Dronekuvien hyödyntäminen peltojen kasvukunnon arvioimisessa

Peltopäivä 27.9.2019 Inkoo

Roope Näsi ja
DroneFinland-tutkimusryhmä
Maanmittauslaitos

www.dronefinland.fi

DroneFinland - smarter aerial remote sensing - on UAS kaukokartoitusteknologian tutkimus- ja innovaatiokeskus Paikkatietokeskuksessa

- Starting in 2008
- Lead by Dr. Eija Honkavaara
- Drone photogrammetry, laser scanning, hyperspectral imaging, thermal imaging
- New sensors, rigorous sensor data processing
- Efficient and intelligent processing algorithms
- Test fields, calibration and validation
- Application know-how, collaboration
- Success stories

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FGI drone fleet

Commercial drones

DJI Phantom 4, Payload: 200 g, Total weight: 1.4 kg, Flight time: 20 min

Avartek ARX-30 octocopter, payload 10 kg, Total weight: 25 kg, Flight time: 30 min

FGI Hexacopter UAV, Payload 3 kg, Flight time: 20 min

FGI Quadcopter UAV, Payload 2 kg, Flight time: 30 min

FGI built drones

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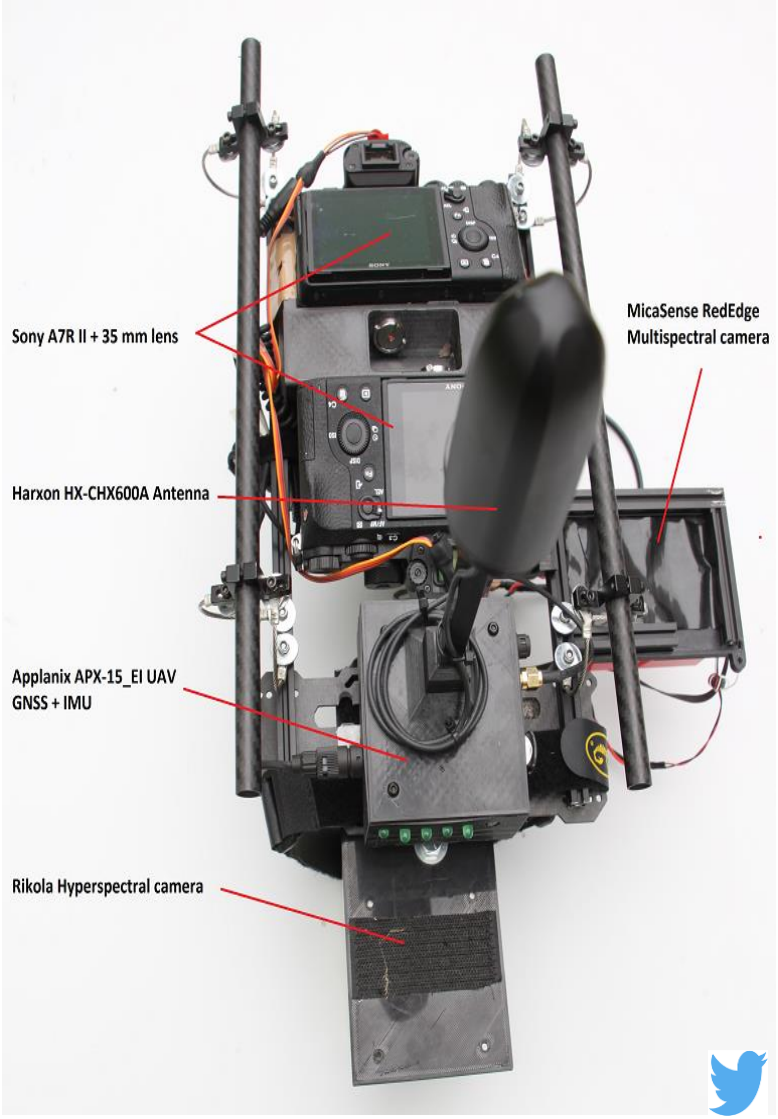
Image based remote sensing

