Potential IoT technology application for black soils land use ecological risk mitigation

SUN LAB, RUDN

LAMP LAB, RSAU MTAA

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Remote sensing

Eddy covariance tower

New methods of monitoring
LAMP – agriculture
SUN – urban environment

Artificial soil constructions

Monitoring tree physiology and vertical stability

Different types of pavements
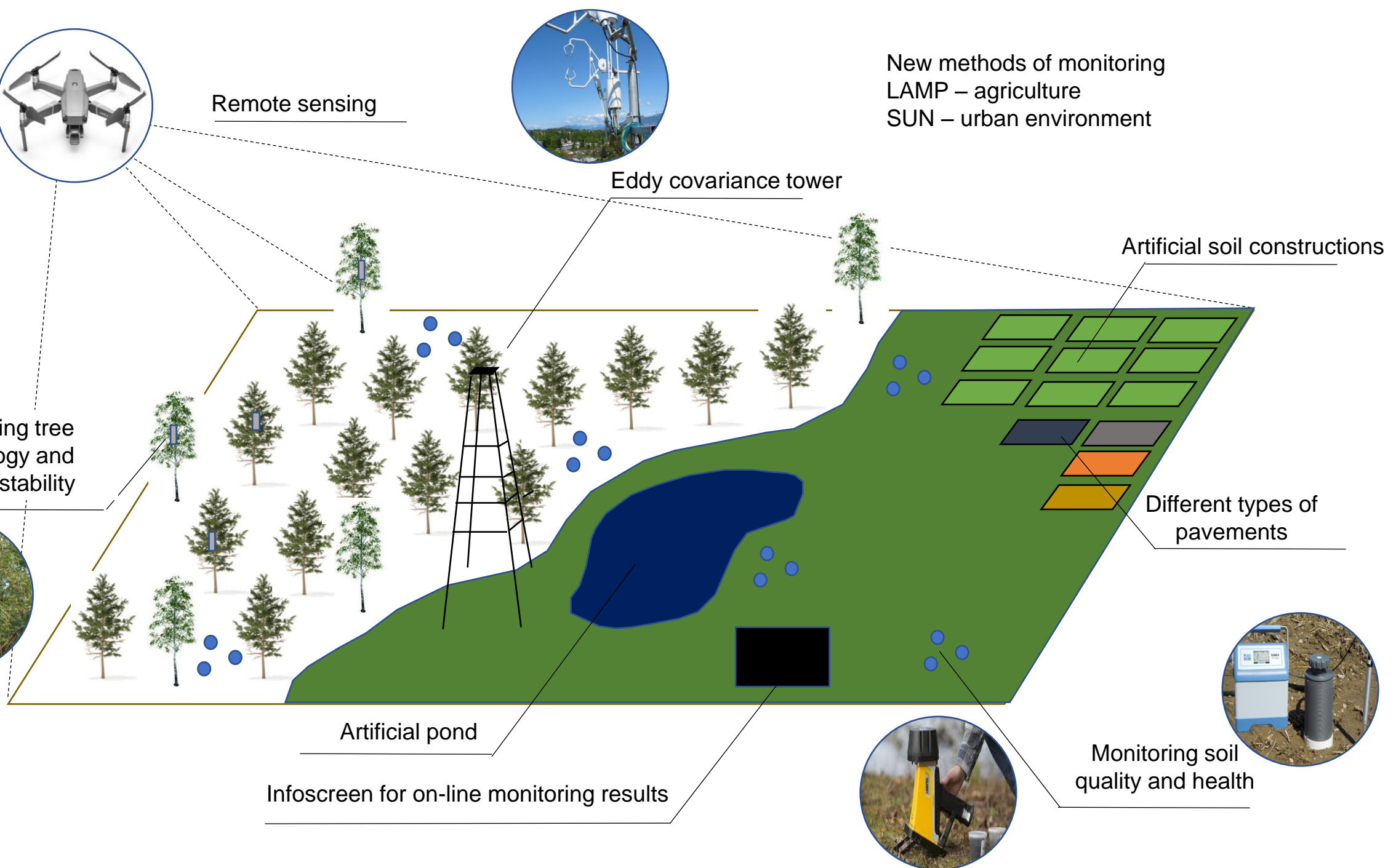
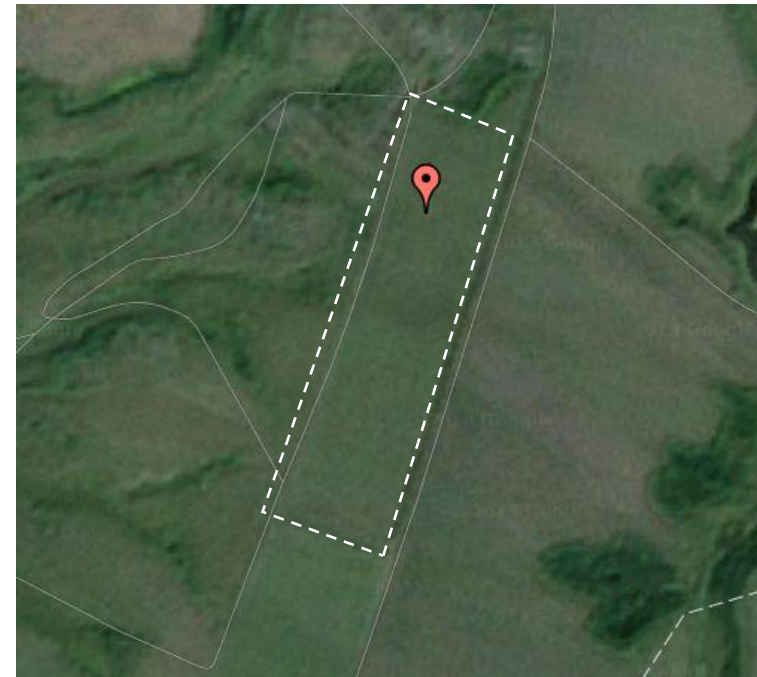Monitoring soil quality and health

