

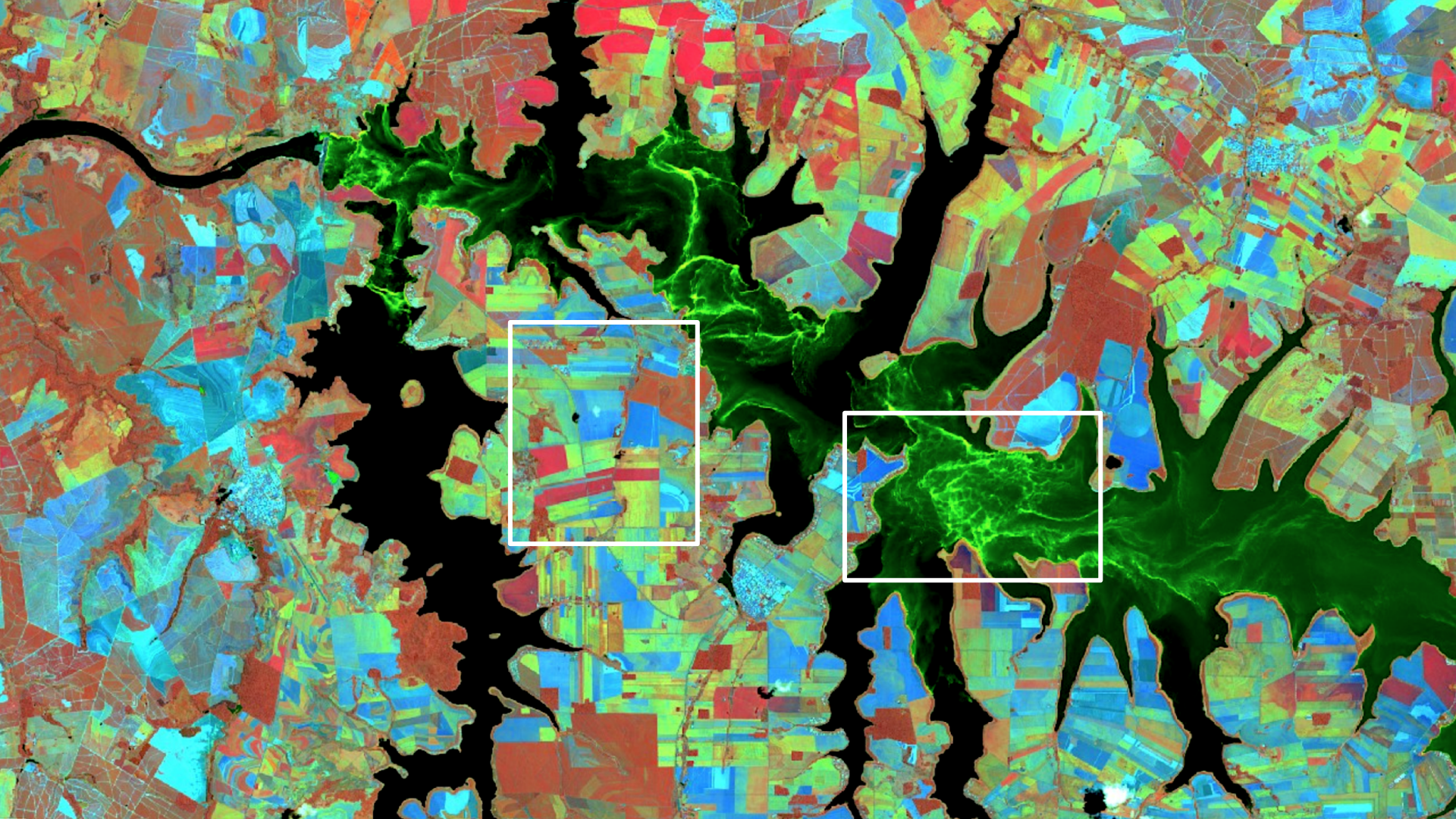
ARTIFICIAL ENVIRONMENTAL INTELLIGENCE WITH HIGH FLYING, FAR WALKING AND DEEP LEARNING

Luca Baldassarre
28 January 2019



GAMAYA

**AM
LD**



\$5 TN INDUSTRY, \$500 BN in PROFITS, \$100 BN OPPORTUNITY

EFFICIENCY



FUEL



FERTILISERS



CHEMICALS



WATER



MANUAL LABOR

PRODUCTIVITY

YIELD



QUALITY



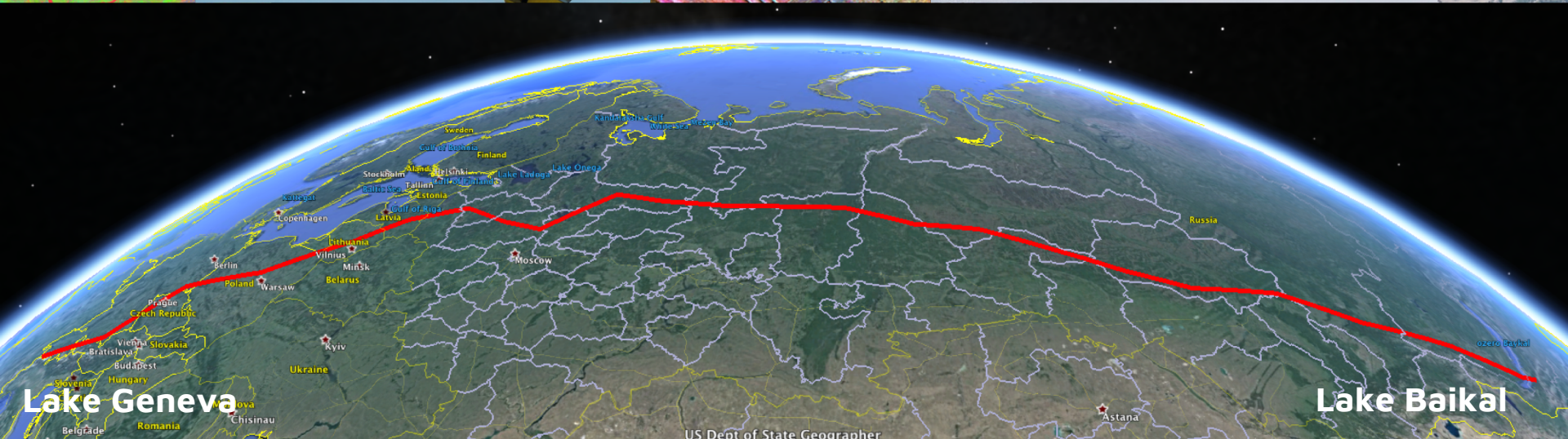
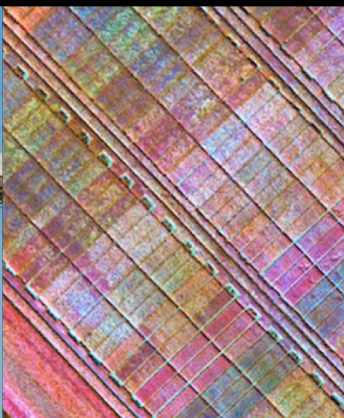
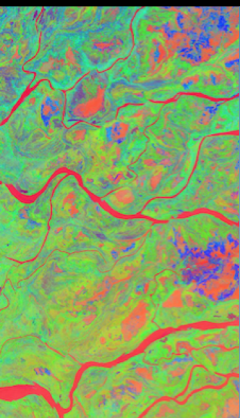
BUSINESS DECISIONS