Sony A7R II

Rikola Hyperspectral camera



Sequoia multispectral camera

Micasense multispectral camera

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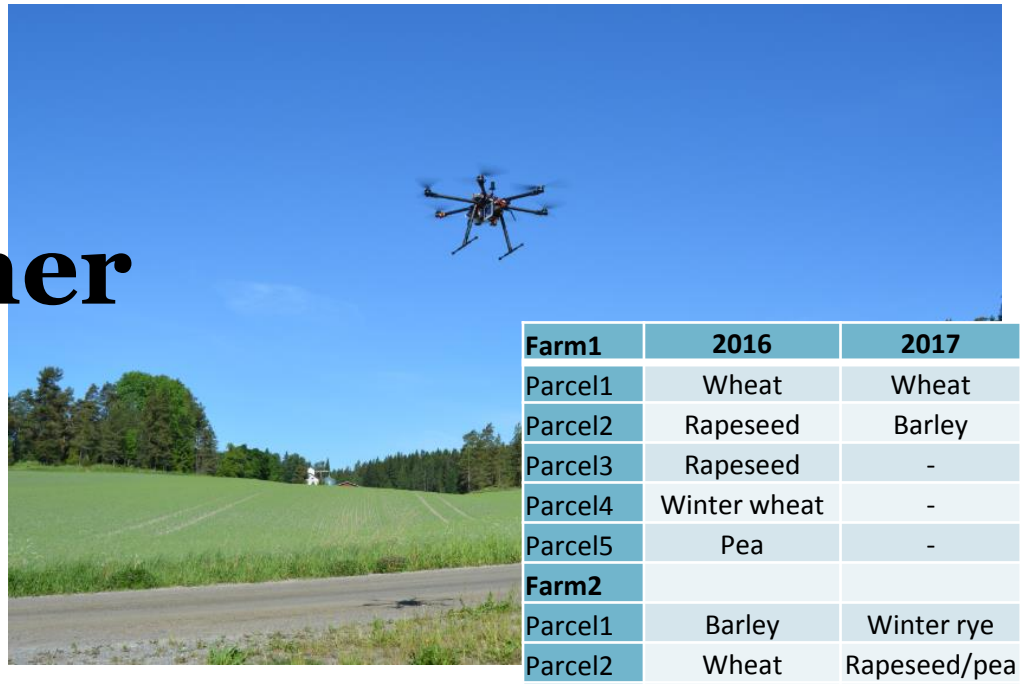
Drone data capture summer 2016-2017



- 4 different farms
- 14 flight campaings
  - 51 different flights
  - 18 different parcels
    - (1)-3 times during growing season
- 84 data sets
- Plants
  - TABLE: grass, wheat (summer and winter), barley, oat, rye, rapeseed and pea

Farm1	2016	2017
Parcel1	Wheat	Wheat
Parcel2	Rapeseed	Barley
Parcel3	Rapeseed	-
Parcel4	Winter wheat	-
Parcel5	Pea	-
Farm2		
Parcel1	Barley	Winter rye
Parcel2	Wheat	Rapeseed/pea
Parcel3	Pea	Winter wheat
Parcel4	Pea	Winter rye
Parcel5	Rye	-
Parcel6	(sub-drainage)	-
Parcel7	Winter wheat	-
Farm3		
Parcel1	Barley	-
Parcel2	Oat	-
Parcel3	Timothy grass	-
Parcel4	Red clover	-
Farm4		
Parcel1	-	Grass
Parcel2	-	Barley

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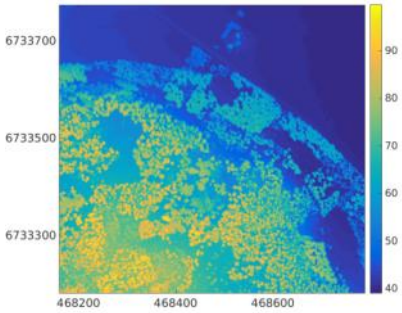
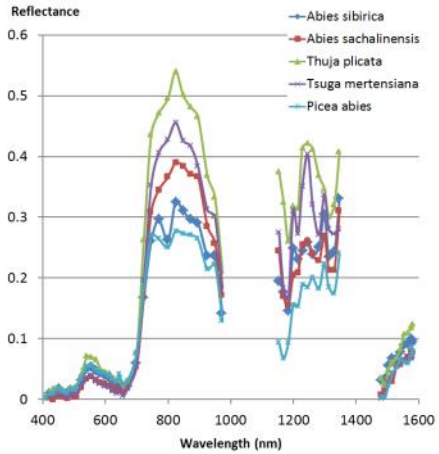
Analysis Processing flow for Hyper-spectral UAS data





