Precision Farming applied to turfgrass (sports turf and sod production)

Filippo Lulli Ph.D. - TURF EUROPE srl - www.turfeurope.eu

Josh Friell Ph.D. - The TORO Company - www.toro.com

turf europe

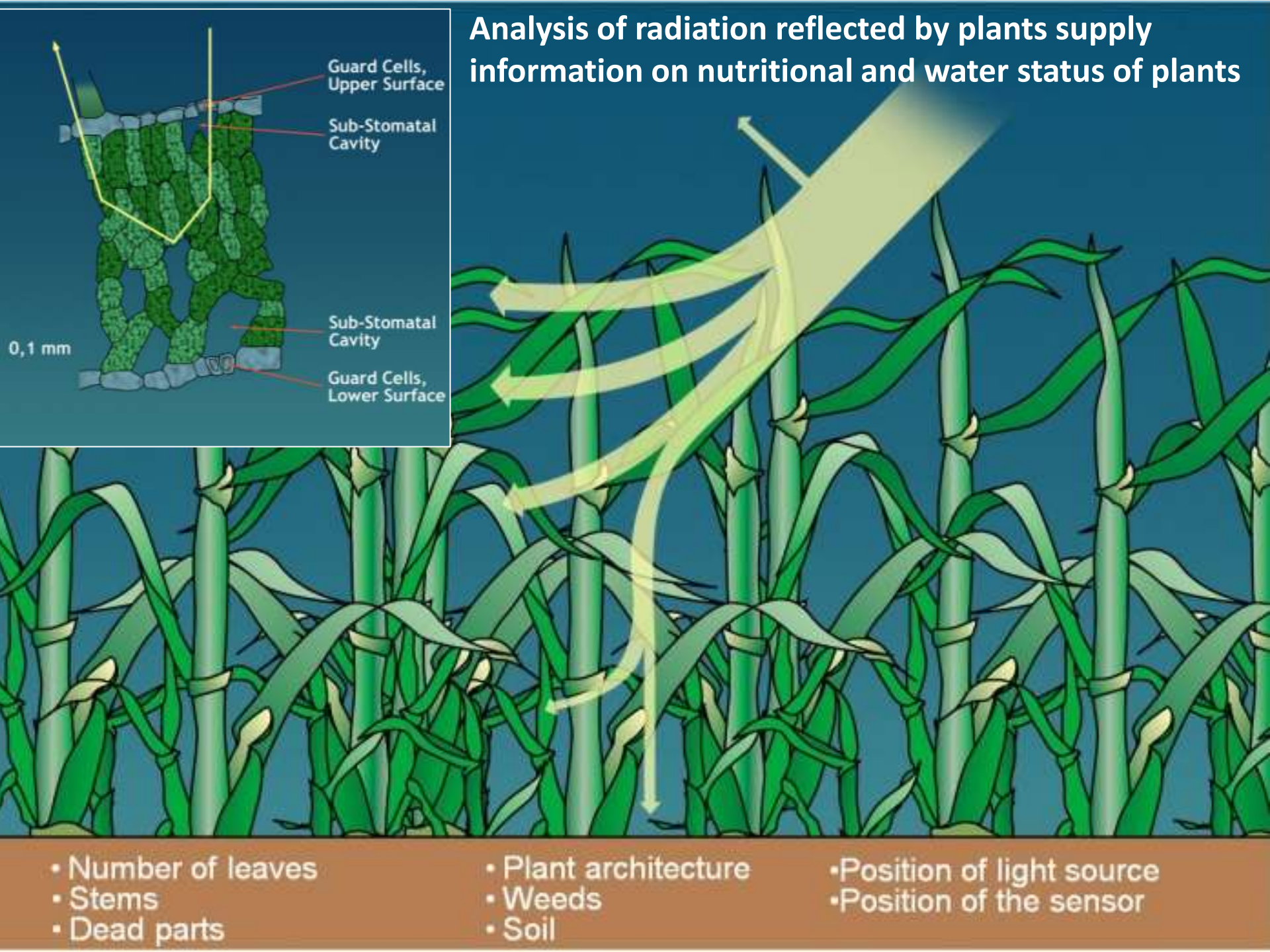
AZIENDA SPINOFF DELL'UNIVERSITÀ DI PISA

ETP
European Turfgrass Producers

PA and Satellite Monitoring of Turfgrass Sod Production

Filippo Lulli Ph.D. TURF EUROPE srl www.turfeurope.eu

novo green


Analysis of radiation reflected by plants supply information on nutritional and water status of plants
Guard Cells, Upper Surface
Sub-Stomatal Cavity
Sub-Stomatal Cavity
Guard Cells, Lower Surface
0,1 mm
• Number of leaves
• Stems
• Dead parts
• Plant architecture
• Weeds
• Soil
•Position of light source
•Position of the sensor

SATELLITE MONITORING OF TURFGRASS SOD PRODUCTION: Challenges

We know that monitoring of crops via satellite-acquired spectral reflectance works. **Why are we not using it more?**

1. Cost of satellite images 1500-5000 $/image
2. Sourcing: up to 60 days from order to delivery
3. Military has priority, weather is limiting (up to 15% cloud cover)
4. Sometime “shady” customer service (satellite change, dates, etc.)
5. Prices do not include vegetational analysis
6. Image analysis through dedicated software (i.e. ENVI) is not easy !
7. Images are 25 km^2 (2500 ha). A lot of “wasted” acquisition...
8. Interpretation is **CROP-SPECIFIC** ! !

SATELLITE MONITORING OF TURFGRASS SOD PRODUCTION: Opportunities

We need to work towards overcoming the problems, since **the opportunities / applications are very interesting.**

1. Images are big, can neighbouring farmers pool resources?
2. Between date comparison ("...is an agronomical program working?")
3. Monitoring of uniformity of agronomical work and results
4. Resolution is nowadays very good ("multispectral" pixel down to 1m)
5. Up to 8 MS bands are now available (WV2)
6. A wealth of vegetational indices can be calculated for crops
   i.e. **www.indexdatabase.de** an online resource for VI that can be calculated from each satellite sensor data

SATELLITE MONITORING OF TURFGRASS SOD PRODUCTION: methods

- 3 acquisition sites sod farms (Plantec, IT; Richter, SK; Ostfoldgress, NO);
- 2 dates (August 2015 and October 2015);
- 3 satellites: WorldView-2 (WV2), GeoEye-1 (GO1), Pleiades-1A (P1A);