Artificial pond

Infoscreen for on-line monitoring results

Moscow

Precision Farming Experimental Field of the Timiryazev Agricultural University (55°55'14''N, 37°33'56''E) situated in Moscow.

100m

Pristen area, Kursk region

Agricultural field near the Pristen place (51.14567°N 36.50624°E), Kursk region, Russia

200m

| Moscow	Pristen area, Kursk region
Arable Albeluvisols Umbric have around 1% of SOC, 5.4 pH(KCl) and NPK medium-enhanced contents in sandy loam topsoil.	Arable Chernozems have around 4% of SOC, 6.5 pH(KCl) and NPK high-enhanced contents in sandy loam topsoil.
The field was used for barley planting (*Hordeum vulgare L., breeding line Mihailovsky*).	The field was used for barley planting (*Hordeum vulgare L., breeding line Xanadu*).
Sowing was in early May 2013 and harvest was in August, 14.	Sowing was 25-27 of April and harvest was 14-19 of August.

Common for both sites part of vegetation period, from 1 of May till end of August were observed.

Two sites main difference besides different soil type and climate is different amount of fertilizers applied

Private farmer vs academical field
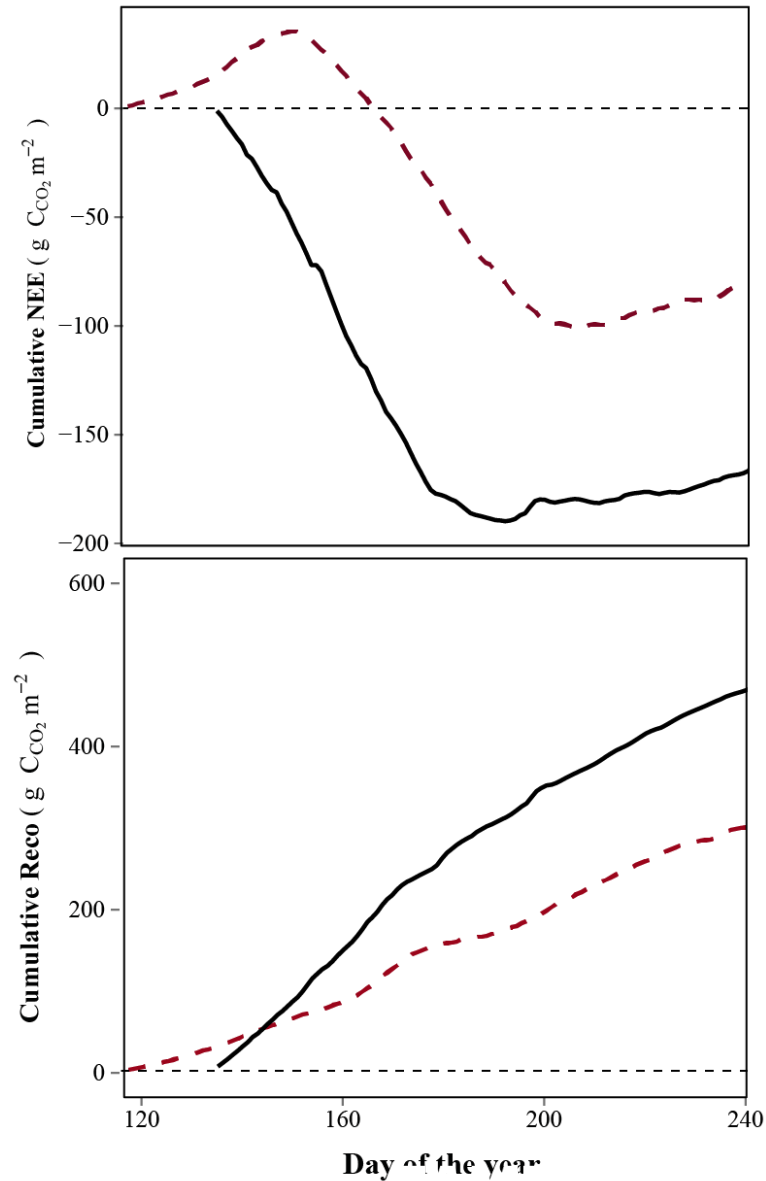
- Higher amount of mineral fertilizers applied lead not only to rising GPP, but also to higher Reco, which lasted long after crop removal and lead to higher carbon loss
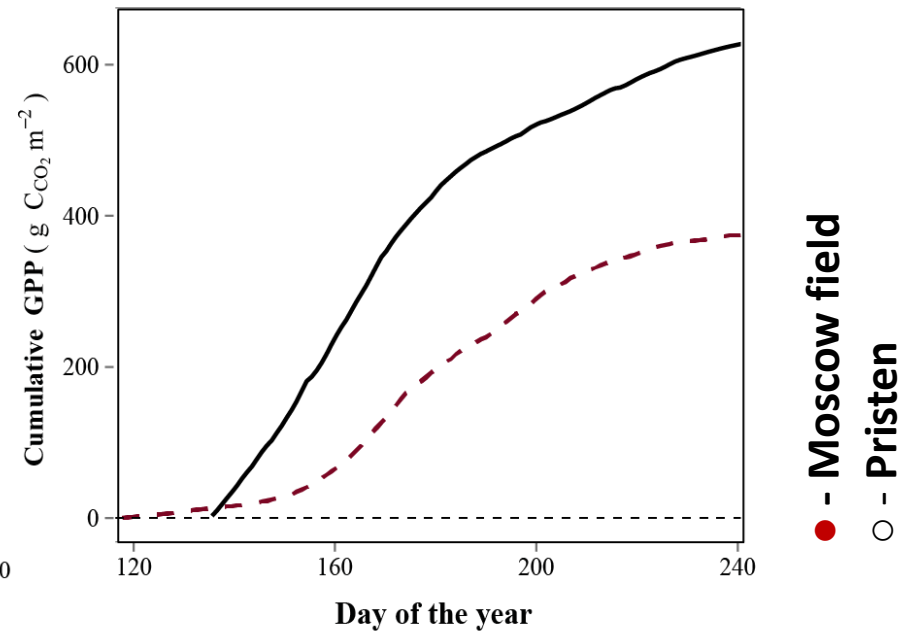
● - Moscow field
○ - Pristen

- Eddy covariance method used for those result is very precise but very pricy and complicated method

- We need technology which should be easy to use and have price appropriate for many farmers

Technology & Telecommunications › Consumer Electronics › Internet of Things - number of connected devices worldwide 2015-2025