ALS DTM

Data capture

Image pre-processing

Image orientation

DSM generation

Target detection

Spectral characteristics of samples

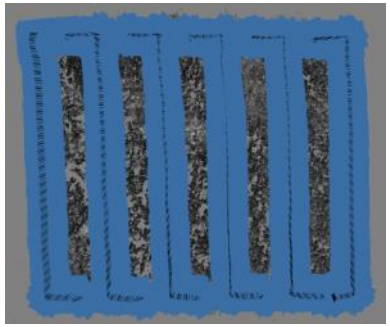
Field reflectance reference

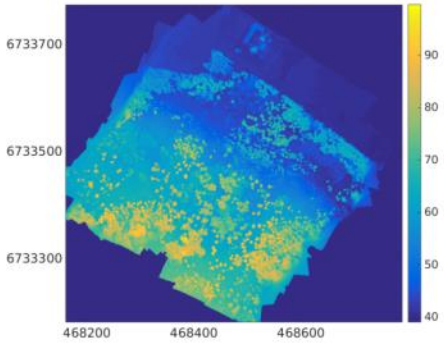
Radiometric block adjustment

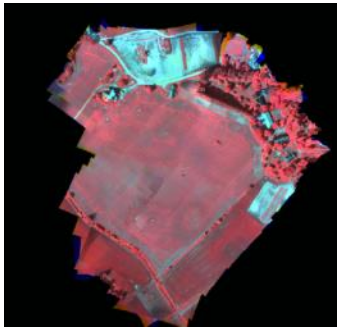
Mosaic generation

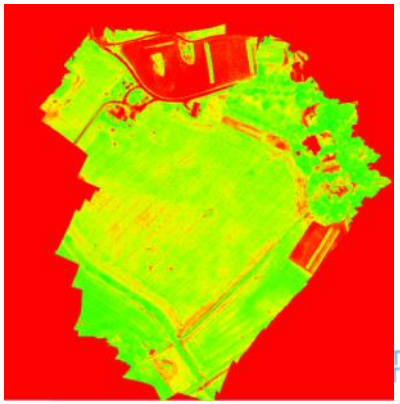
Reference plots

Analysis

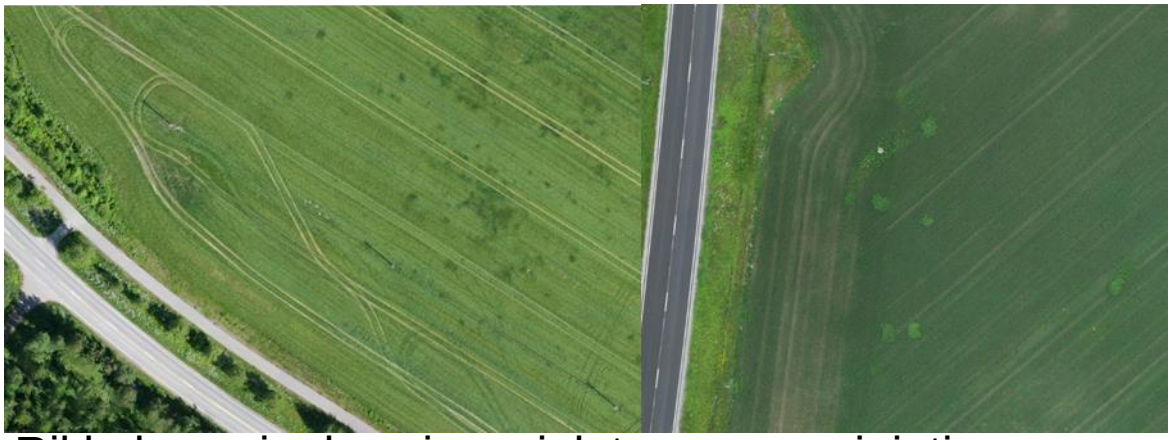








Mitä RGB ortokuvista voidaan nähdä?