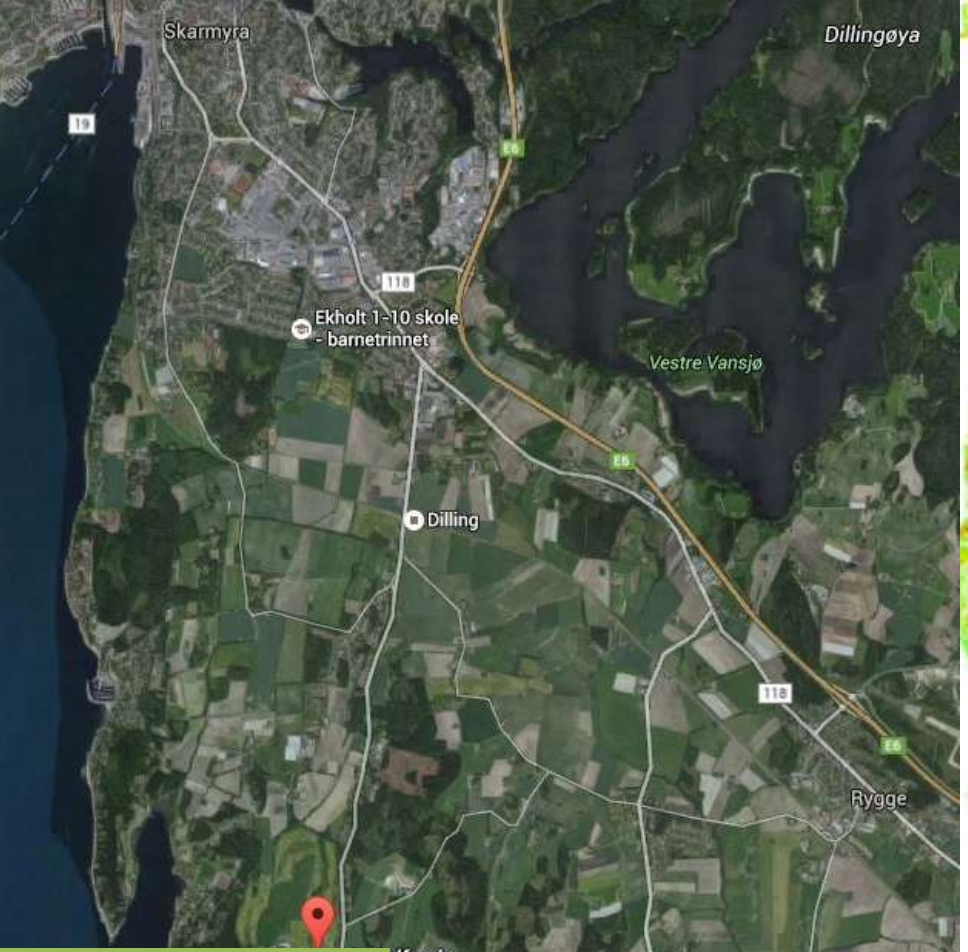
MS response on areas with naturally-occurring variability due to: **variety**, **soil** and **agronomic practices**.

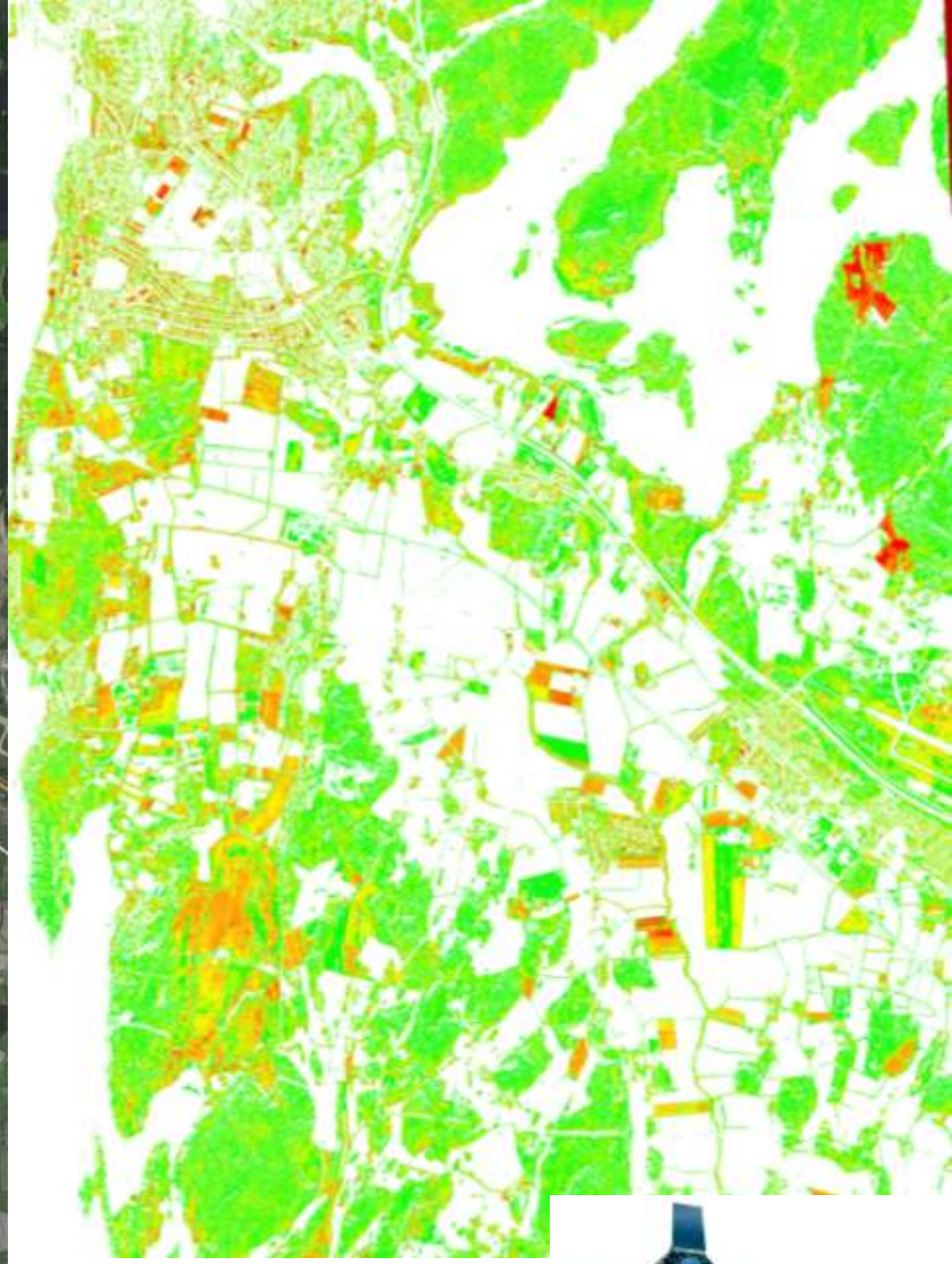
(1) Harvested vs. non harvested areas;
(2) European vs. American varieties of the same species;
(3) Areas subject to natural *P. annua* or *C. dactylon* infestation (>5%)

Satellites bands

WorldView 2	GeoEye 1	Pleiades-1A
Multispectral Resolution 2.39 m Panchromatic 450 - 800 Coastal 400 - 450 Blue 450 - 510 Green 510 - 580 Yellow 585 - 625 Red 630 - 690 Red edge 705 - 745 Nir 1 770 - 895 Nir 2 860 - 1040	**Multispectral Resolution** 2.72 m Panchromatic 450–800 nm Blue 450–510 nm Green 510–580 nm Red 655–690 nm Near IR 780–920 nm	**Multispectral Resolution** 2.84 m Panchromatic : 480-830 nm Blue: 430-550 nm Green: 490-610 nm Red: 600-720 nm Near IR: 750-950 nm

Resolution very similar and comparable between satellites





Pleiades 1

Dilling area (NOR)