IMPACT ACROSS 10 SDGs



Building on years of scientific research in remote sensing of vegetation



Lake Geneva

Lake Baikal

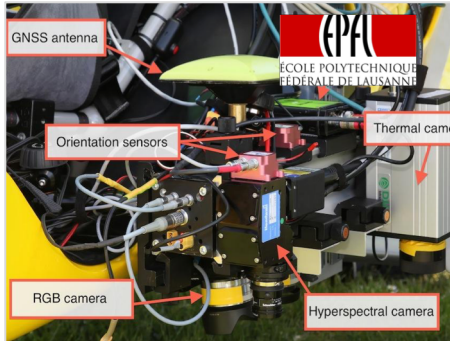
US Dept of State Geographer

UNIQUE & PATENTED HYPERSPECTRAL IMAGING TECHNOLOGY

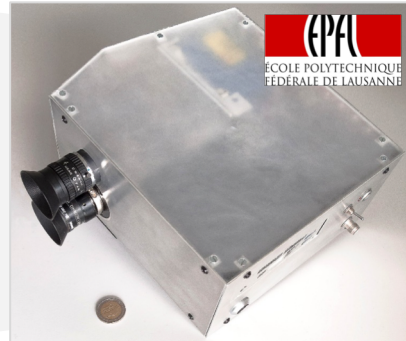
WORLD'S SMALLEST AND LIGHTEST INTEGRATED HSI CAMERA



2013 - 15kg



2014 - 5kg



2015 - 250g



2018 - 200g



UNIQUE HARDWARE

Unique HSI sensor:

- Miniaturised (fit on any drone)
- Lightweight (< 250g)
- High data compression (up to 100x)

PROPRIETARY ANALYTICAL PLATFORM

Integrated system:

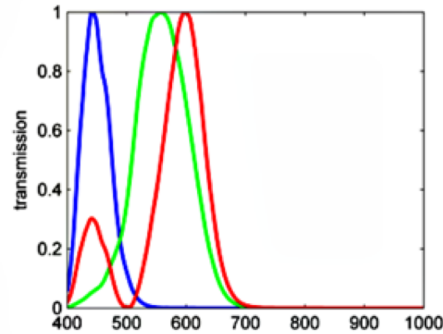
- Calibration processes and tools
- Tailored software and algorithms
- Data fusion and machine learning

Proven capabilities:

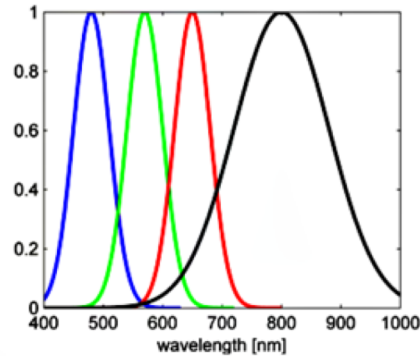
- Commercial solutions
- Advanced R&D pipeline
- Expert team

HYPERSPECTRAL IMAGING

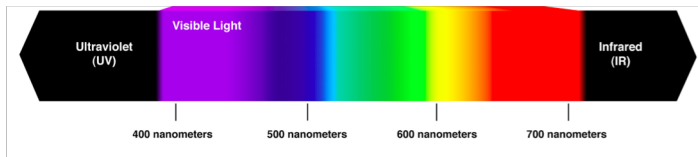
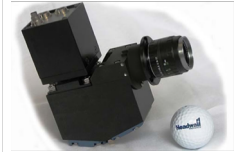
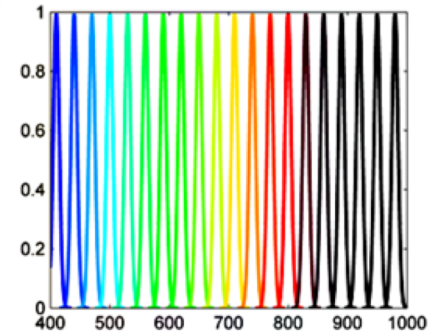
Color



Multi-spectral



Hyperspectral



How does hyperspectral data look like?

Spectral images are 3D structures (also called spectral cubes):

2 spatial dimensions (*latitude, longitude*)

1 spectral dimension (*wavelength*)

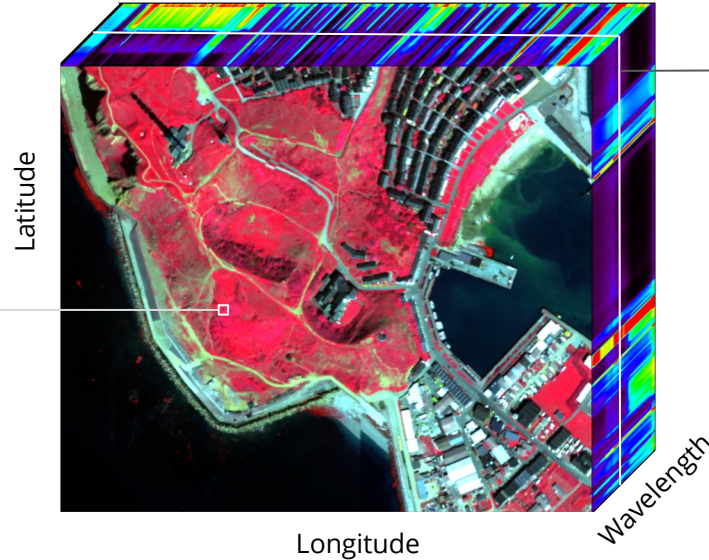
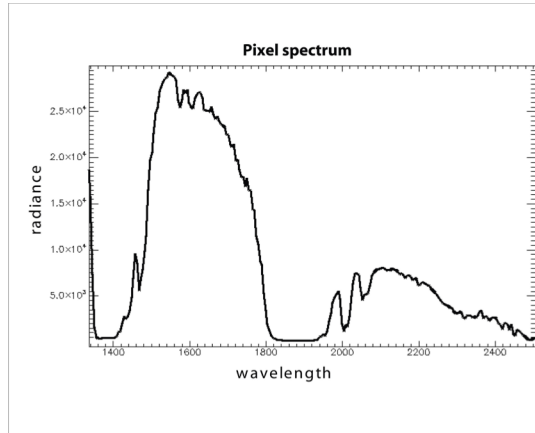
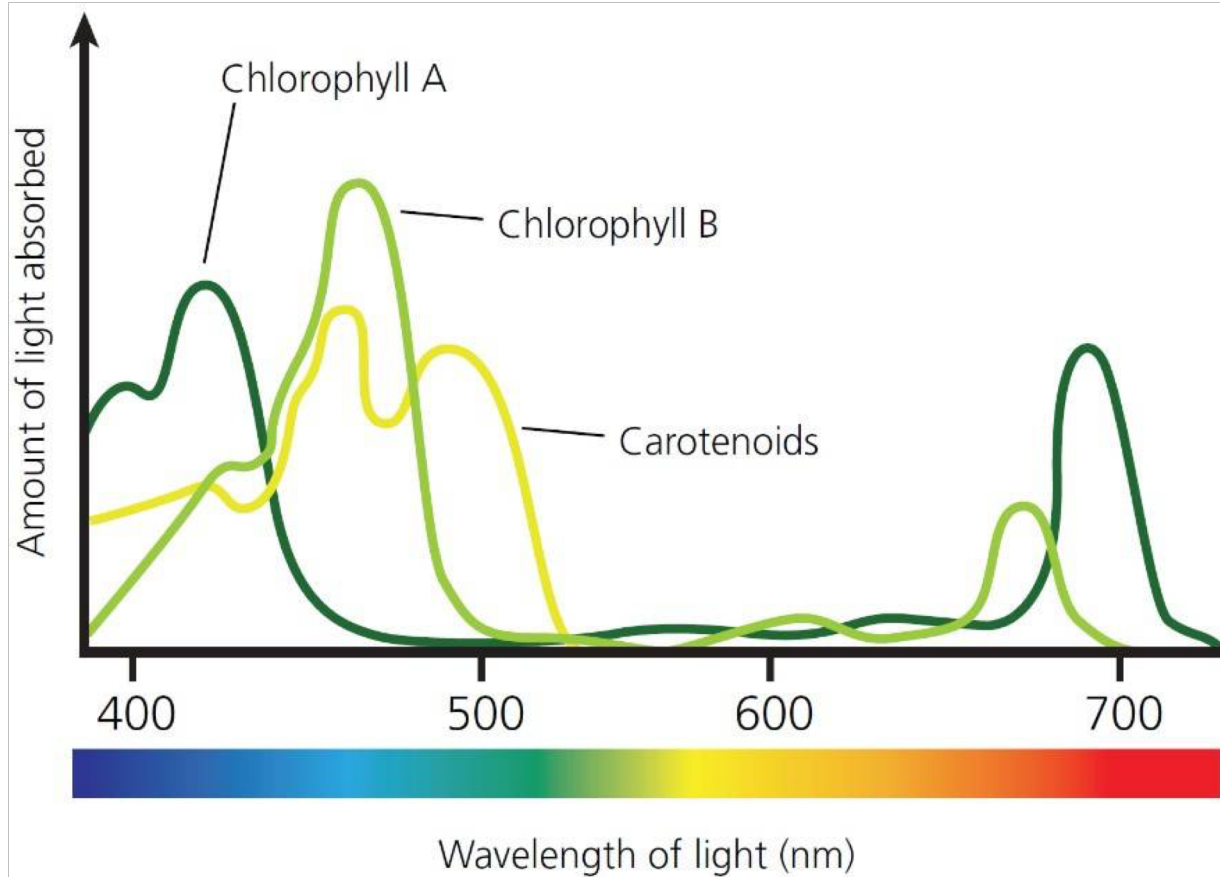