Internet of Things (IoT) connected devices installed base worldwide from 2015 to 2025 (in billions)
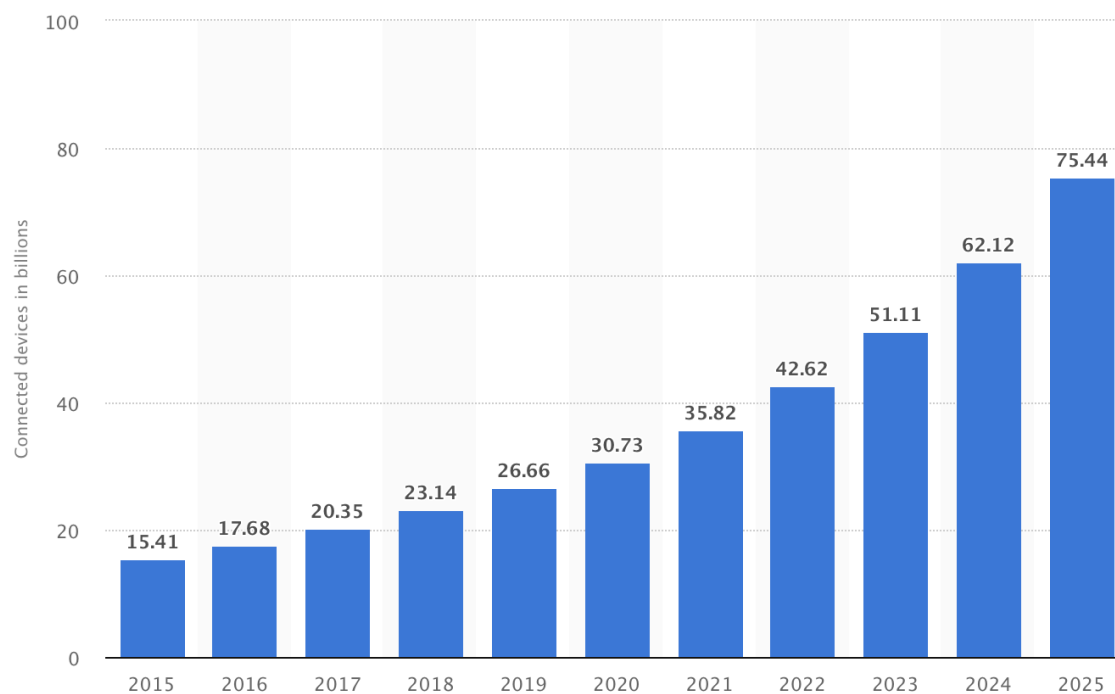
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PNG +   PDF +   XLS +   PPT +