Area: 25 km^2

Resolution: 2.82 m

4 MS bands:

R: 600-720

G: 490-610

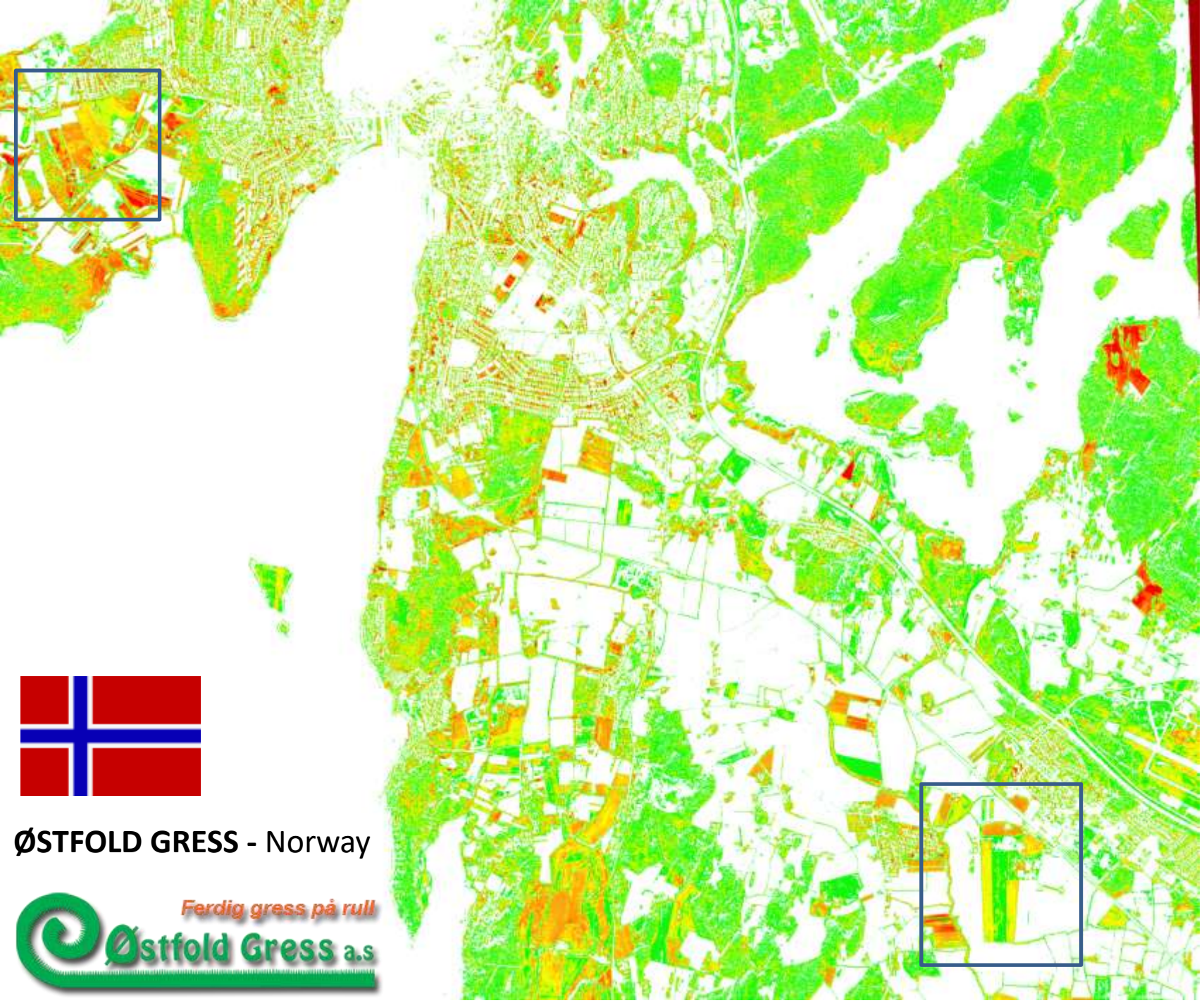
B: 430-550

NIR: 750-950

Summer 2015

SODSAT

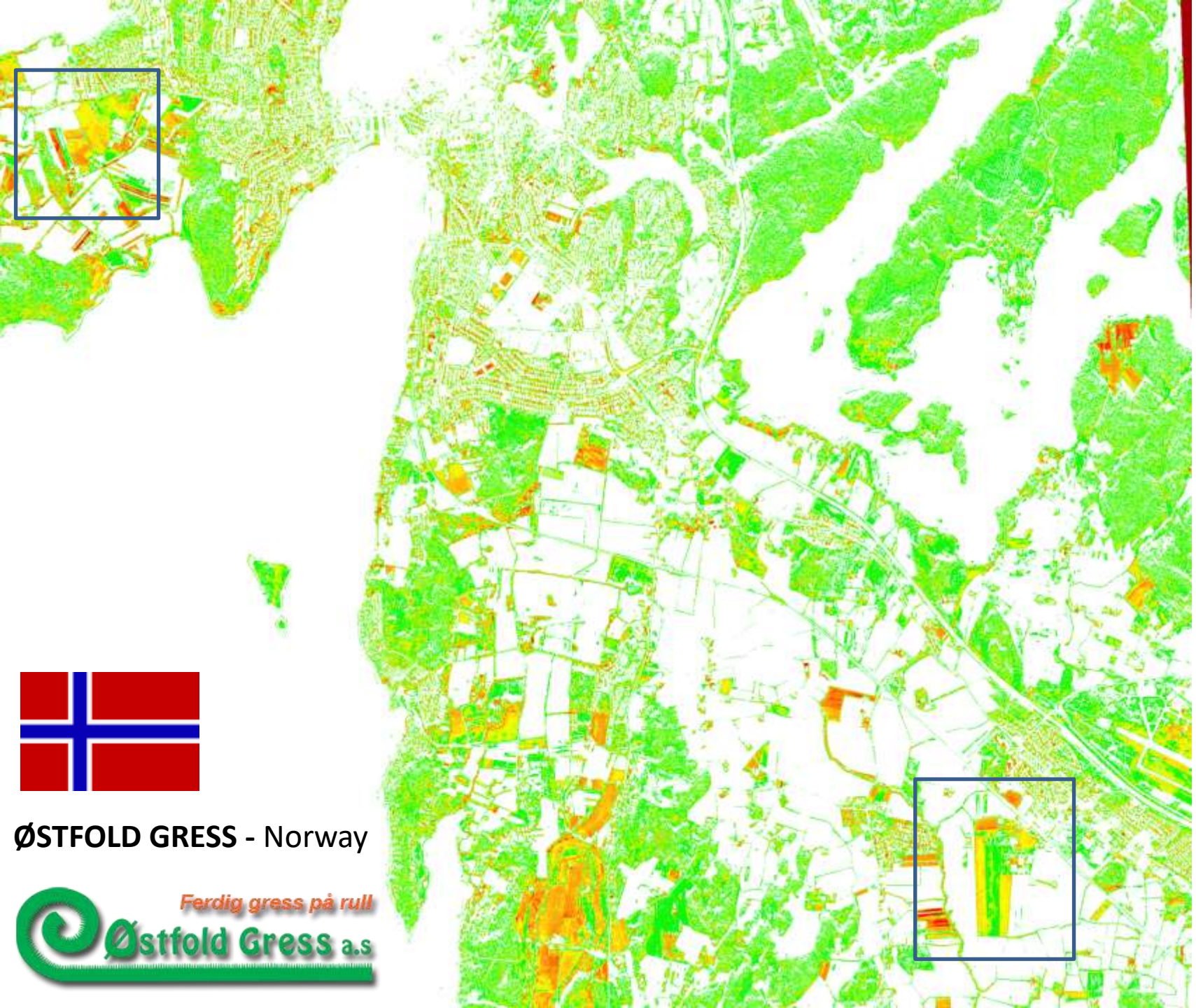
PLÉIADES IMAGERY SERVICES



ØSTFOLD GRESS - Norway

Ferdig gress på rull

Østfold Gress a.s