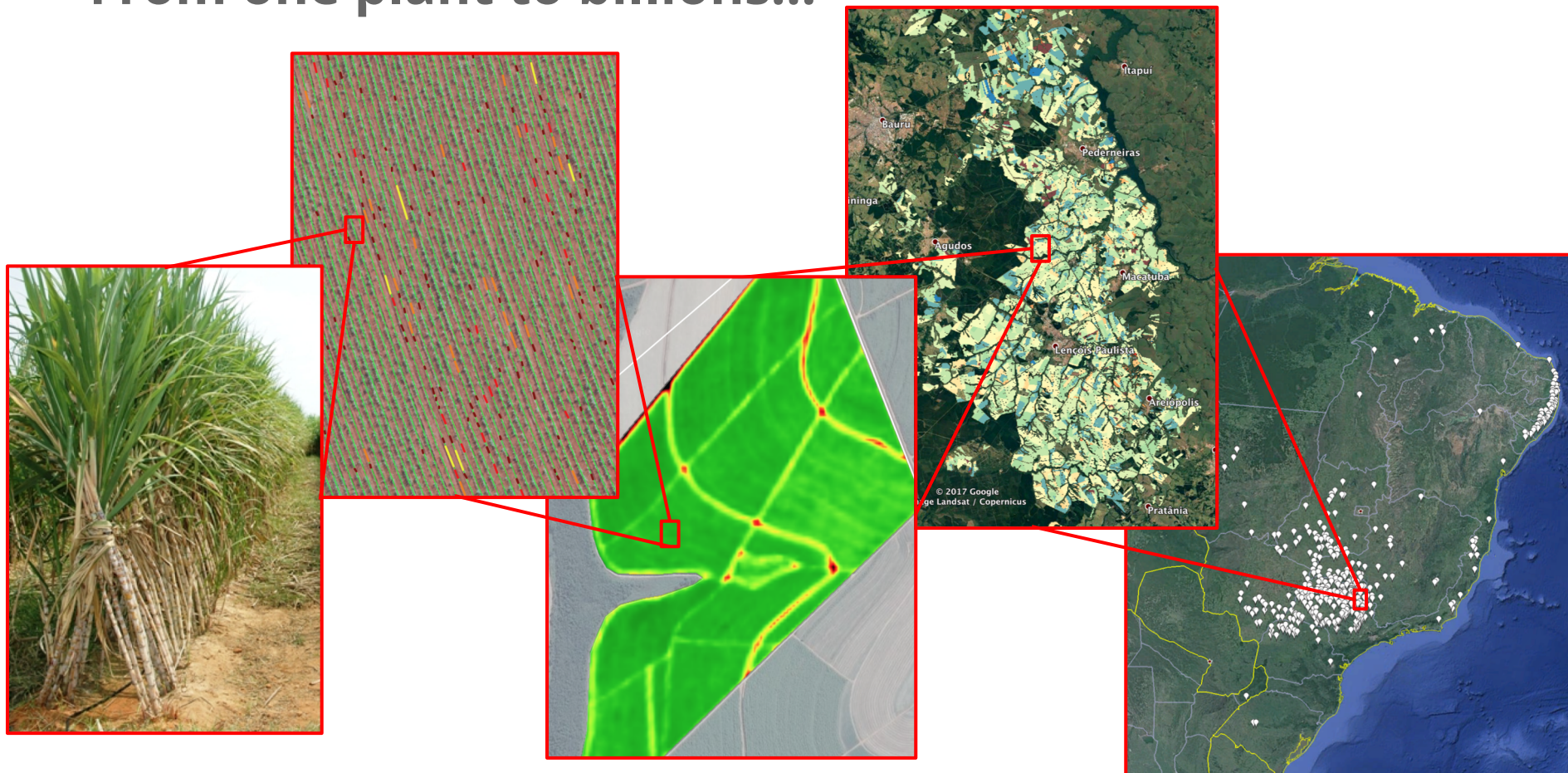
Image at a single wavelength



Plant pigments



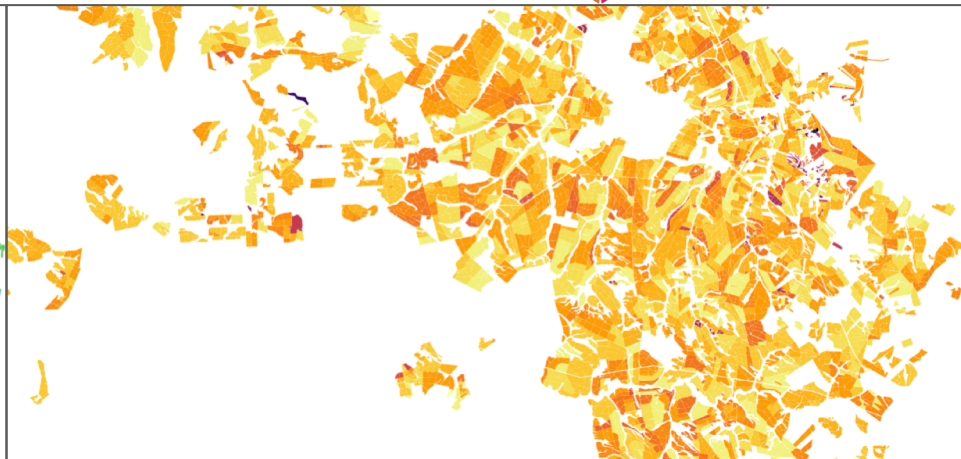
From one plant to billions...



