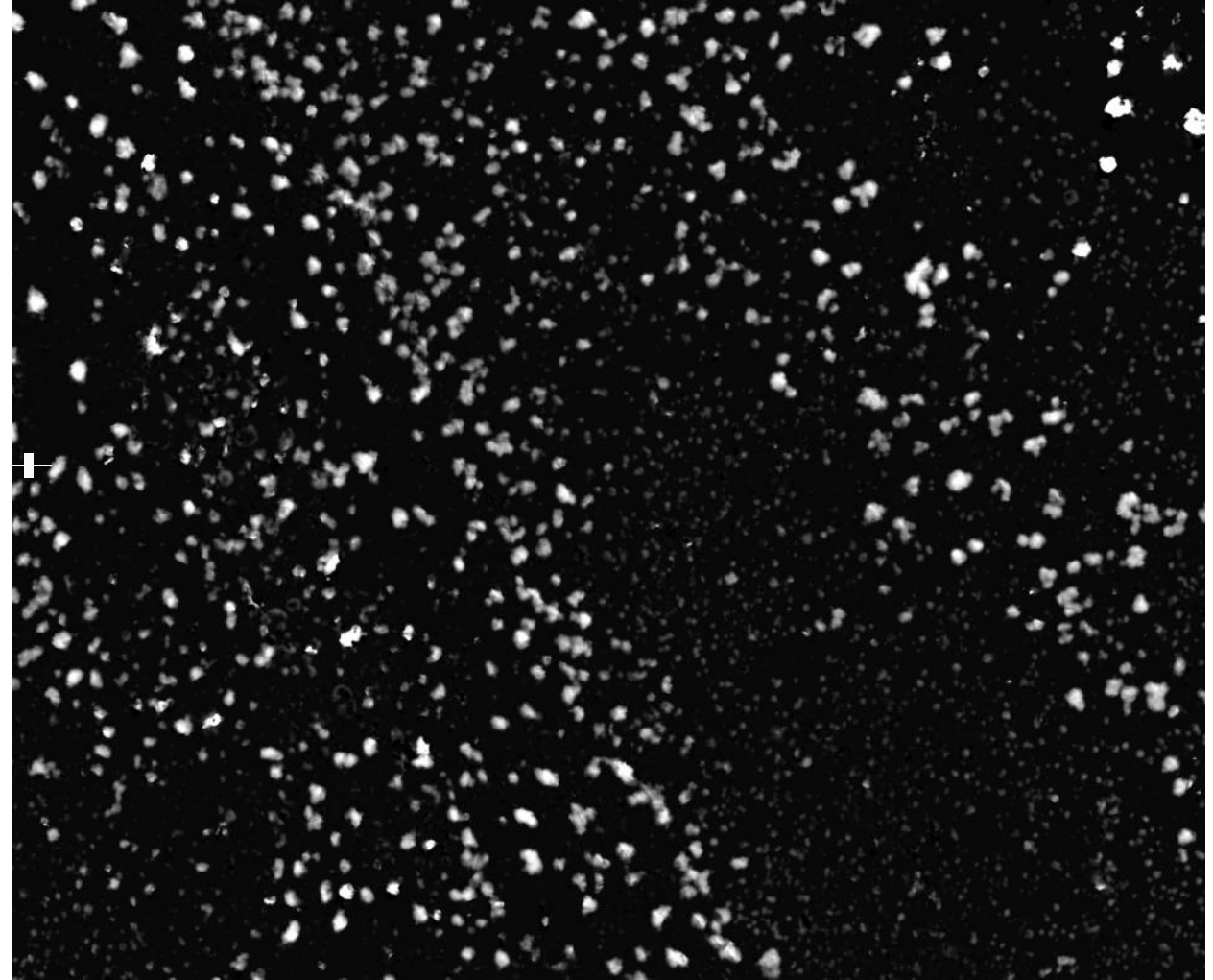- Aggregate classes to Landsat and Sentinel resolutions