ØSTFOLD GRESS - Norway

Ferdig gress på rull

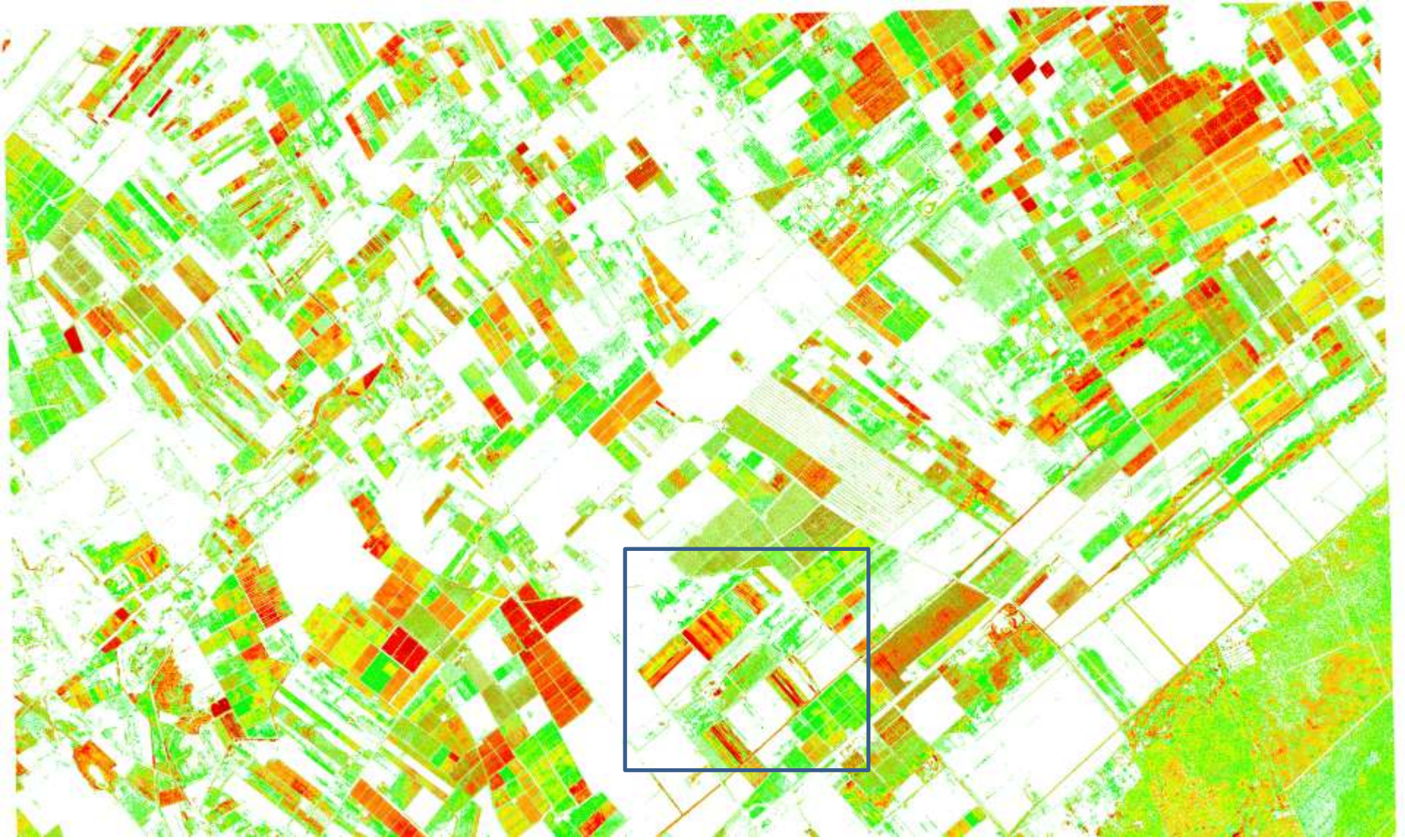
Østfold Gress a.s

RICHTER RASEN

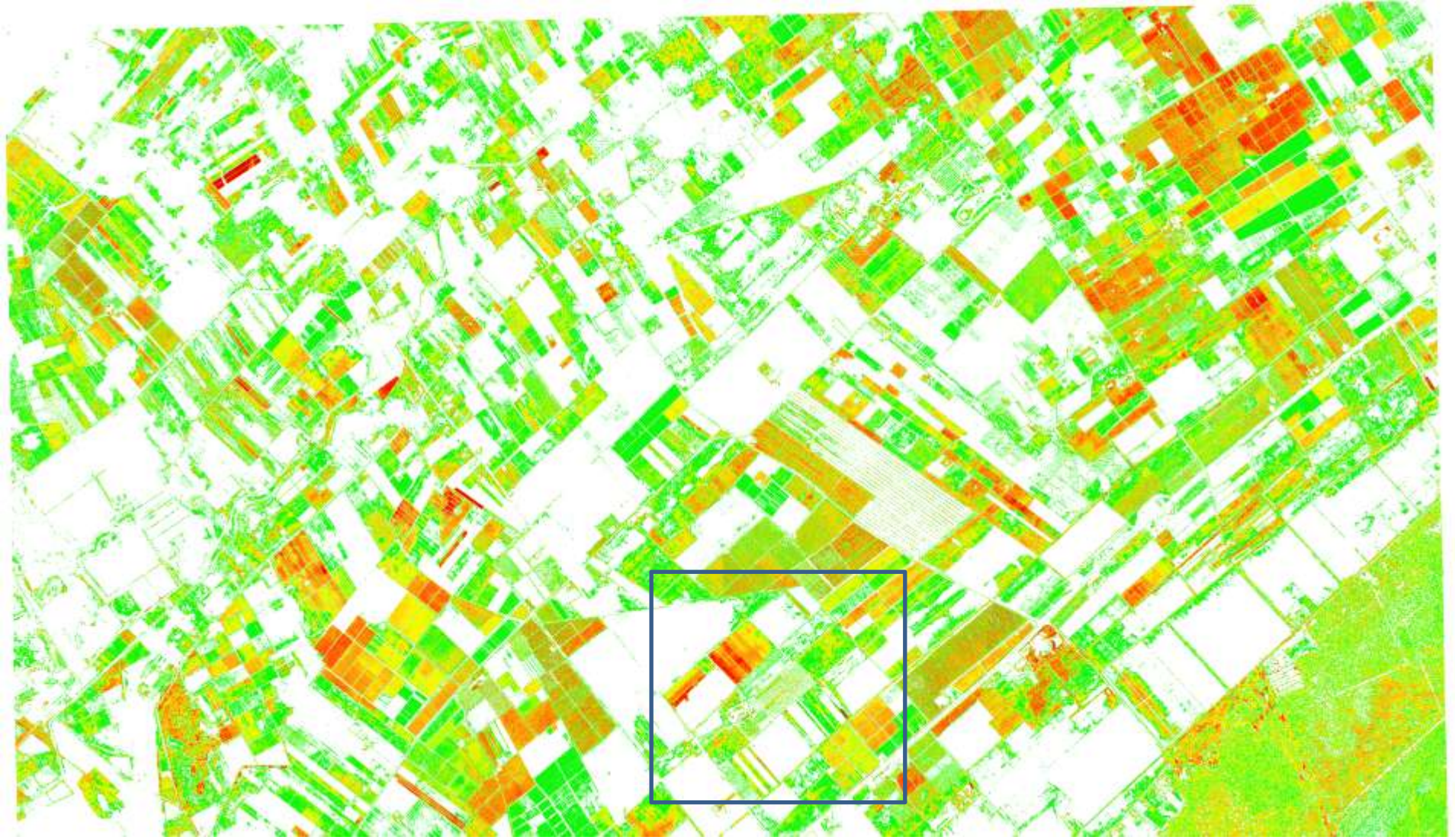
RICHTER RASEN

Slovakia

RICHTER RASEN
Slovakia

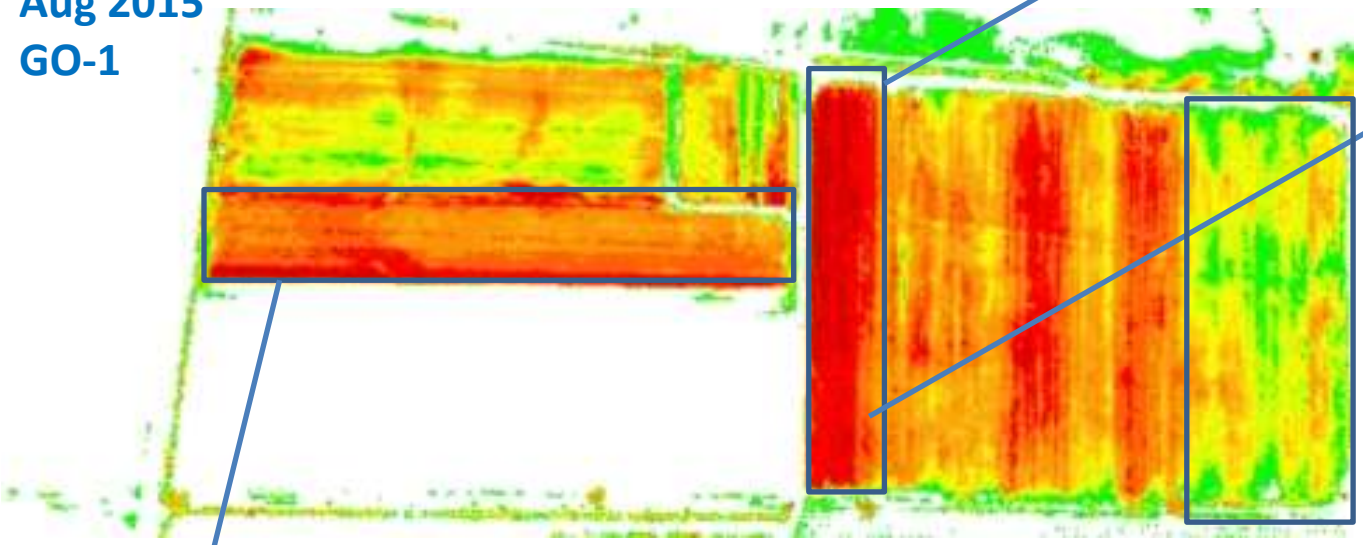


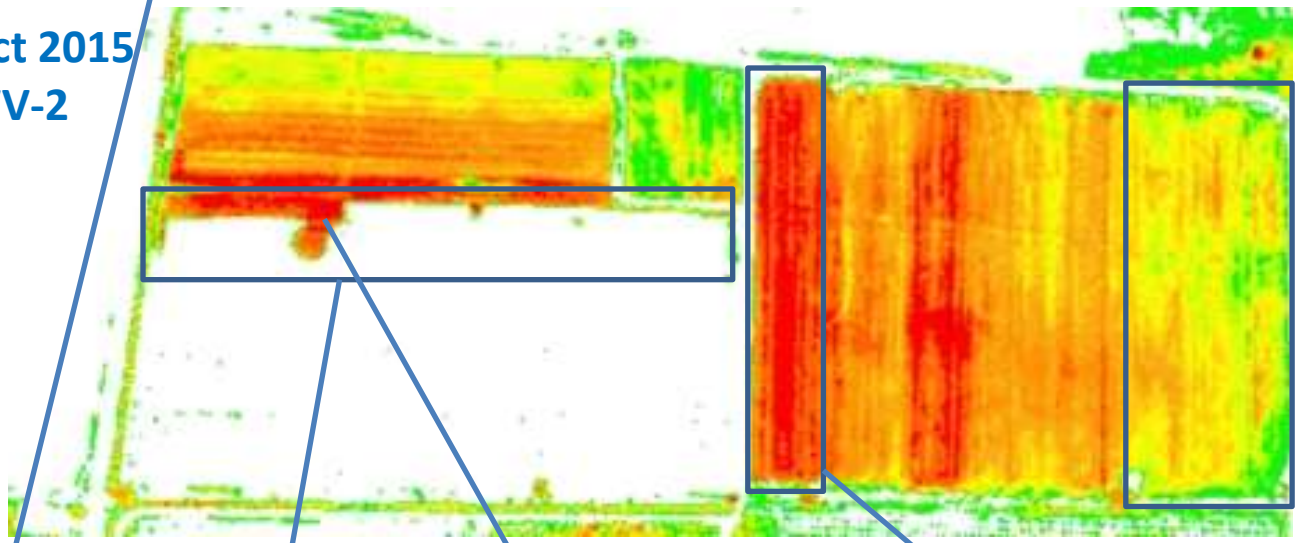
PLANTEC – Pratoplà