Harvest month



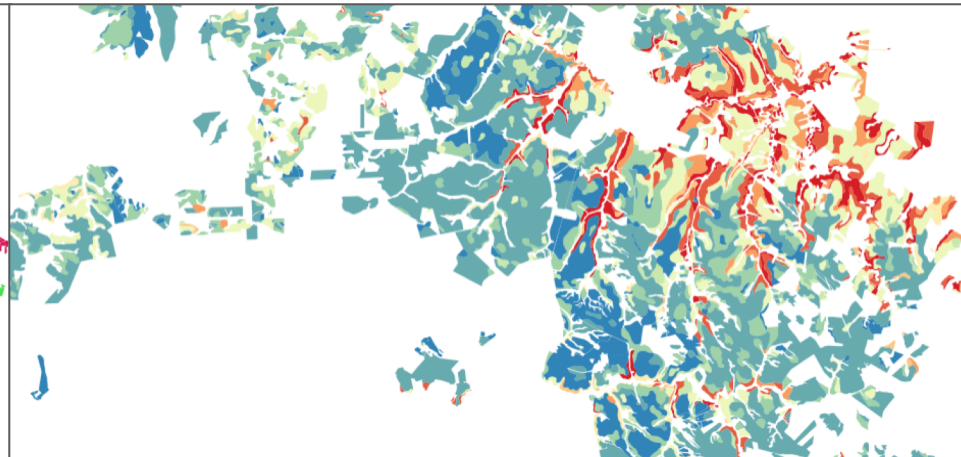
Age



Variety




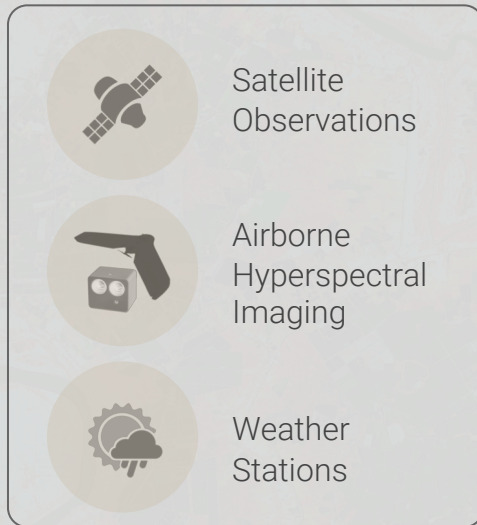
Environment



GAMAYA ENVIRONMENTAL INTELLIGENCE PLATFORM

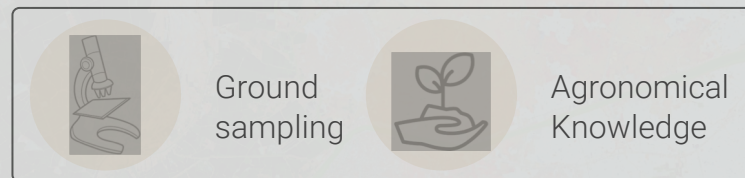
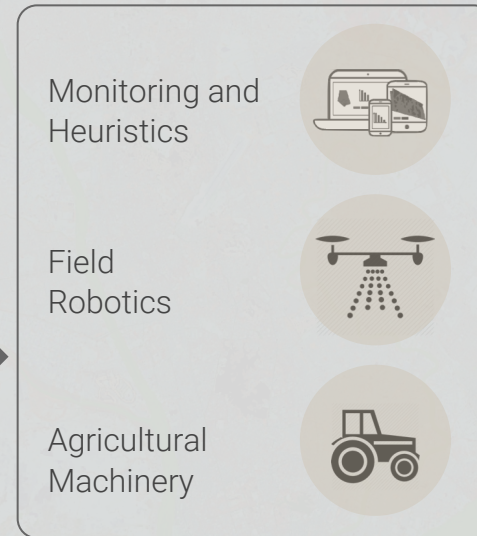
Holistic approach using multiple data sources and unique capabilities to provide actionable insights

MULTI-SCALE SENSOR FUSION



Crop Model and Spectral
Signature Database

DECISION SUPPORT AND AUTOMATION



Data and Model Challenges

1. Aerial and satellite imagery is highly **variable**.
2. **Fuse** data from multiple sensor types.
3. **Ground-truthing** is expensive (walk the fields).
4. **Visual labelling** is tedious and time consuming (stare at the pixels).
5. Datasets are constantly **evolving**.
6. DL Semantic Segmentation models take **days** to train.
7. Move quickly from prototype to deployment: **Docker** containers.