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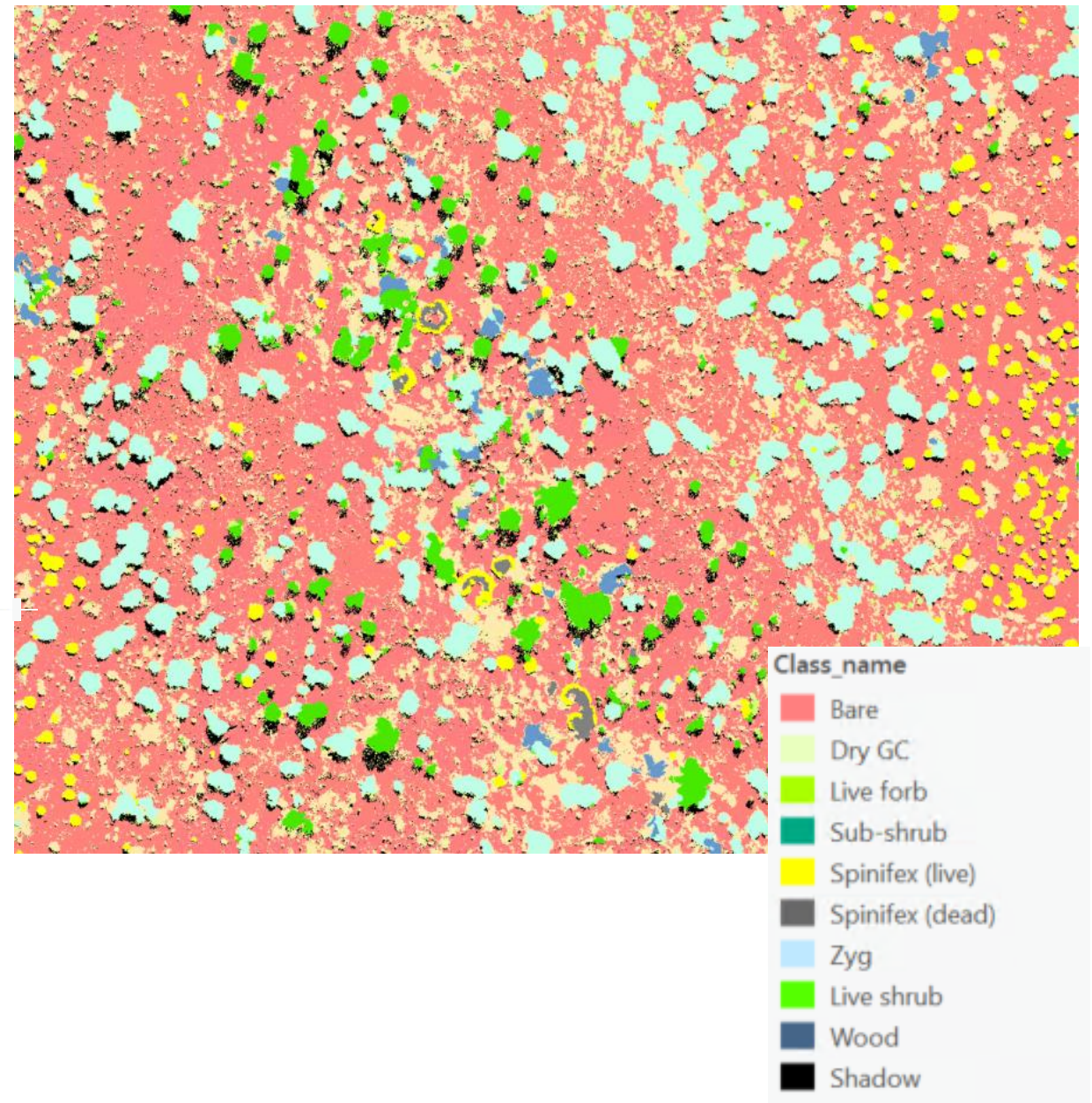- Aggregate classes to Landsat and Sentinel resolutions