Italy



PLANTEC – Pratoplà

Italy

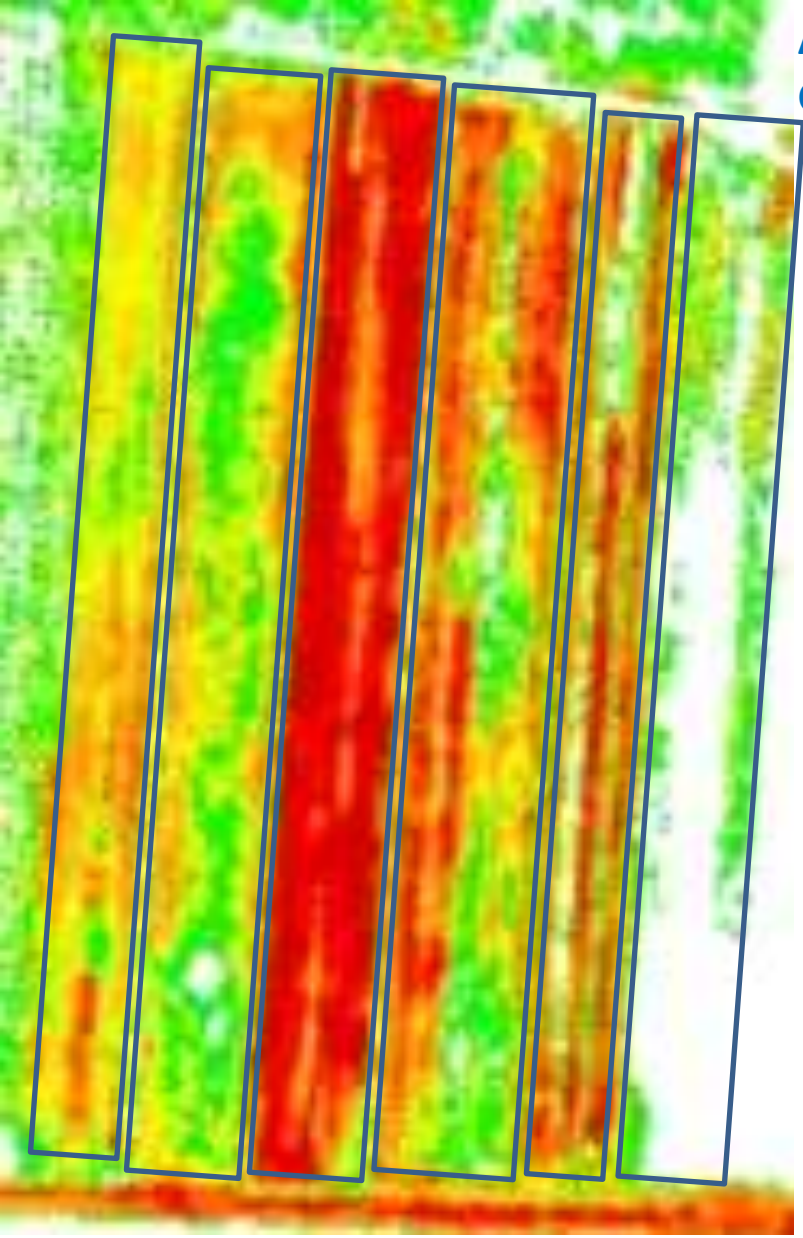




PRATOPLA Italy

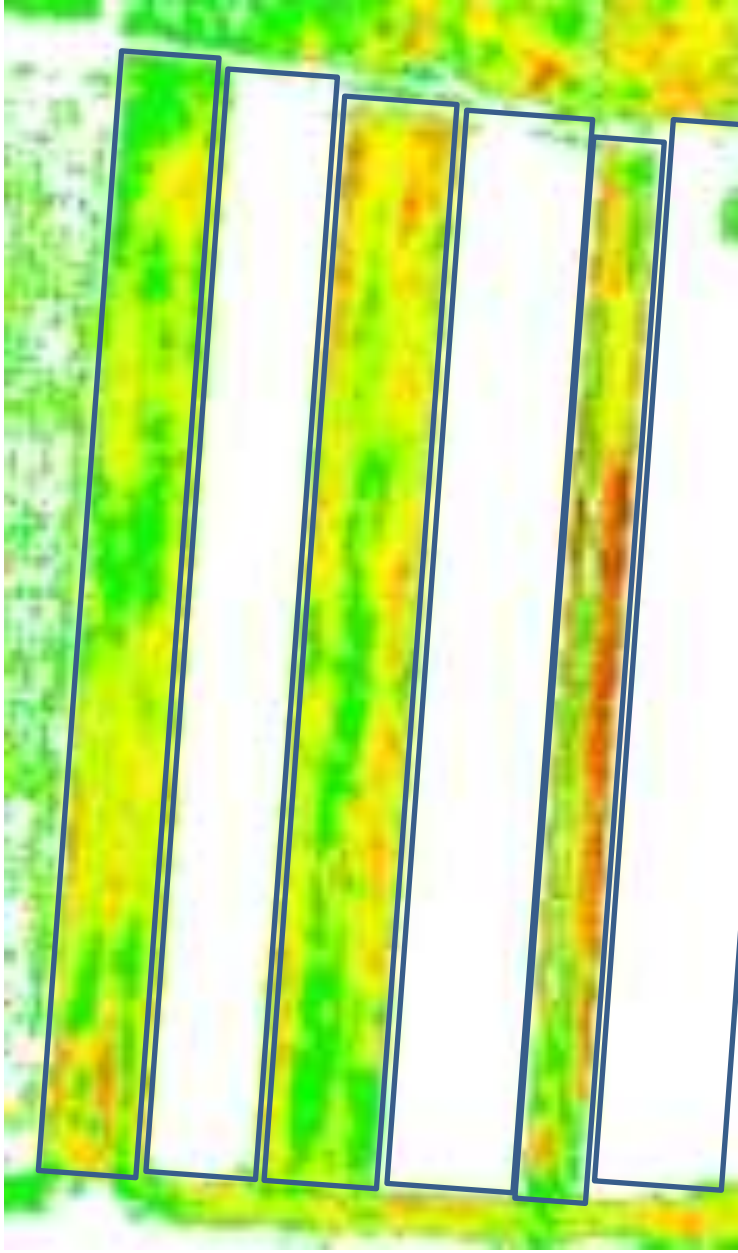
Aug 2015
GO-1

PRATOPLA Italy



Cd + Cdxt | *fallow* | *Cdxt* | *Vicia faba* | *Zm* | *stale seed bed*

Oct 2015
WV-2



Cd + Cdxt | *tilled* | *Cdxt* | *tilled* | *Zm* | *stale seed bed*