DESCRIPTION   SOURCE   MORE INFORMATION

This statistic shows the number of connected devices (Internet of Things; IoT) worldwide from 2015 to 2025. For 2020, the installed base of Internet of Things devices is forecast to grow to almost 31 billion worldwide. The overall Internet of Things market is projected to be worth more than one billion U.S. dollars annually from 2017 onwards.
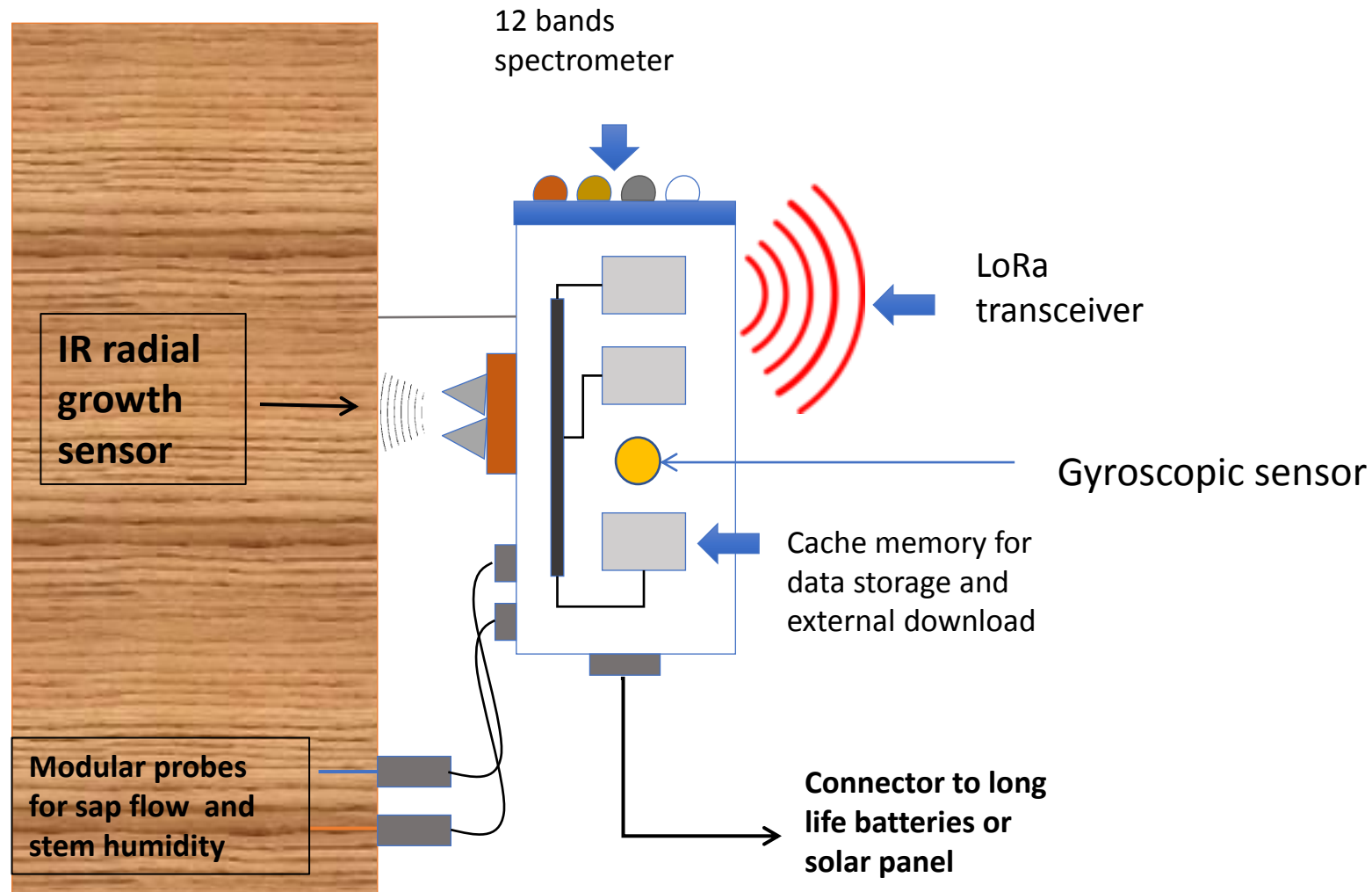
Chart data (Connected devices in billions):

Year	Connected devices in billions
2015	15.41
2016	17.68
2017	20.35
2018	23.14
2019	26.66
2020	30.73
2021	35.82
2022	42.62
2023	51.11
2024	62.12
2025	75.44