SUGARCANE SOLUTIONS

PLANTING EFFICIENCY ANALYSIS TO SUPPORT REPLANTING AND CORRECTION

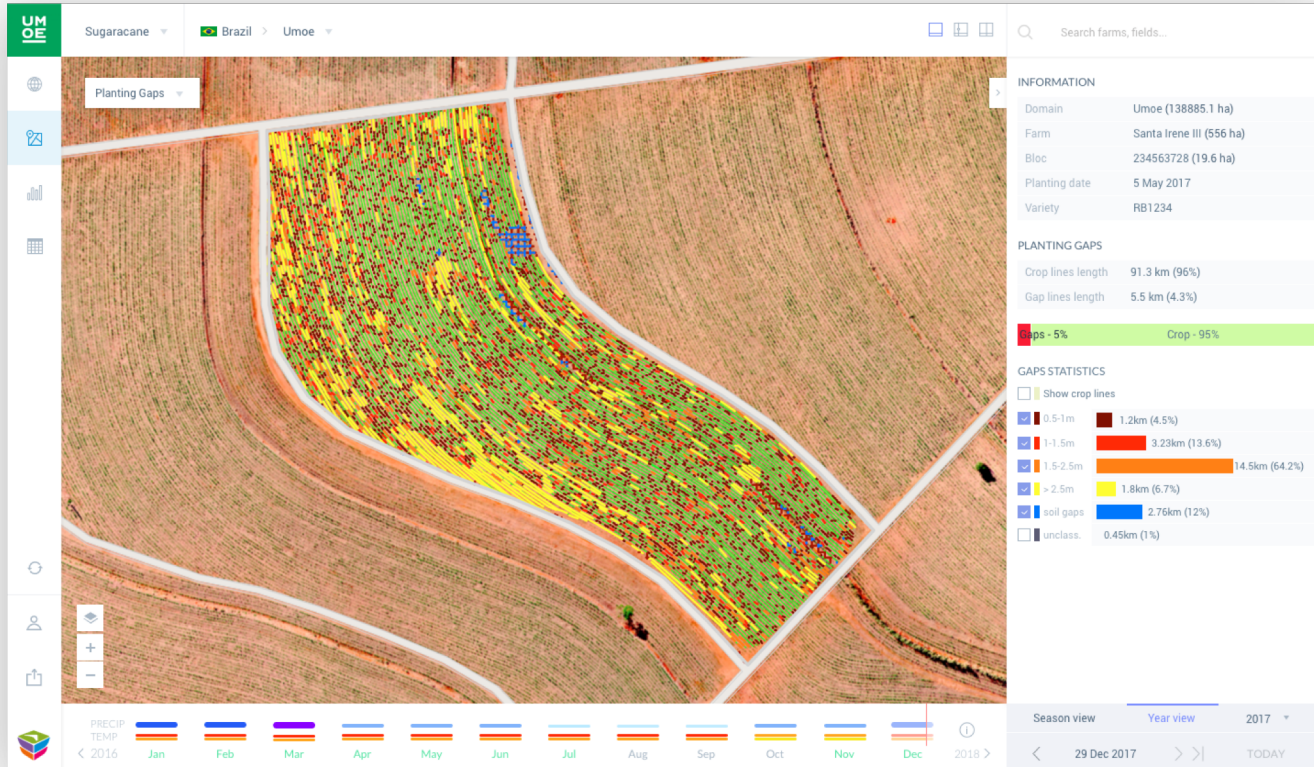
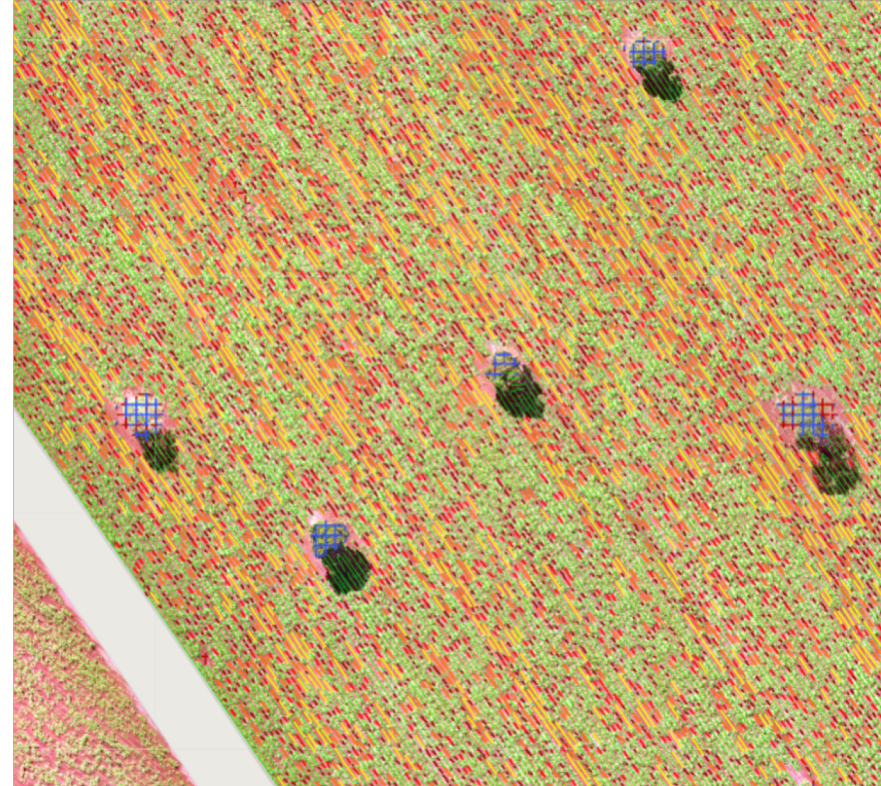
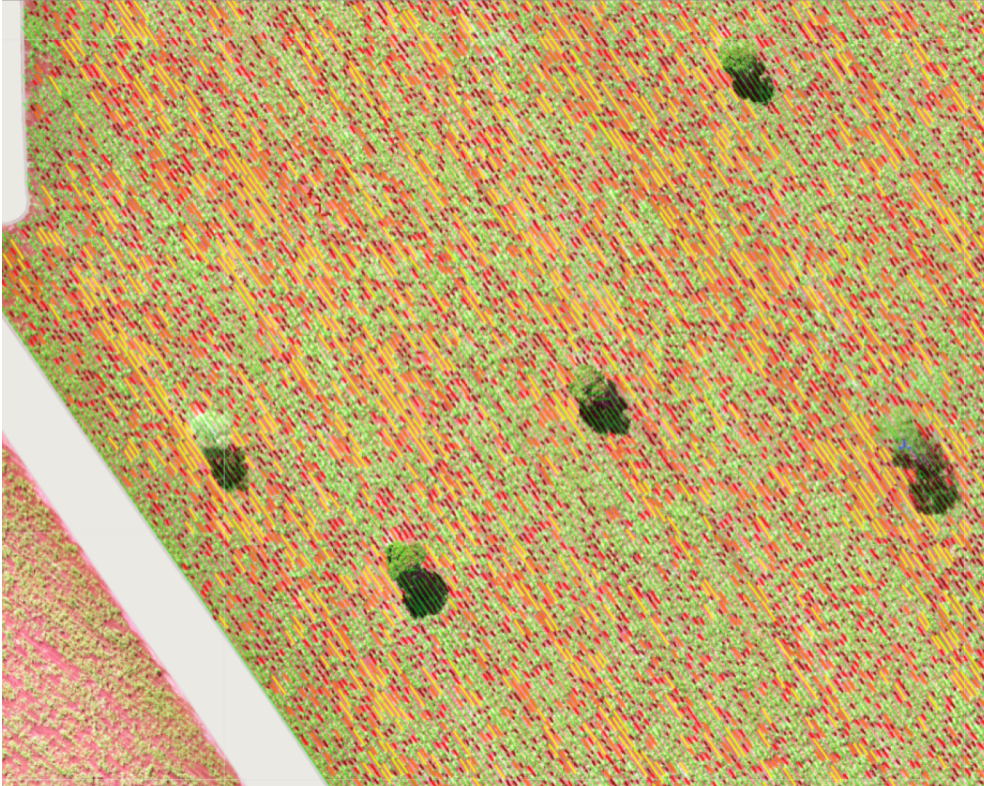
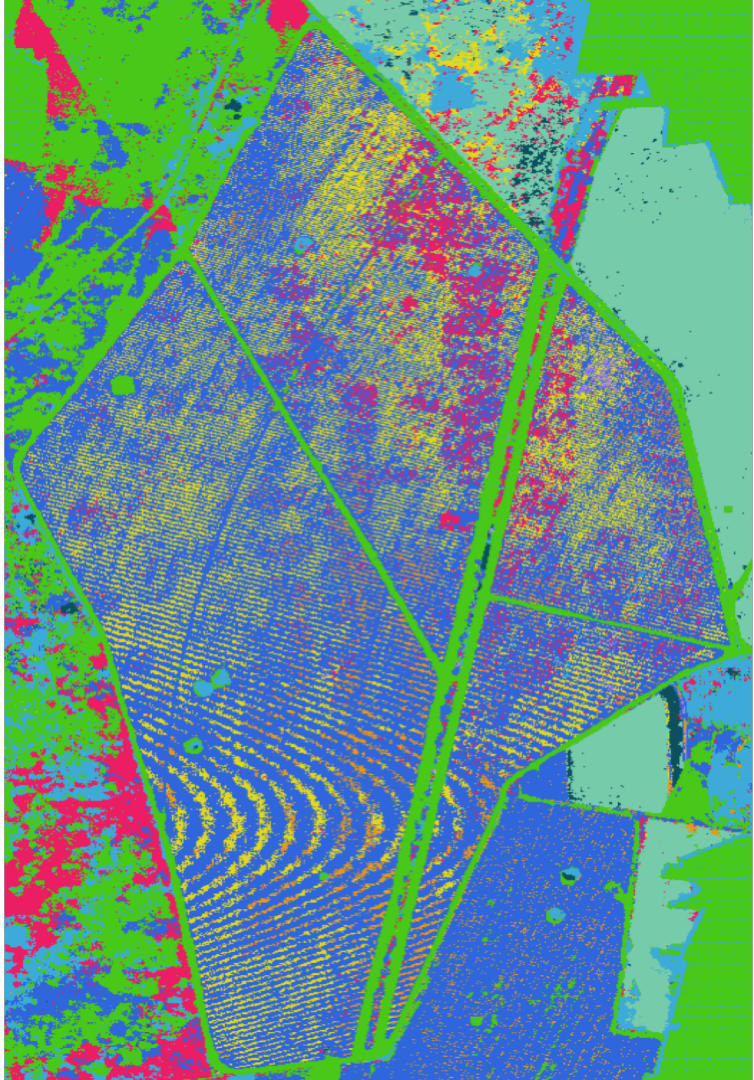