SATELLITE MONITORING OF TURFGRASS SOD PRODUCTION: How to analyse all this?

- 3 acquisition sites sod farms (Plantec, IT; Richter, SK; Ostfoldgress, NO);
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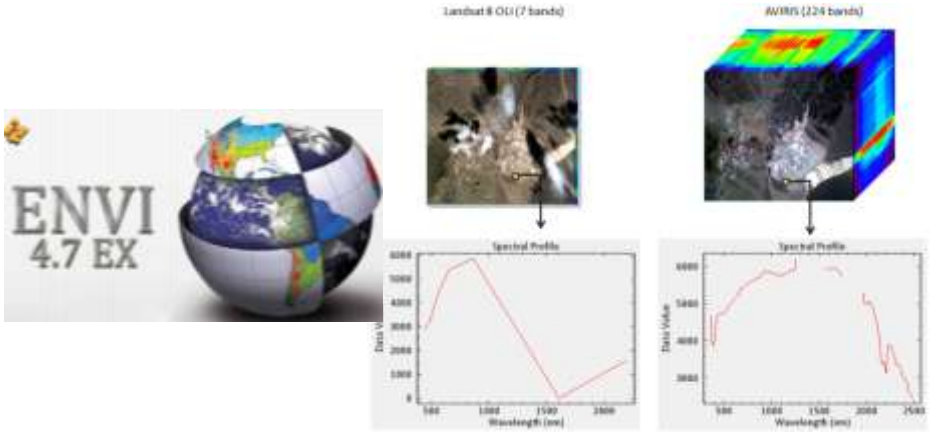
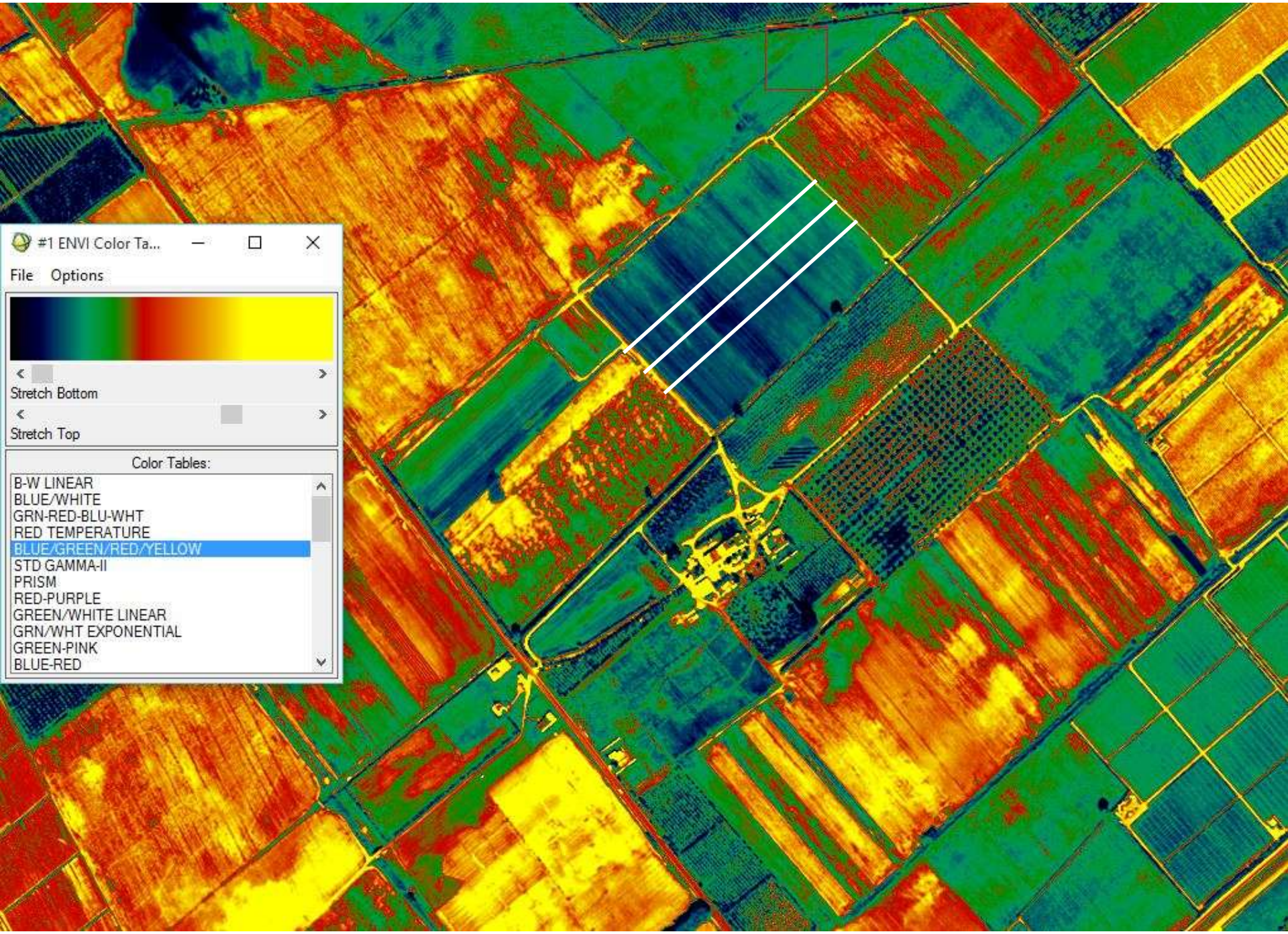