Rikkakasveja, kasvinsuojelutarpeen arviointi

Syysvehnän jääpolte, toimenpiteet, vanhat salaojat

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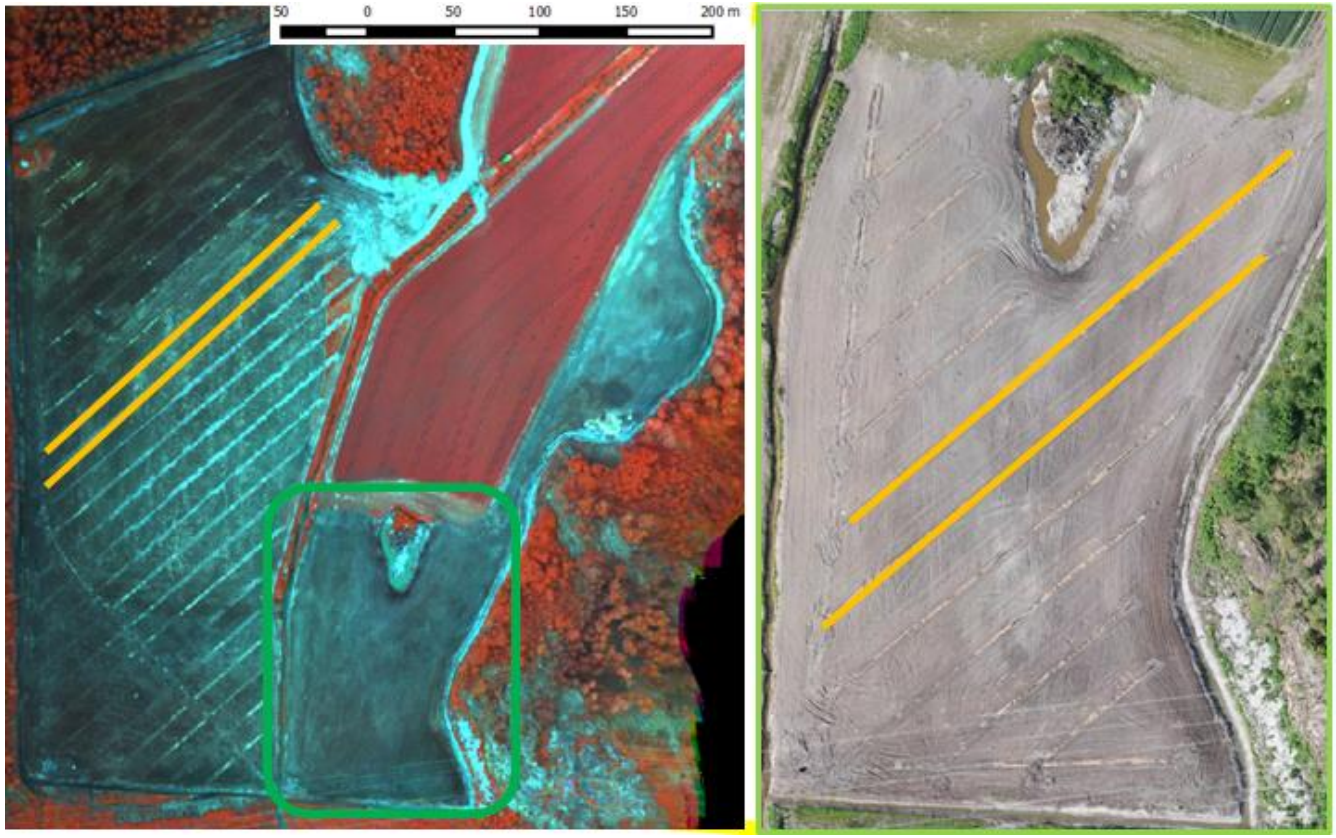
Uusien salaojien dokumentointi



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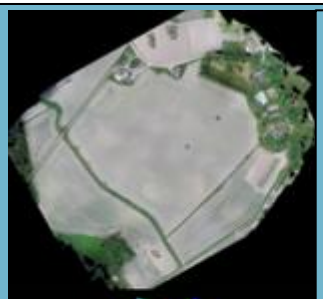
Drone data from pea parcel

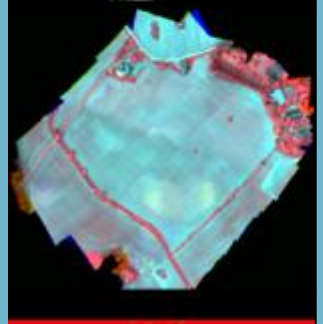
Source: Näsi, Honkavaara, Hakala, Viljanen, Peltonen-Sainio. 2017. How farmer can utilize drone mapping? FIG Working Week in Helsinki, Finland May 29 - June 2, 2017

- Pea field
- Time serie collection during growing season
- Anomalies visible espacially in last data set
  - Rain and topography