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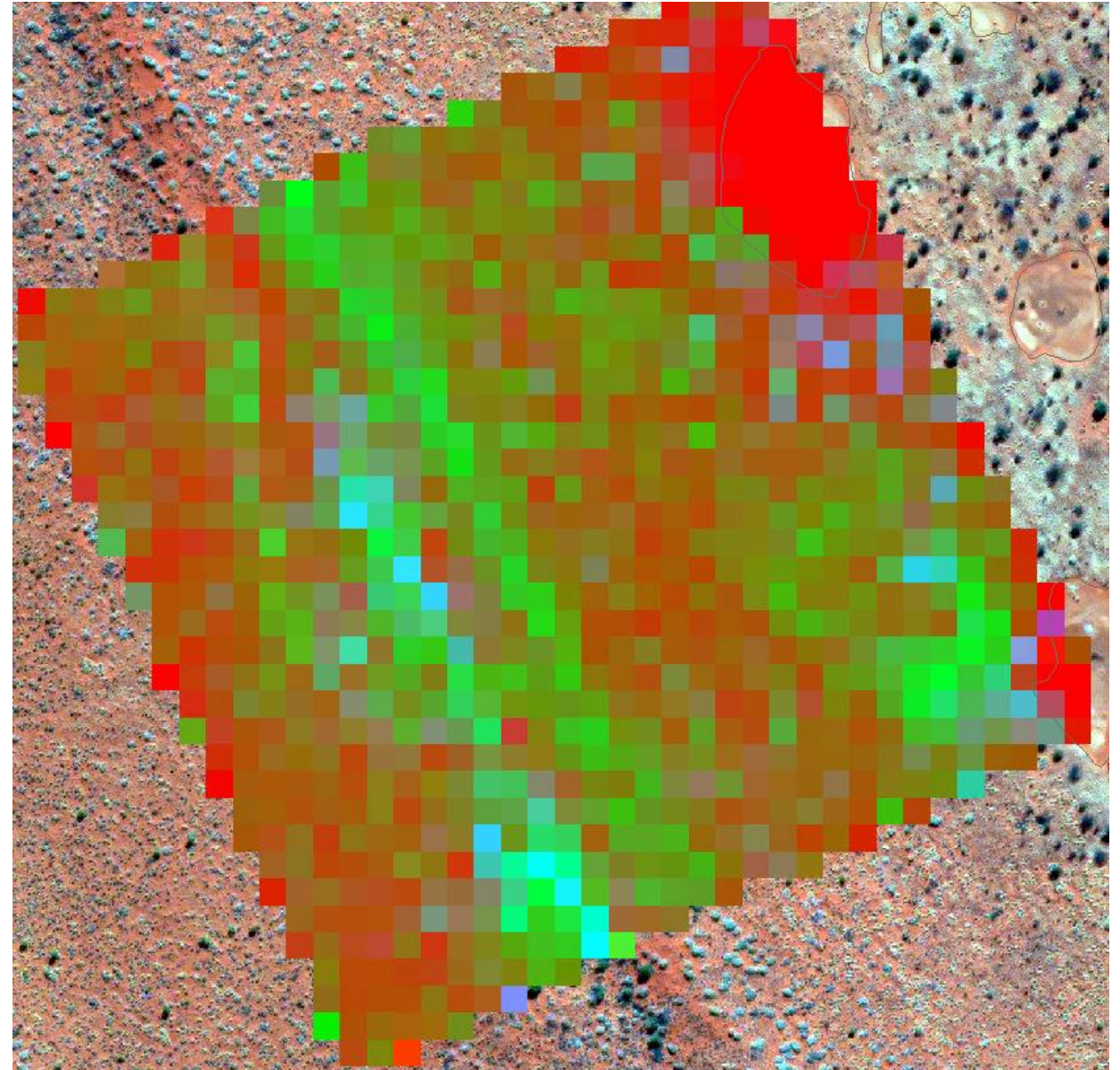