ØSTFOLD GRESS - Norway

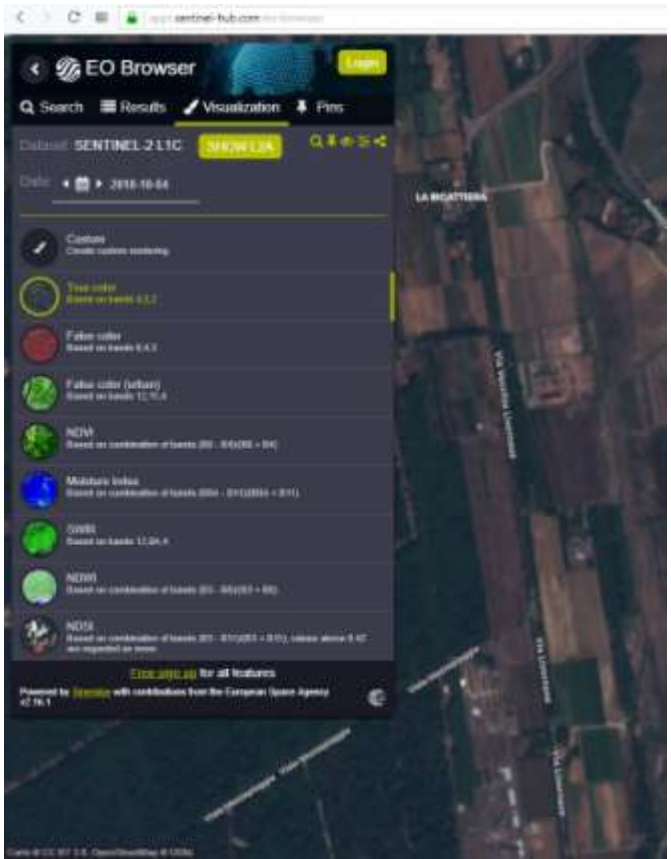

#1 ENVI Color Ta...
File
Options
Stretch Bottom
Stretch Top
Color Tables:
B-W LINEAR
BLUE/WHITE
GRN-RED-BLU-WHT
RED TEMPERATURE
BLUE/GREEN/RED/YELLOW
STD GAMMA-II
PRISM
RED-PURPLE
GREEN/WHITE LINEAR
GRN/WHT EXPONENTIAL
GREEN-PINK
BLUE-RED

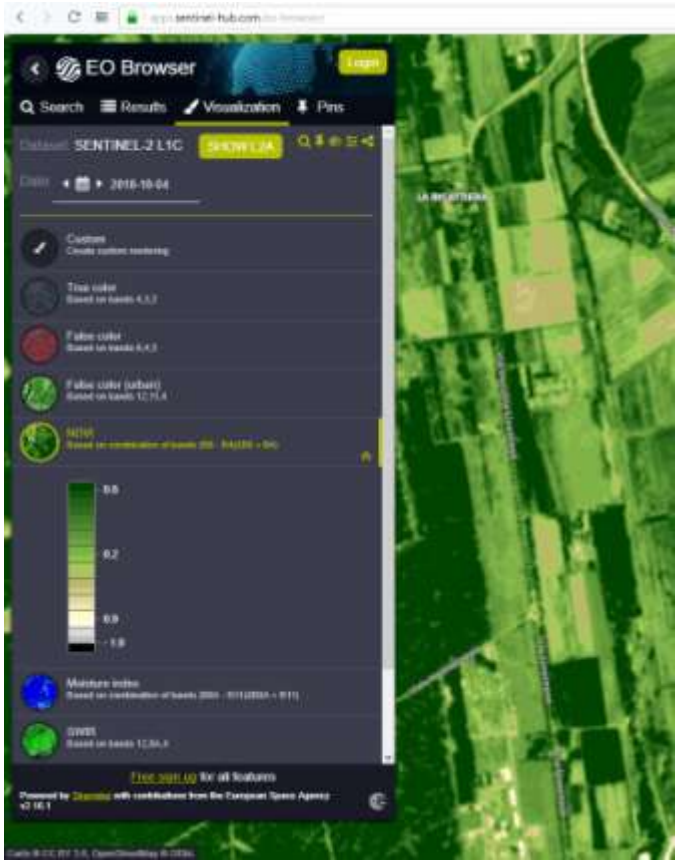
What's available for free ?

Sentinel-2 NDVI Maps (Google Play)

or https://apps.sentinel-hub.com/eo-browser/

- 100 m^2 pixel (10x10m) optical and NDVI images
- new pass every 2-3 days





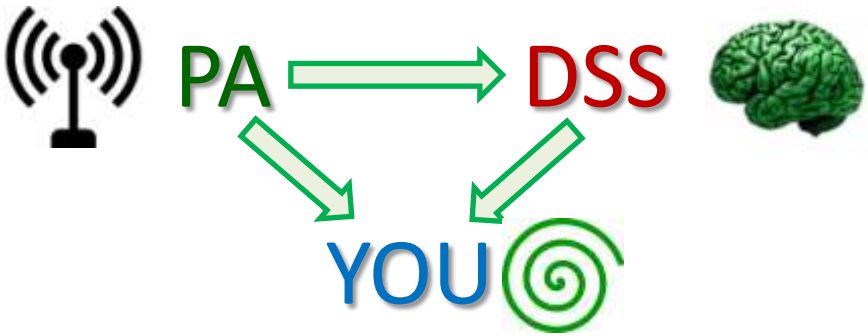
More PA for your farm ?

DO YOU USE IT ?

- yes
- no

WHY NOT?

- too expensive
- too complicated
- don't trust it
- I have tried it and it didn't work for me
- it's imprecise
- it's too precise (too much info…)
- I might feel useless…



More PA for your farm ?

Can I harvest or work ?
Will my treatment stick to leaves ?
Did my seed “float” (mm/h) ?

Can I do a liquid treatment (wind)?
Can I expect frost or heavy dew?
Am I at risk of fungal disease?
How much H_2O is my turf losing (ET_0)?

Can I harvest or work ?
Do I need to irrigate (WP or FC) ?
Is the soil T° right for seeding ?
Am I at risk of fungal disease ?

then **YOU** decide…

More PA for your farm ?

PRECISION FARMING APPS

- Farm logs
- Pest localization
- Order arial pictures (drone or satellite)
- Tank mix calculators
- Etc. Etc.

www.precisionag.com/service-providers/10-new-mobile-apps-for-precision-agriculture/

www.croplife.com/editorial/17-agriculture-apps-that-will-help-you-farm-smarter-in-2017/

www.farmindustrynews.com/precision-farming/top-agricultural-mobile-apps-your-smartphone/

www.useprecisionag.com/blog/the-top-5-precision-farming-apps-for-your-business/

Trends and opinions

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…while most startups focus on solving one aspect of the supply chain, **growers need app and software solutions for the entire production process**. It is unlikely for growers to adopt multiple apps or software that each of them provides just a narrow aspect of the multifaceted growing needs...

Moreover, while each solution individually claims to save time for the grower, **working on multiple apps consumes even more time**, which the grower doesn't have.