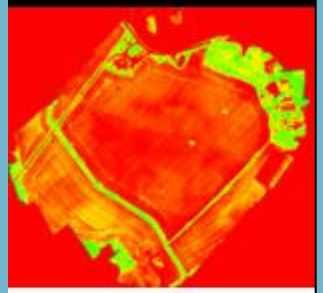
RGB mosaic



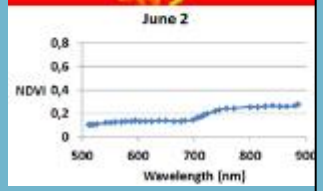
FPI Spectral mosaic

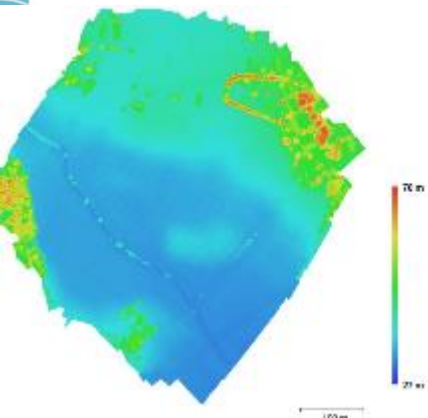


NDVI map

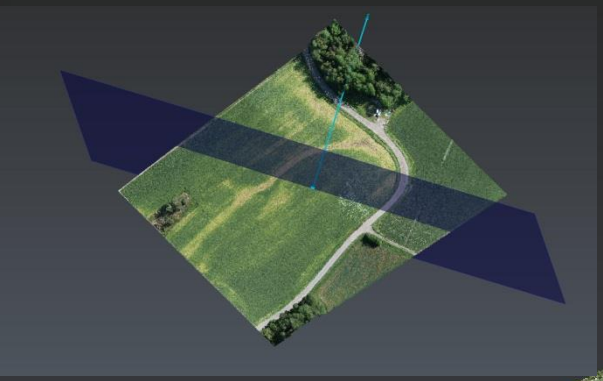


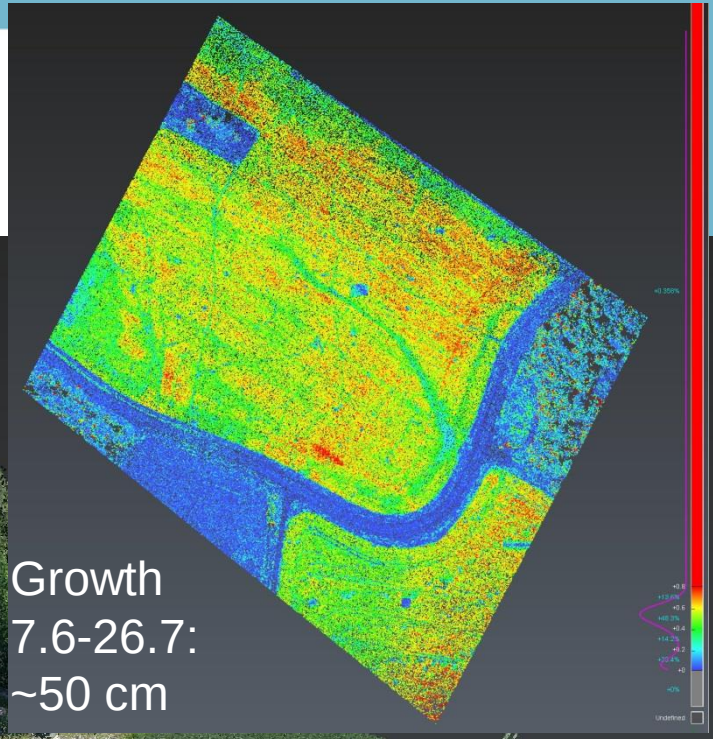
Average spectra





3D photogrammetric pointcloud data





Growth
7.6-26.7:
~50 cm