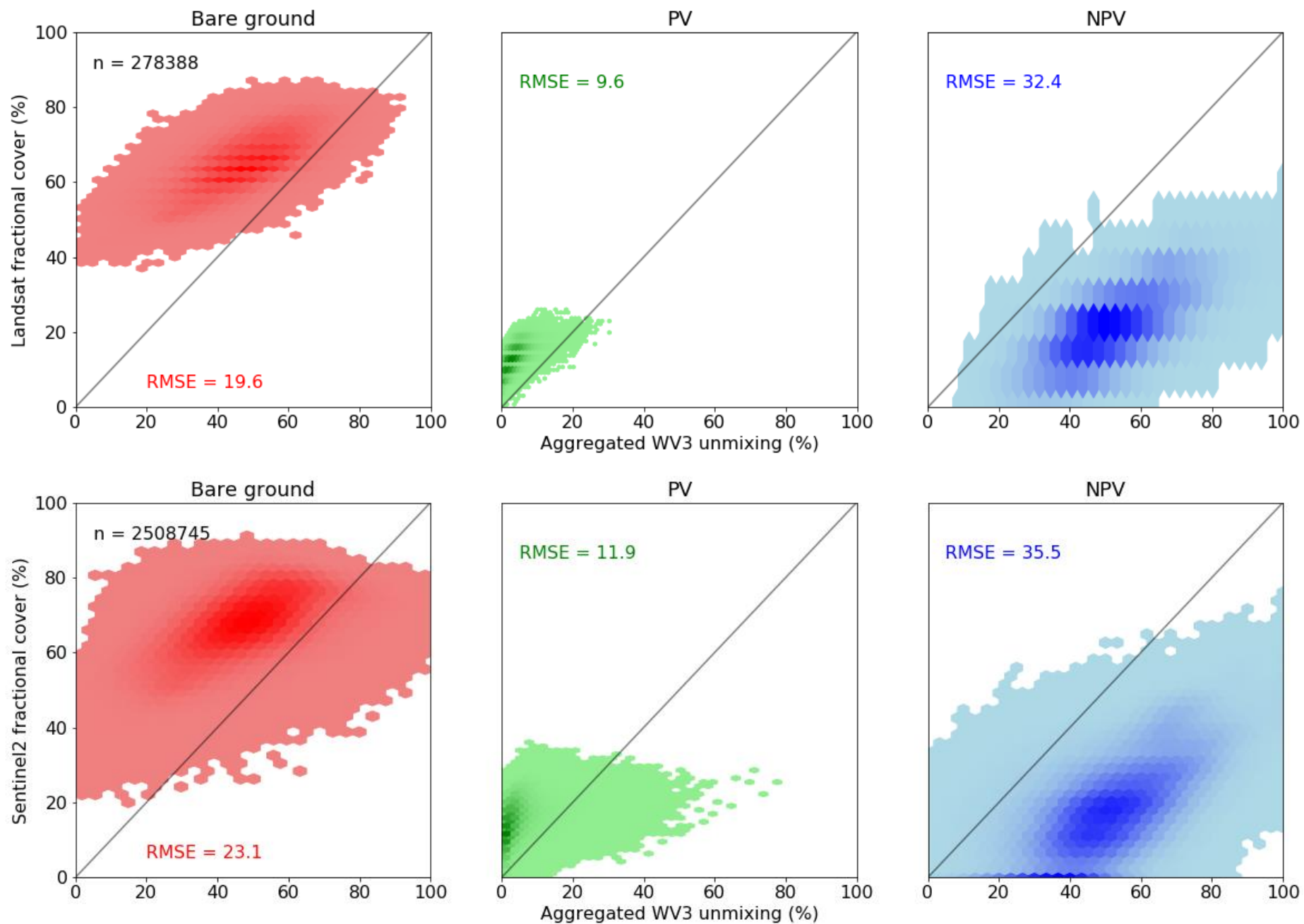- Aggregate classes to Landsat and Sentinel resolutions