Image processing only

with Deep Learning







SUGARCANE SOLUTIONS

DETECTION OF WEEDS FOR TARGETED HERBICIDE APPLICATION

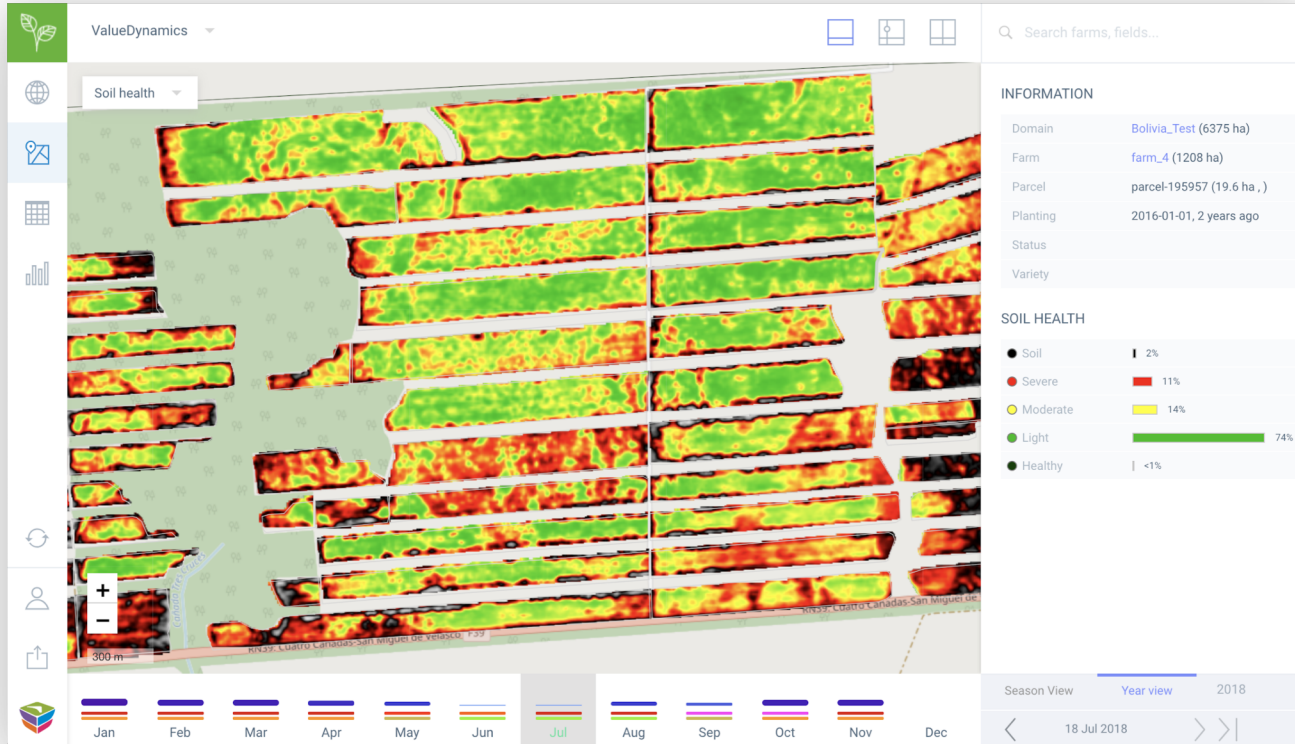




SOYBEAN SOLUTIONS

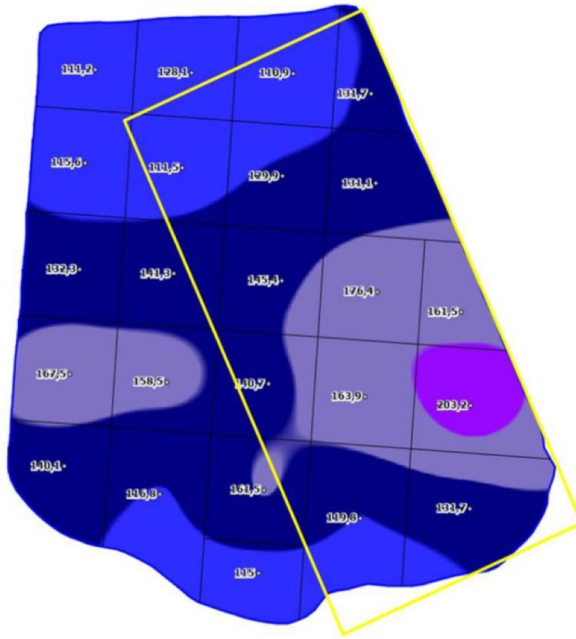
SOIL FERTILITY ZONING

PREDICTION OF YIELD, SOIL HEALTH MANAGEMENT

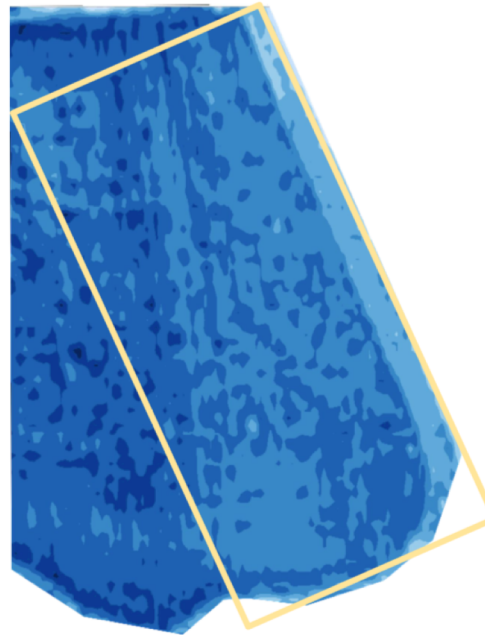


NUTRITION (PHOSPHORUS EXAMPLE)

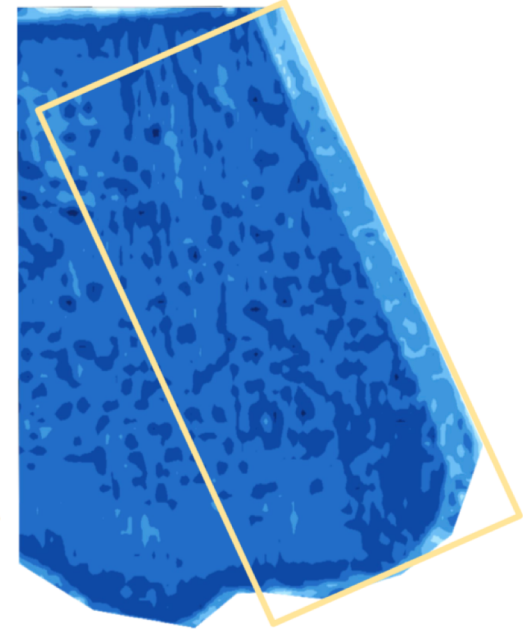
ONGOING R&D EFFORTS IN EASTERN EUROPE TO DETECT MACRO AND MICRONUTRIENTS IN CROP DURING THE GROWING SEASON USING GAMAYA'S UNIQUE HYPERSPECTRAL IMAGERY