Riccardo Valentini reaction when he first read about IoT

Ok, will do that

The TreeTalker®

12 bands spectrometer

LoRa transceiver

IR radial growth sensor

Gyroscopic sensor

Cache memory for data storage and external download

Modular probes for sap flow and stem humidity

Connector to long life batteries or solar panel

NatureTalkers
nature and bioscience metrics

The Network

NatureTalkers
nature and bioscience metrics

Dedicated APPS and WEB visualization

Router

Data Server

Spatial Mapping

Data Analysis
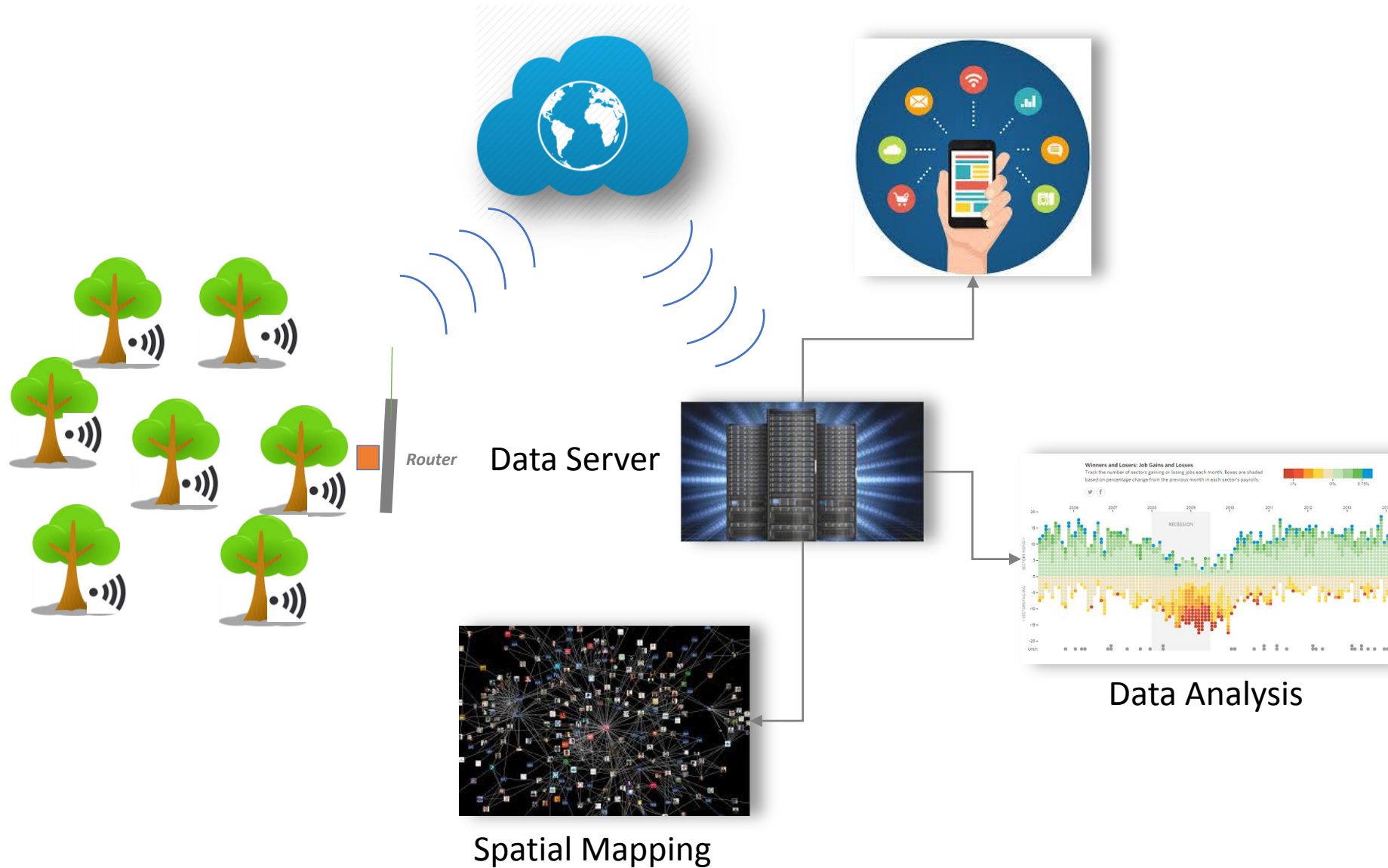
Join the TT epidemy

✓ Now installed from Cordoba to Beijin

✓ 250 installed in Russia more than 2000 all over the world and growing

✓ In Russia: Moscow, Saint-Peterburg, Rostov and Voronezh in plans

Ecosystem is growing

✓ TTG for tree stability

✓ TT-Carbon for carbon storage

✓ TT-Fire for fire prediction

✓ And..