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- Aggregate classes to Landsat and Sentinel resolutions

Class_name
- Bare
- Dry GC
- Live forb
- Sub-shrub
- Spinifex (live)
- Spinifex (dead)
- Zyg
- Live shrub
- Wood
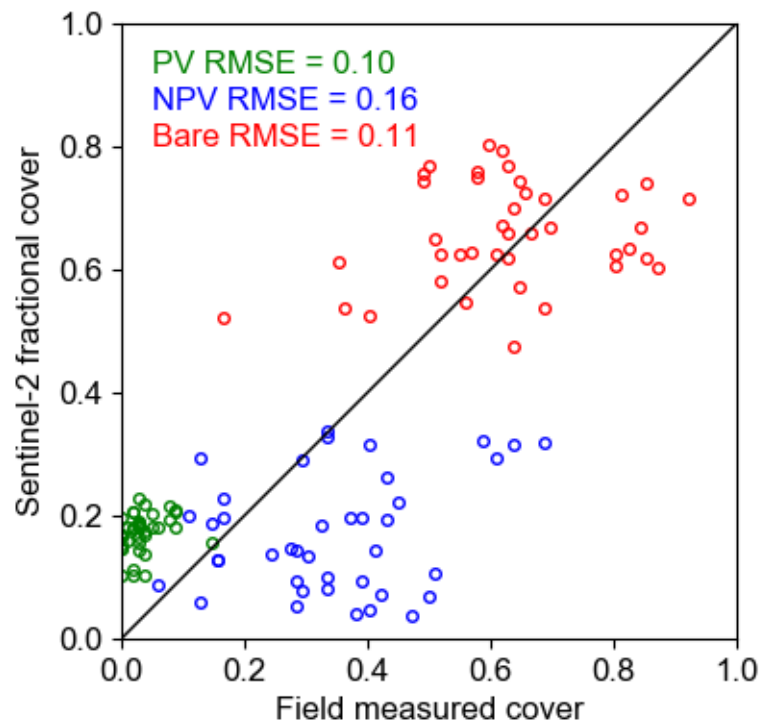- Shadow

Drone processing

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- Segment (fine and coarse scale)