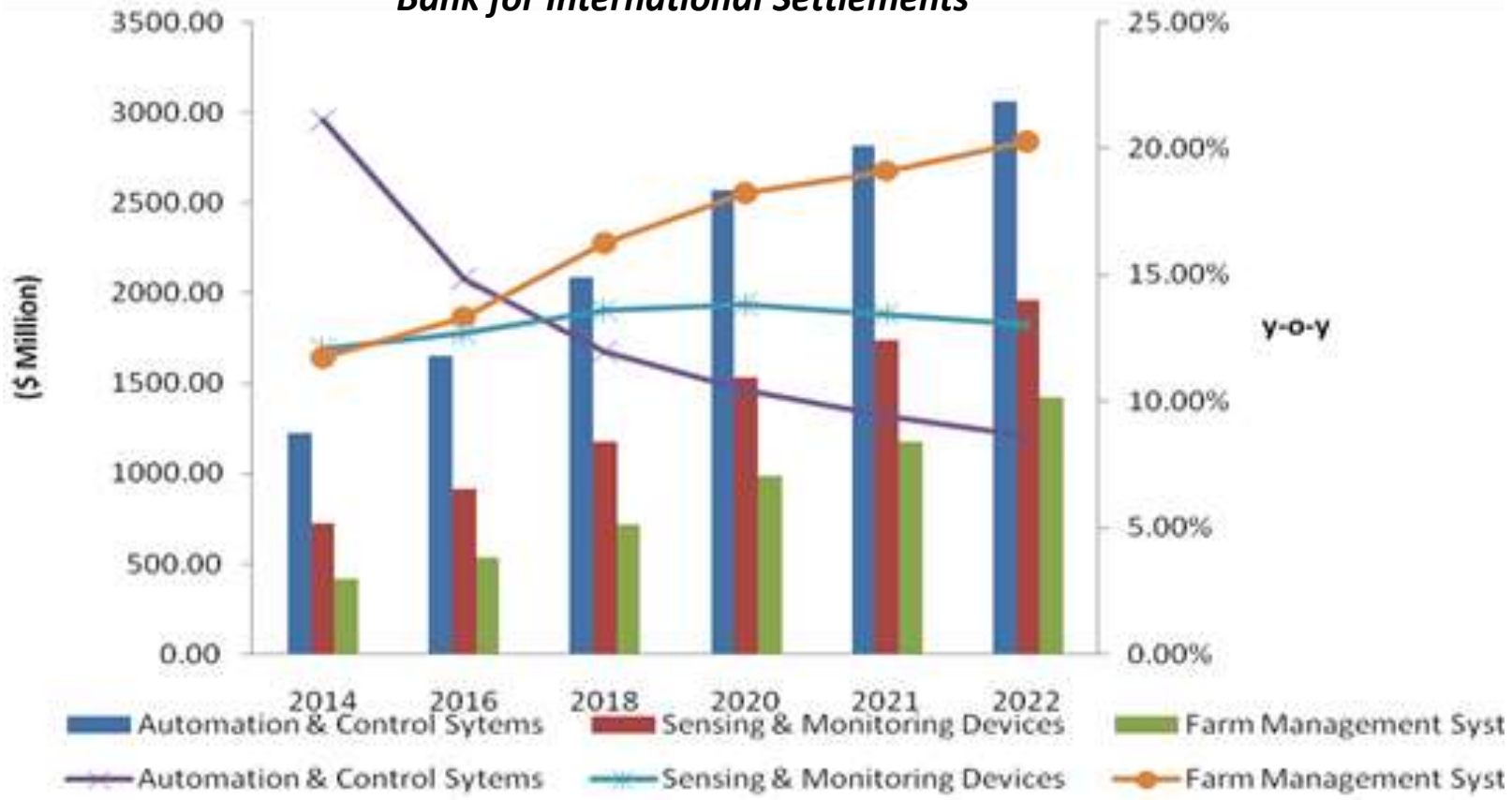
When growers are asked what their main expectation from an agricultural software or app is, most say that **it must be simple and easy to use and that it must provide a solution for "all"** (i.e., for at least the three main practices – irrigation, crop protection, and fertilization).

Trends and opinions

BIS

Bank for International Settlements

Prec. Agriculture Market



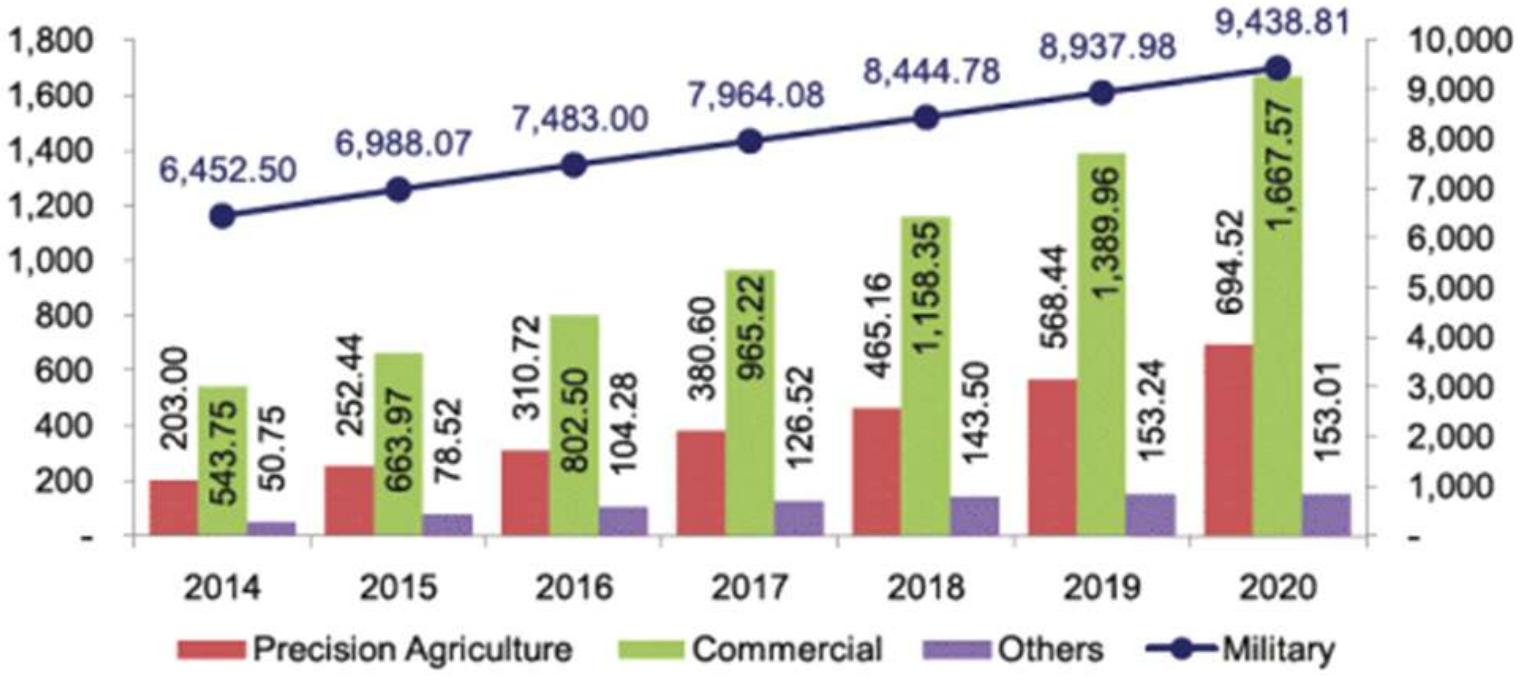
Global Precision Agriculture Market Analysis & Forecast (2015-2022) Technology (VRA, Soil Mapping, Yield Monitoring, Precision Irrigation, Others). Components and Systems. Bank for International Settlements. 2014. Business Intelligence and Strategy Research.

Trends and opinions

BIS

Drone Market

Bank for International Settlements



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Trends and opinions

European Parliament

Precision agriculture and the future of farming in Europe

Scientific Foresight Study

European Parliament

Precision agriculture in Europe

Legal, social and ethical considerations

fertilizers europe · Ceettar · EFFAB · copa cogeca · ESA · CEMA European Agricultural Machinery · FEFAC · CEJA · European Crop Protection

A new tool for sod farmers

Portable
All-in-one
Geolocalized
Autonomous
User-friendly
Remote access
Turfgrass-friendly

...and golf
...and parks
...and rugby
...and football

turf europe

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ETP
European Turfgrass Producers

PA and Satellite Monitoring of Turfgrass Sod Production

greengo

MUITO OBRIGADO !

novo green