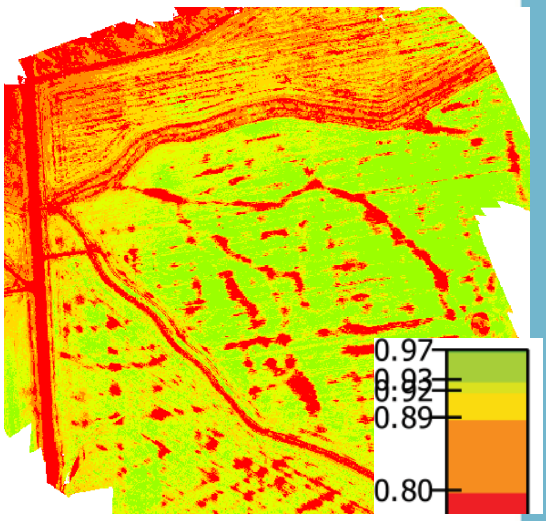
26.7
21.6
7.6

Nurmisadon seuranta -Liminka

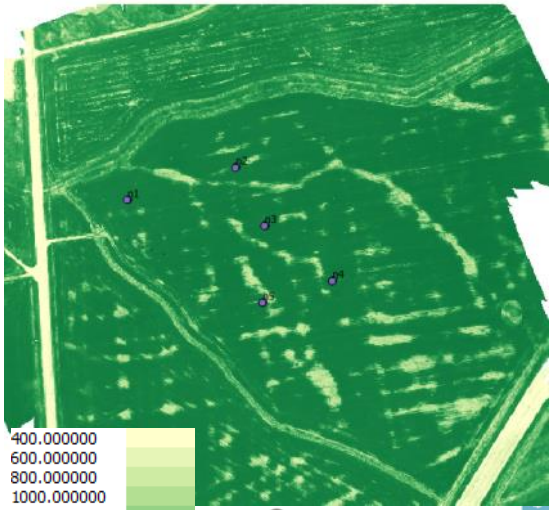
14.6

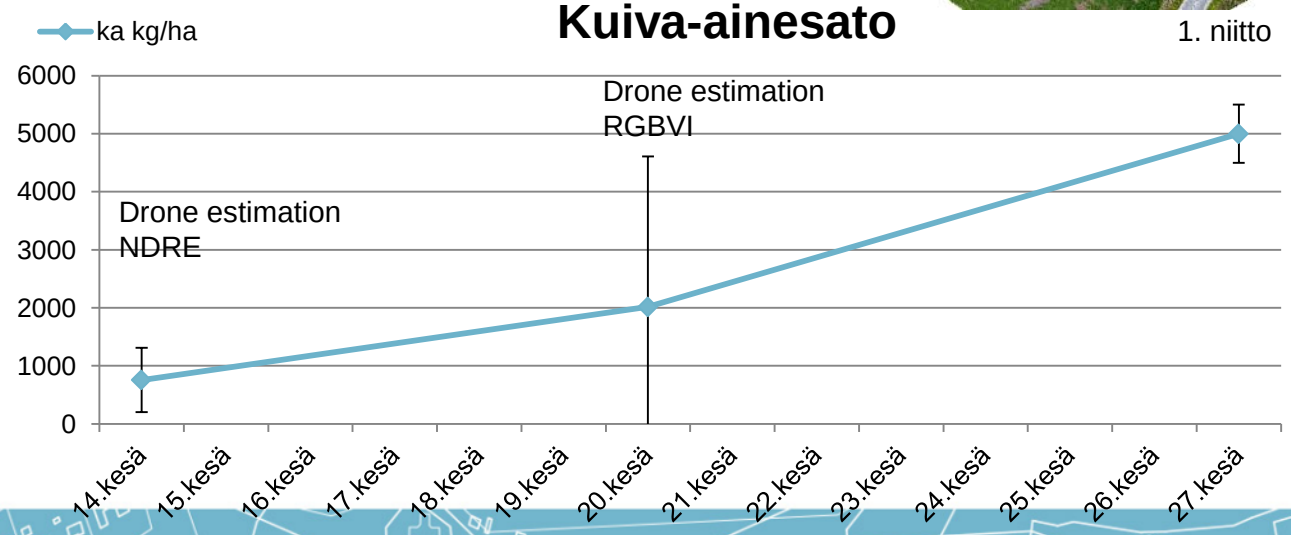
20.6

Indeksikartta



Satokartta





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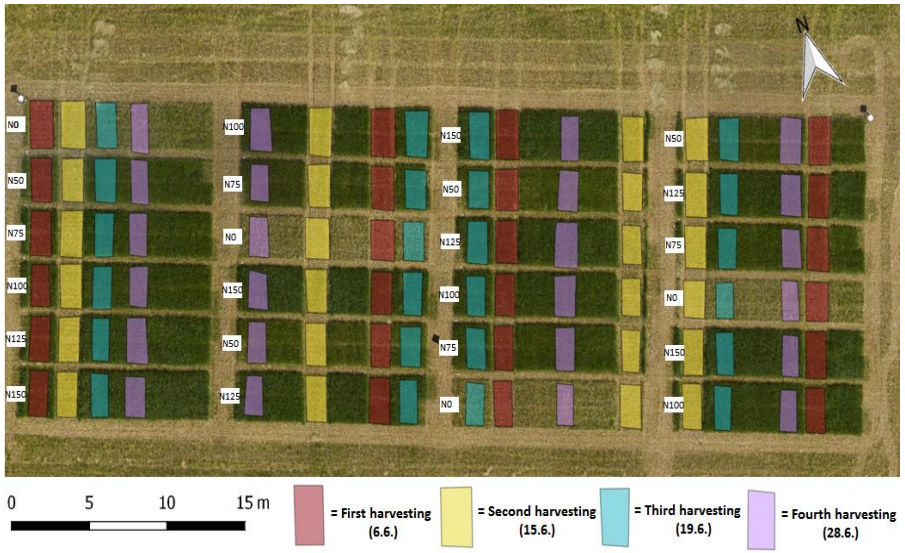
Optimizing harvesting time on grass silage