- Classify ground cover at fine scale

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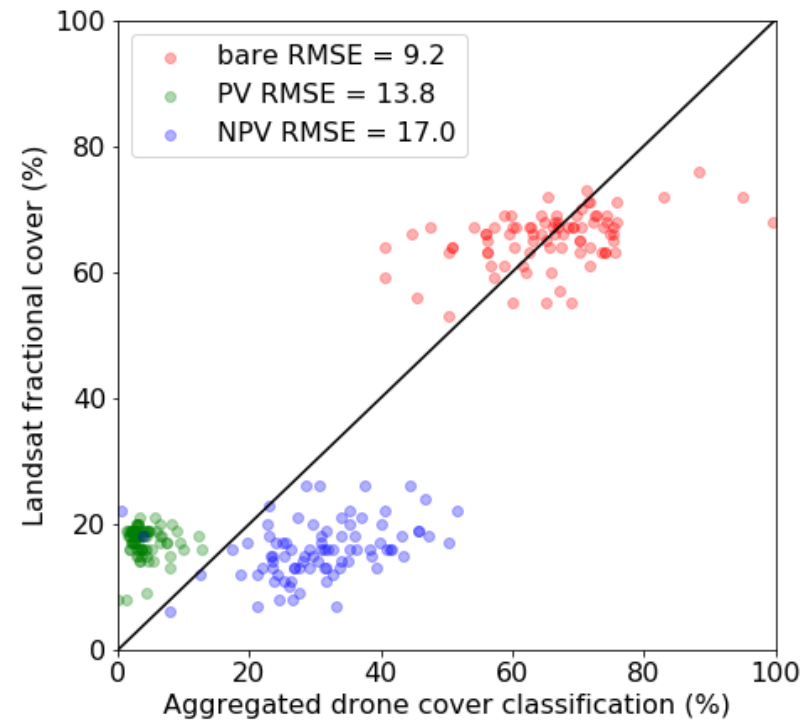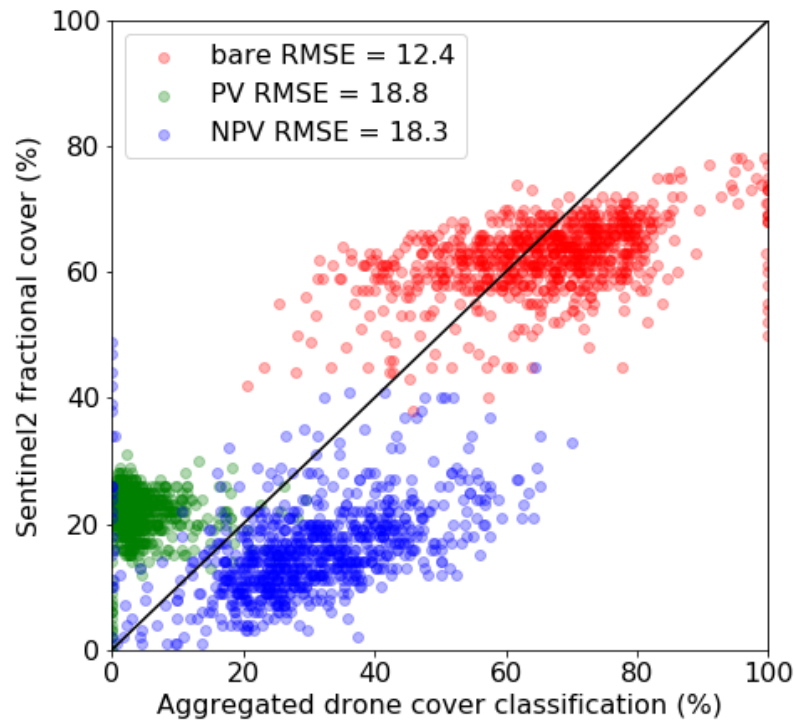- **Aggregate classes to Landsat and Sentinel resolutions**