Availability of P in soil at the beginning of the season



Gamaya P content map, 22-07-2017



Gamaya P content map, 01-08-2017

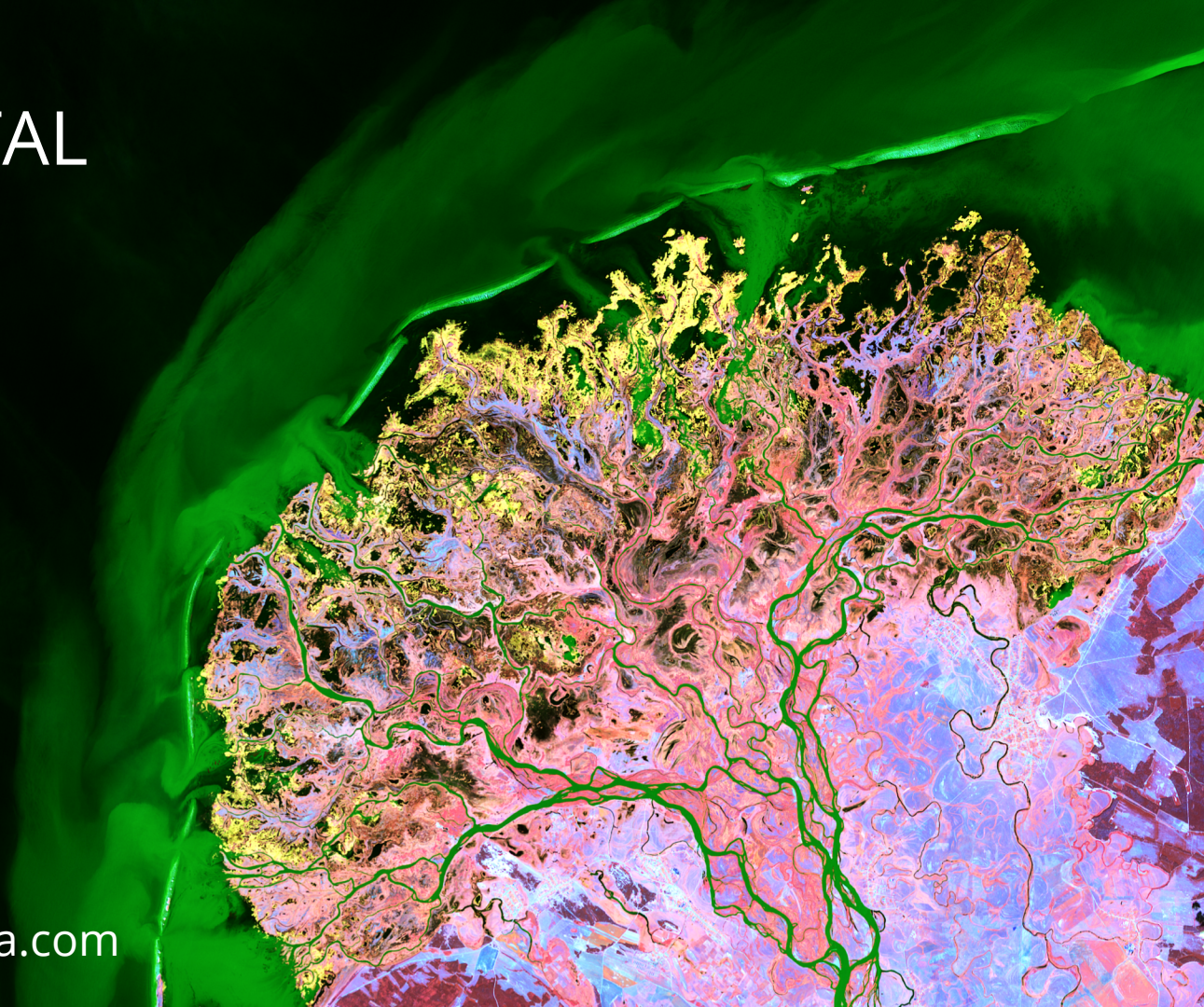


ENVIRONMENTAL INTELLIGENCE

- COMPELLING
- CHALLENGING
- PROFOUND



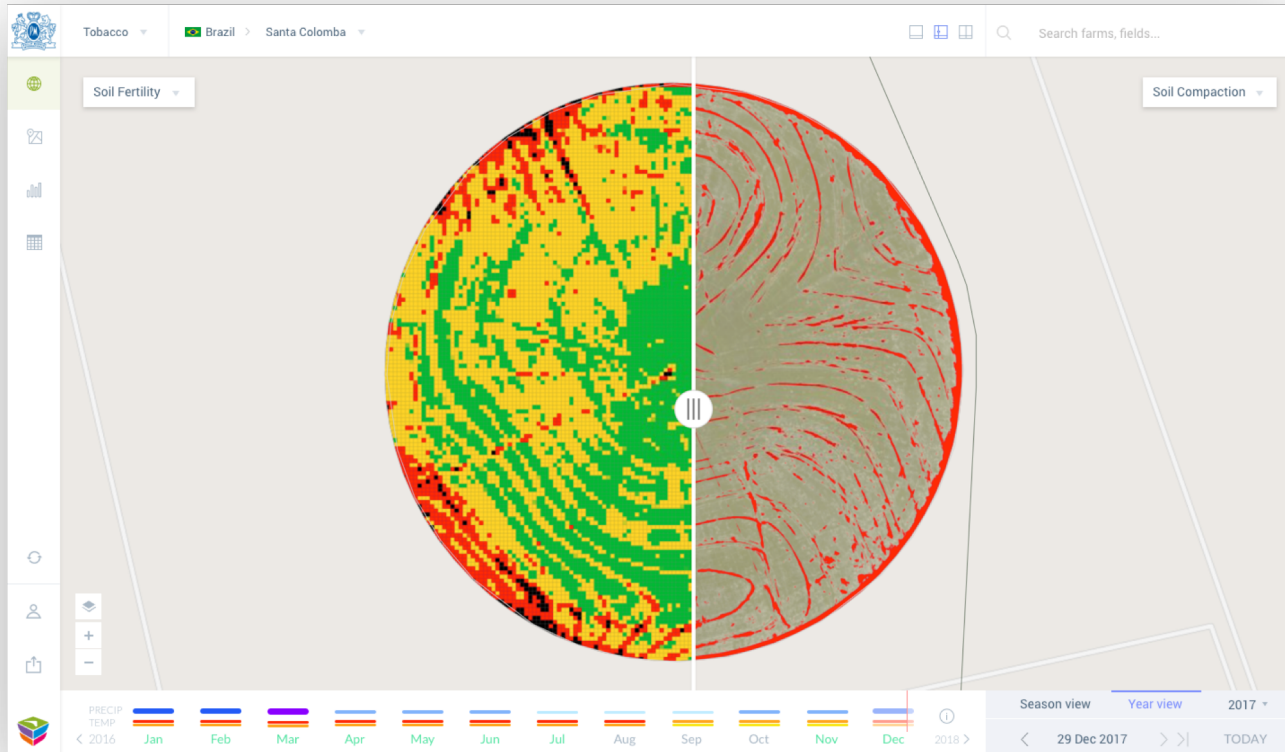
www.gamaya.com
luca.baldassarre@gamaya.com