Grass trial site Primary Growth



- Second-year silage production field with timothy/meadow fescue (65%/35%)
- Large variation of biomass by using six different N-fertilization rates 0, 50, 75, 100, 125, 150 kg/ha
- 4 sampling dates before the first cut: 06.06., 15.06., 19.06. and 28.06.
- 96 samples

Reference measurements

		Average
Quantity	FY - Fresh Yield (kg/ha)	11046
	DMY - Dry Matter Yield (kg DM/ha)	2653
Quality	D-value - Digestibility (g /kg DM)	710
	iNDF - Indigestible Neutral Detergent Fibre (g/kg DM)	92.0
	NDF - Neutral Detergent Fibre (g/kg DM)	538
	WSC - Water Soluble Carbohydrates (g/kg DM)	139
	Ash concentration (g/kg DM)	65.1
	Ncont - Nitrogen concentration in DM (g N/kg DM)	22.1
	NU - Nitrogen uptake (N kg/ha)	53.6

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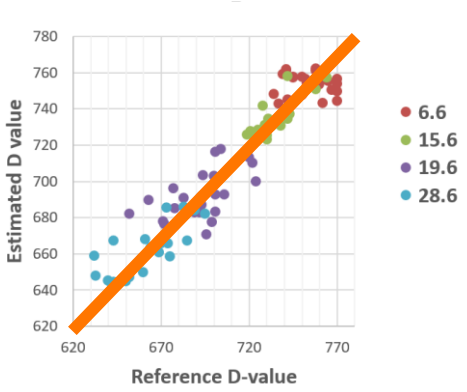
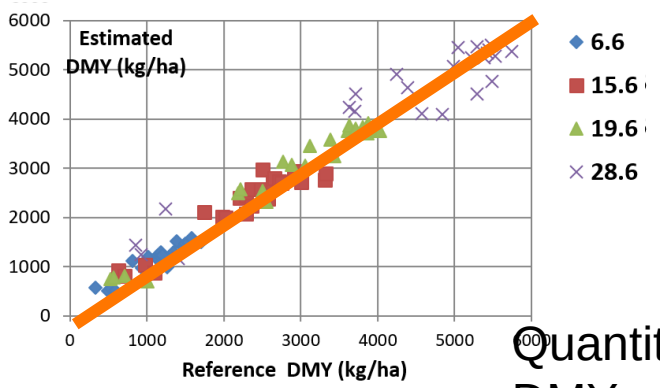
Optimizing harvesting time

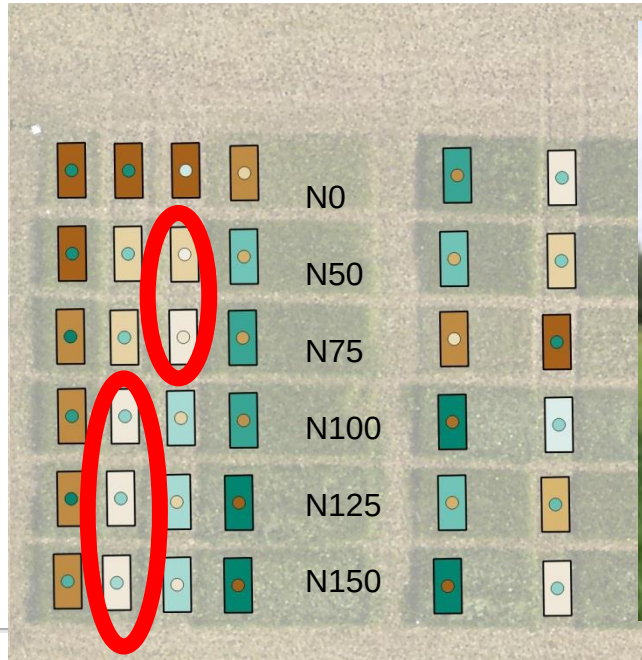
- Tool for farmer to know when is the best time for harvesting
  - Target values
  - D > 680
  - DMY >3000