Bare ground

n = 278388

RMSE = 19.6

PV

RMSE = 9.6

NPV

RMSE = 32.4

Bare ground

n = 2508745

RMSE = 23.1
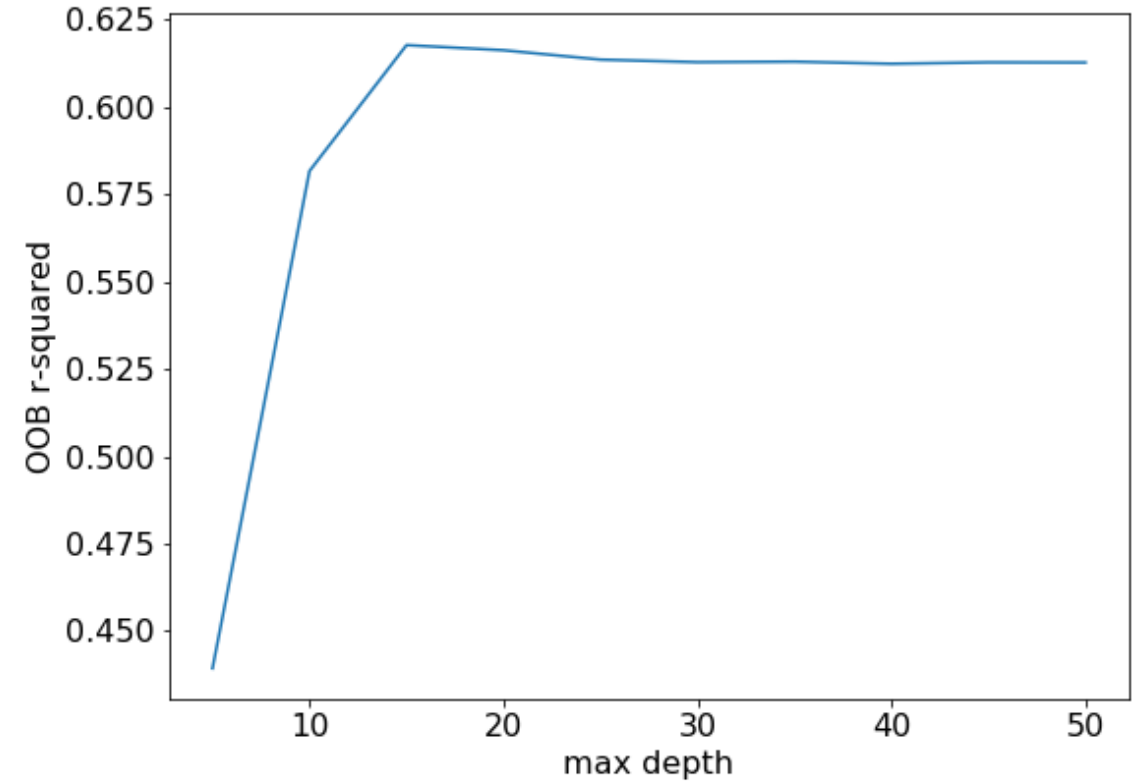
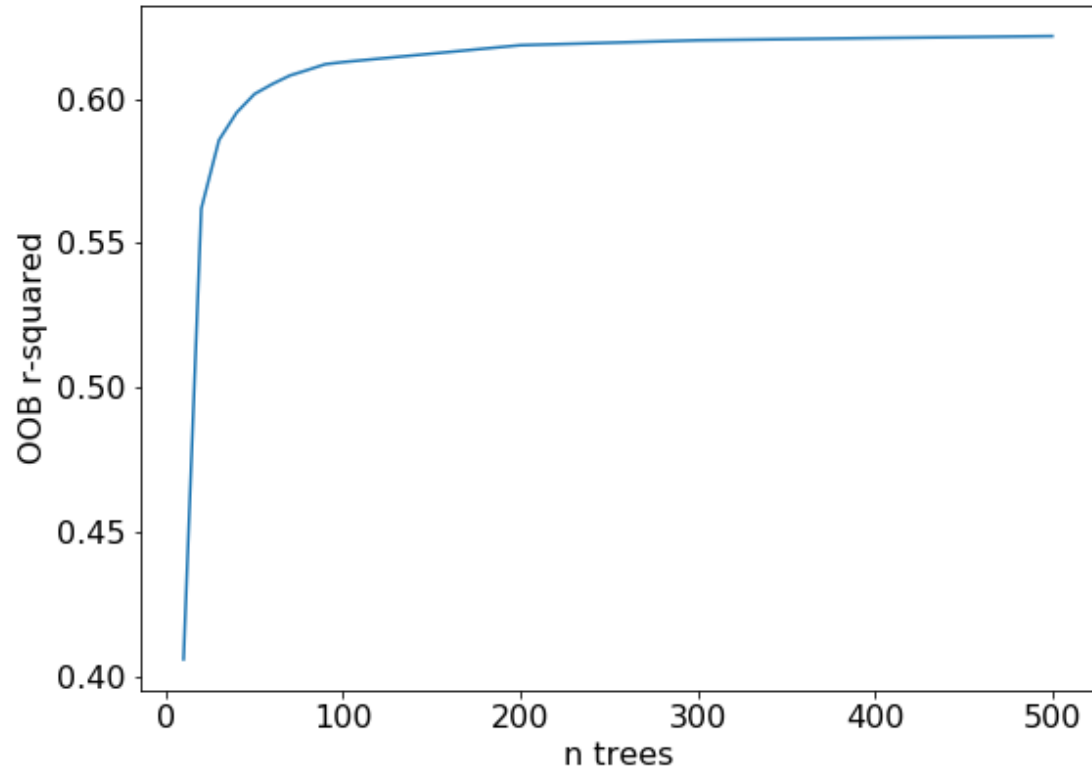PV

