

Joint Workshop of the GOFC-GOLD SCERIN and MedRIN Networks

CIHEAM conference center, Chania, Greece, July 16 – July 19, 2024

Land Cover Change (LCC) and Extreme Events in the Context of Climate Change

Mediterranean Agronomic Institute of Chania

Region of Crete

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NASA LCLUC Program

GOFC-GOLD and START, USA



Drought and fire risk mapping, LULC change monitoring for sustainable ecosystem management in Serbia - CiROCCO Project



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Enhancing the In-situ Environmental Observations across Under-sampled Deserts

Project Facts

Call:

HORIZON-CL6-2022-
GOVERNANCE-01

Topic:

New technologies
for acquiring in-situ
observation datasets
to address climate
change effects

Duration:

36M (2023-2026)

Start Date:

01 March 2023



Cirocco_eu



CiROCCO EU Project



cirocco-project.eu



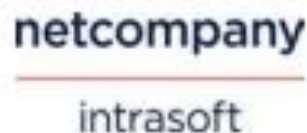
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PROJECT LEADER:

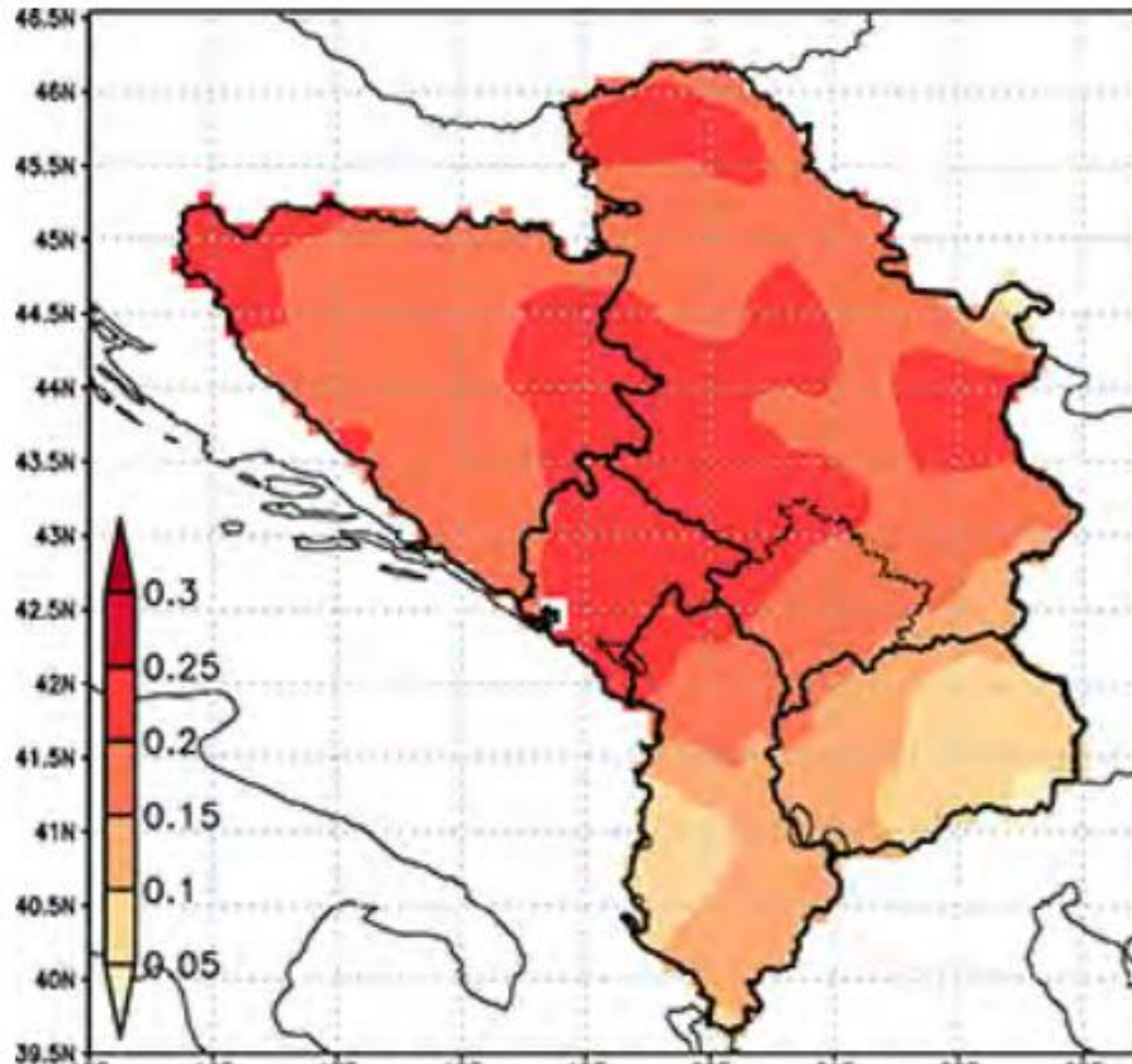
Institute of Communication and Computer
Systems (ICCS), Athens, Greece

Partners



- Seamlessly integrate in situ observations from **low-cost and high-end stand-alone sensing nodes** deployed in hard-to-reach areas together with remote sensing data compiled from **satellite and ground observations**.
- Support the **fusion between remote sensing and in-situ data** as well as the development of **calibration models** and **assimilation methodologies** to capture the variability of targeted **solar radiation, air quality** and other **environmental parameters**.
- Ingest and handle massive amounts of data into pipelines for both **real-time** and **batch processing** - independent of whether these are observations or data from simulations.