CropTalker & SoilTalker
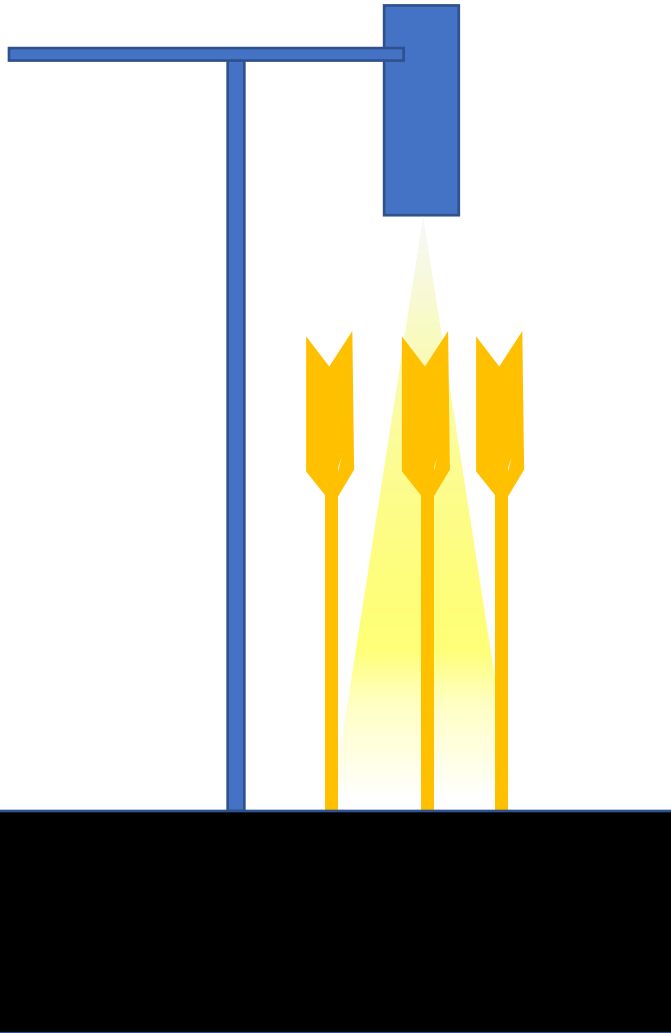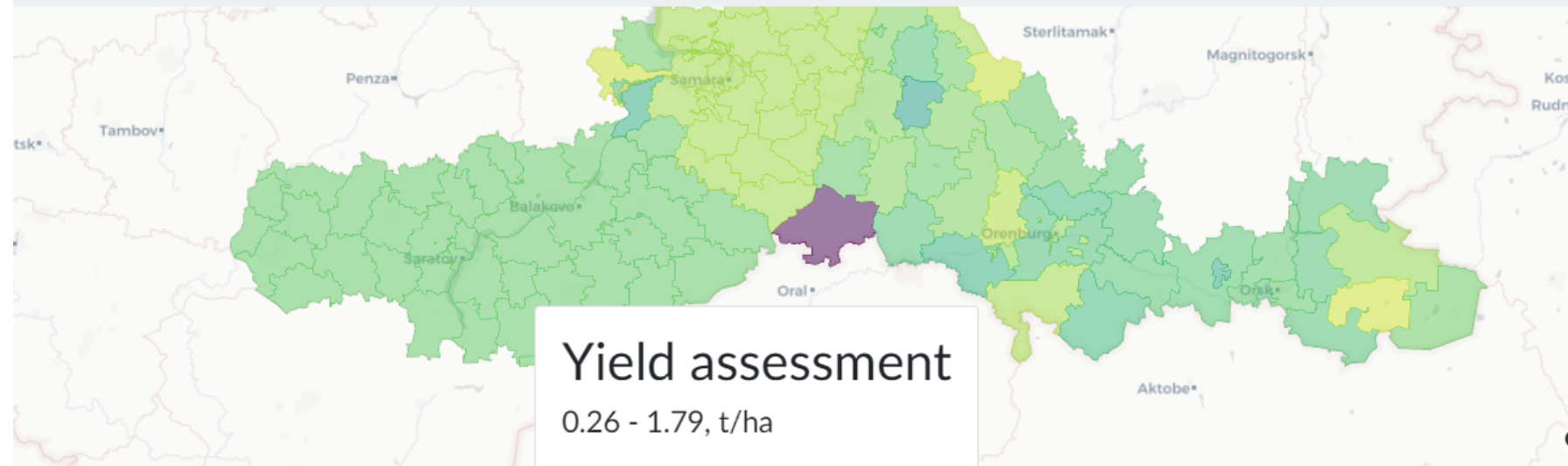

Realtime data about

- Plant height

- Foliage Health (light transmission in 12 spectral bands)

- Climate and soil parameters (temperature, humidity).

- Phenology phases

- Air temperature and humidity

- Soil temperature and humidity

But this is still to complex for real farmer

- CropTalker data should be sent to DSS
- And we developing one – for durum wheat in Volga-Ural region
- http://dss.durum-project.ru/

If you would like to know more about IoT in ecology join
3MUGIS summer school
summer school

- ✓ Joint initiative among RUDN University (Moscow, Russia), CUNY and USI (New York City, USA) under umbrella of IUSS

- ✓ Annual event since 2017

- ✓ School aims to provide a solid background and practical skills training in addressing impacts of urbanization on soils and vegetation

- ✓ 3 weeks, including the 1st week of lectures and the a 2-week field tour in a "From Sea to Sea" format

- ✓ 3ECTS

http://3mugis.org/ | http://ssc-conf.org/