RMSE = 11.9

NPV

RMSE = 35.5

2017 field surveys
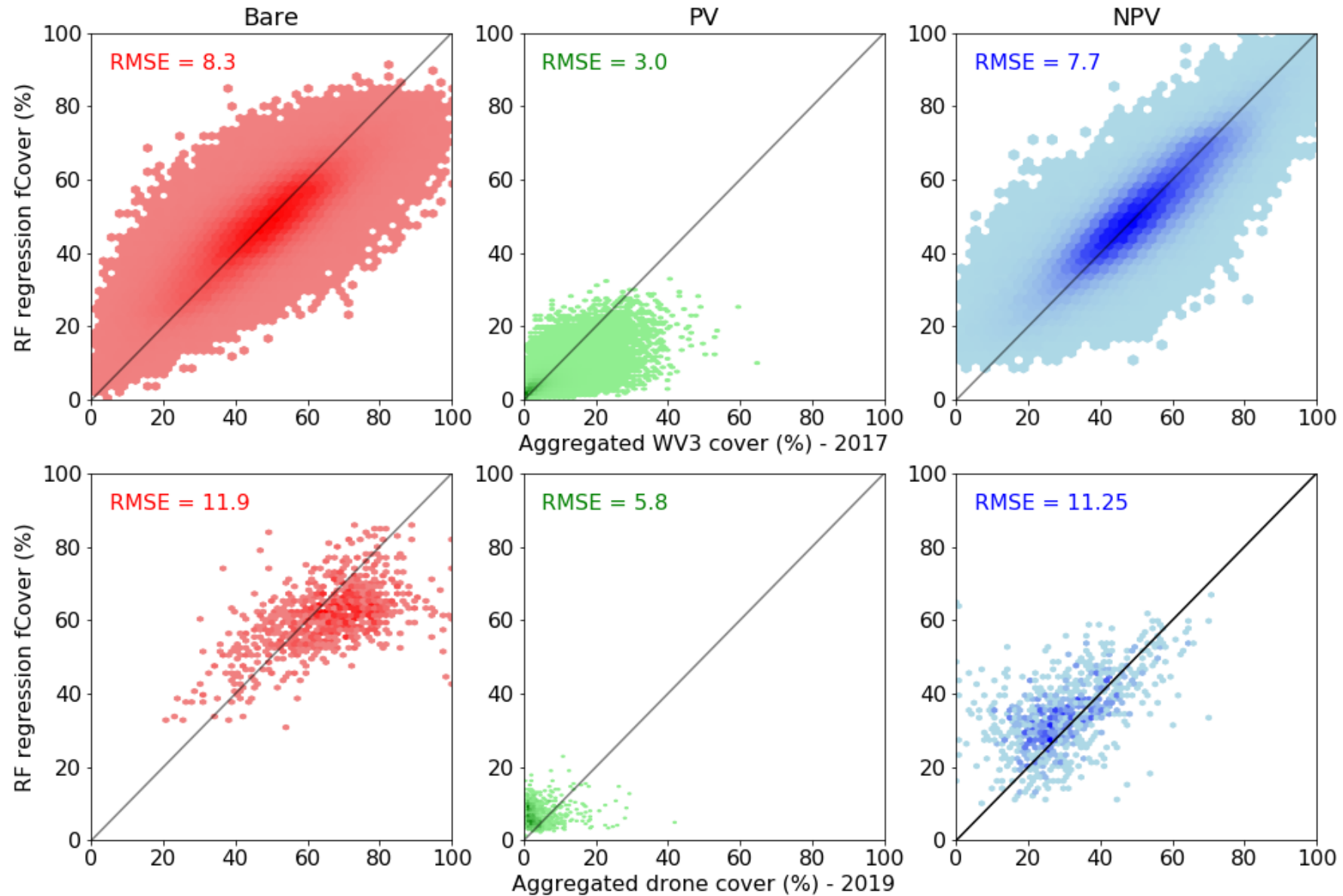
2019 drone imagery (1 of 4 sites processed)

Random Forest Regression (based on Sentinel2 data)

n estimators (trees) = 100
max depth = 15

Regression results

n = 250756

n = 936

Thank you!