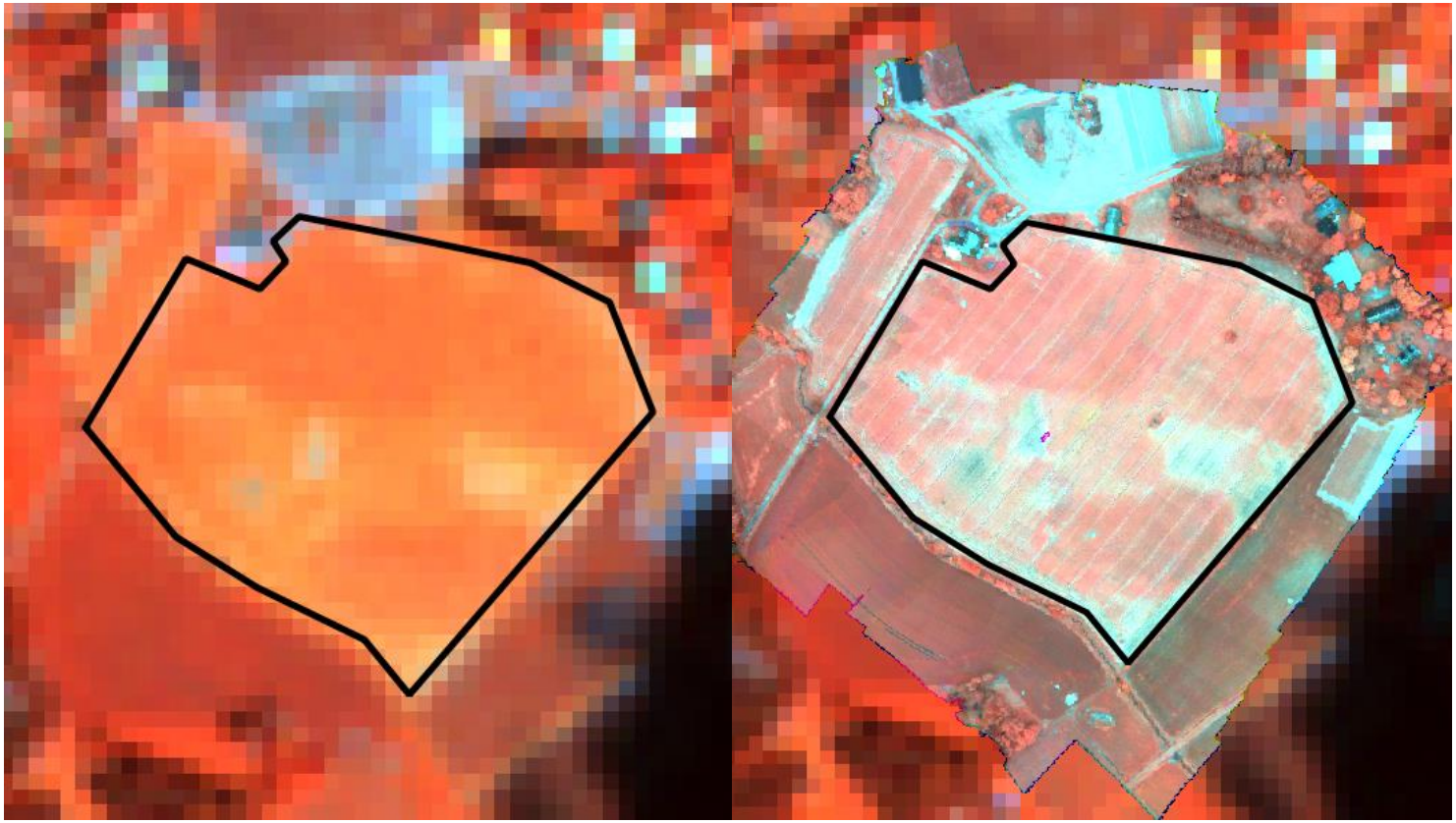


Quality: D-value

Quantity: DMY (kg/ha)



Satellite vs drone



Sentinel-2
19.7.2016

FGI drone
21.7.2016

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ID,count,min,mean,max,median,percentile_10,percentile_90,std
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3994507135
47436,73,0.24719999730587006,0.5598274126444778,0.9451000094413757,0.5357
339645638
```

Loppupäätelmät

- Sadonarvioinnin kehittämiseen olisi hyvä saada lisää aineistoa
- Jo pelkkiä dronekuvia katsomalla viljelijä saa nopeammin pellon kasvustosta kokonaiskuvan kuin koko lohkolla kävelemällä
- Automaattiset ja suoraan koneisiin integroitavat järjestelmät kehittyvät koko ajan
  - Nopeus ja helppokäyttöisyys edelletyksiä siihen että ne otetaan laajasti käyttöön

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OPAL·Life

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