TOBACCO SOLUTIONS (INDUSTRIAL PRODUCTION)

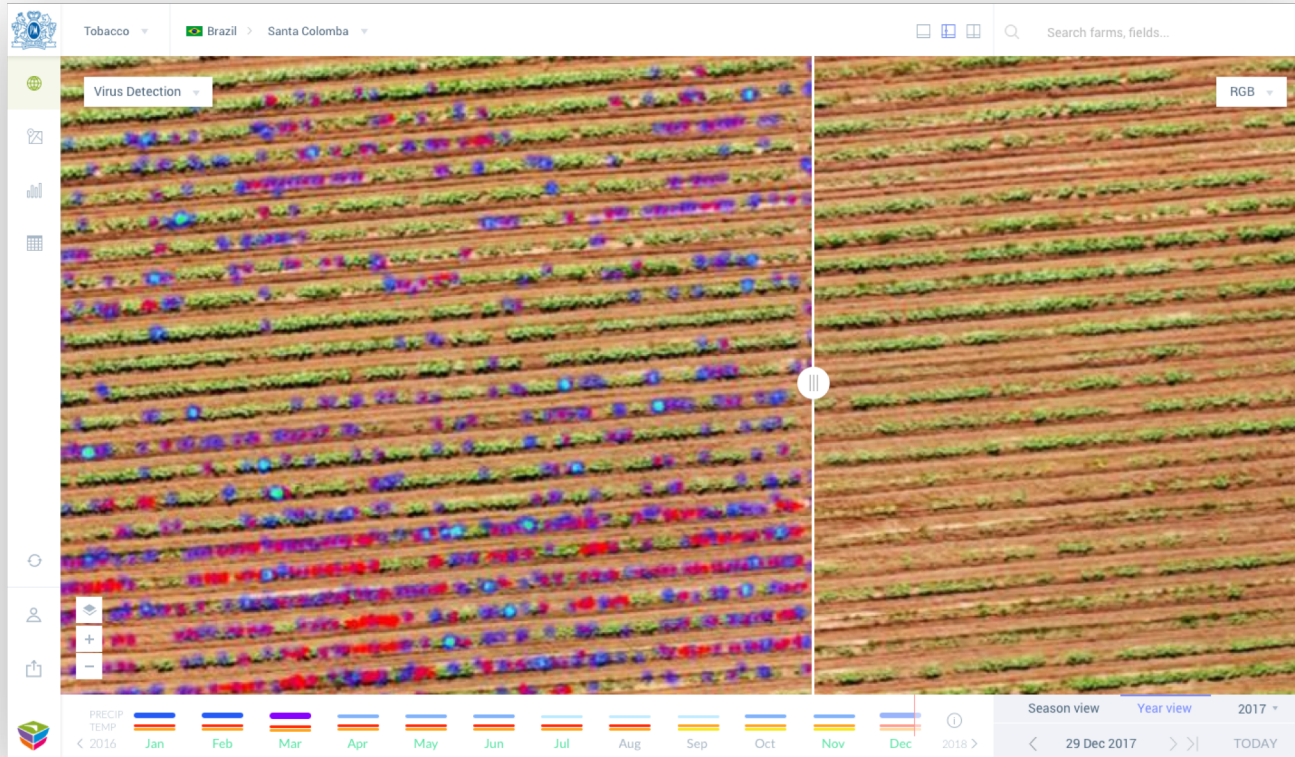
ANALYSIS OF FIELD VARIABILITY, SOIL COMPACTION AND MANAGEMENT ZONES TO OPTIMISE FERTILITY





TOBACCO SOLUTIONS (INDUSTRIAL PRODUCTION)

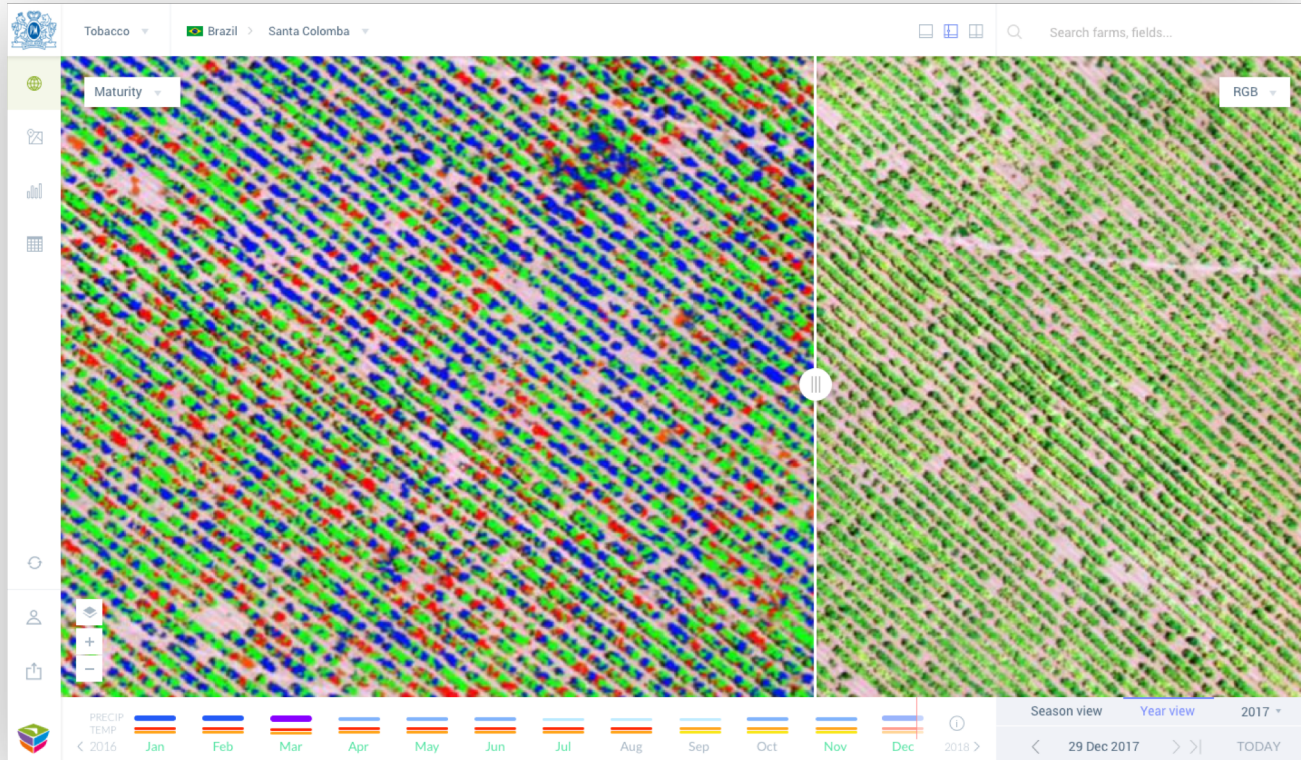
DETECTION OF TOBACCO MOSAIC VIRUS TO REDUCE YIELD LOSSES





TOBACCO SOLUTIONS (INDUSTRIAL PRODUCTION)

CLASSIFICATION OF LEAF MATURITY LEVELS TO OPTIMIZE YIELD QUALITY



CROP AND VARIETY CLASSIFICATION

Single

Split

Side by side

Search fields ...

VARIABILITY

RGB