Climate change in the western Balkans



Mean yearly temperature increased 0.5 - 1.5 °C
Intrusion of sub-tropical air masses further to the north create very hot and dry during the summer season
Expected to have prolonged duration in the coming decades.

Vuković, A., & Vujadinović Mandić, M. (2018). Study on climate change in the Western Balkans region. *Bosnia and Herzegovina: Regional Cooperation Council Secretariat*.

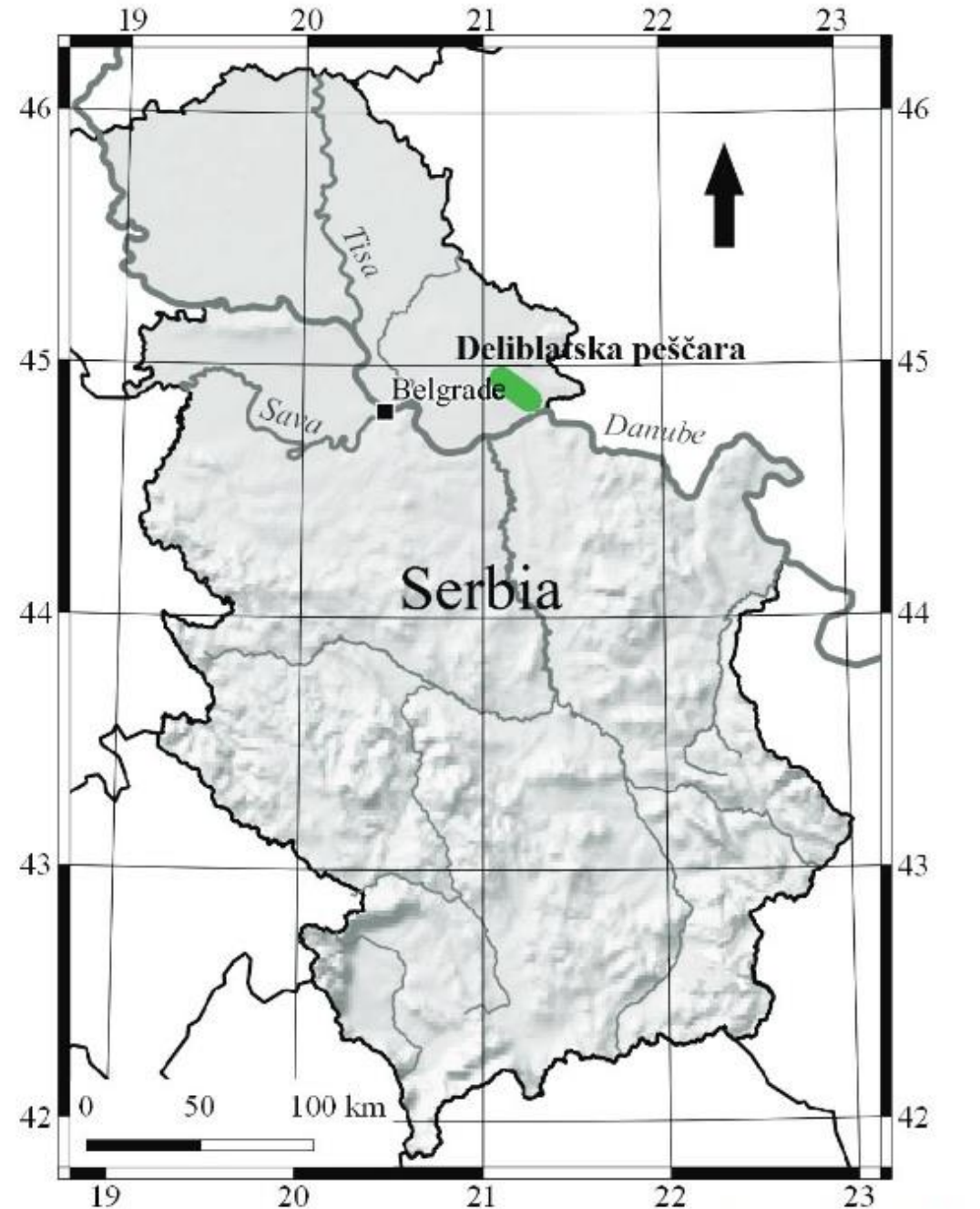
Deliblato sands – CiROCCO Project pilot site



- Unique geomorphological and ecological area
- The largest inland sand region in Europe covering around 300 km²

Deliblato sands

- Located about 50 km east from Belgrade



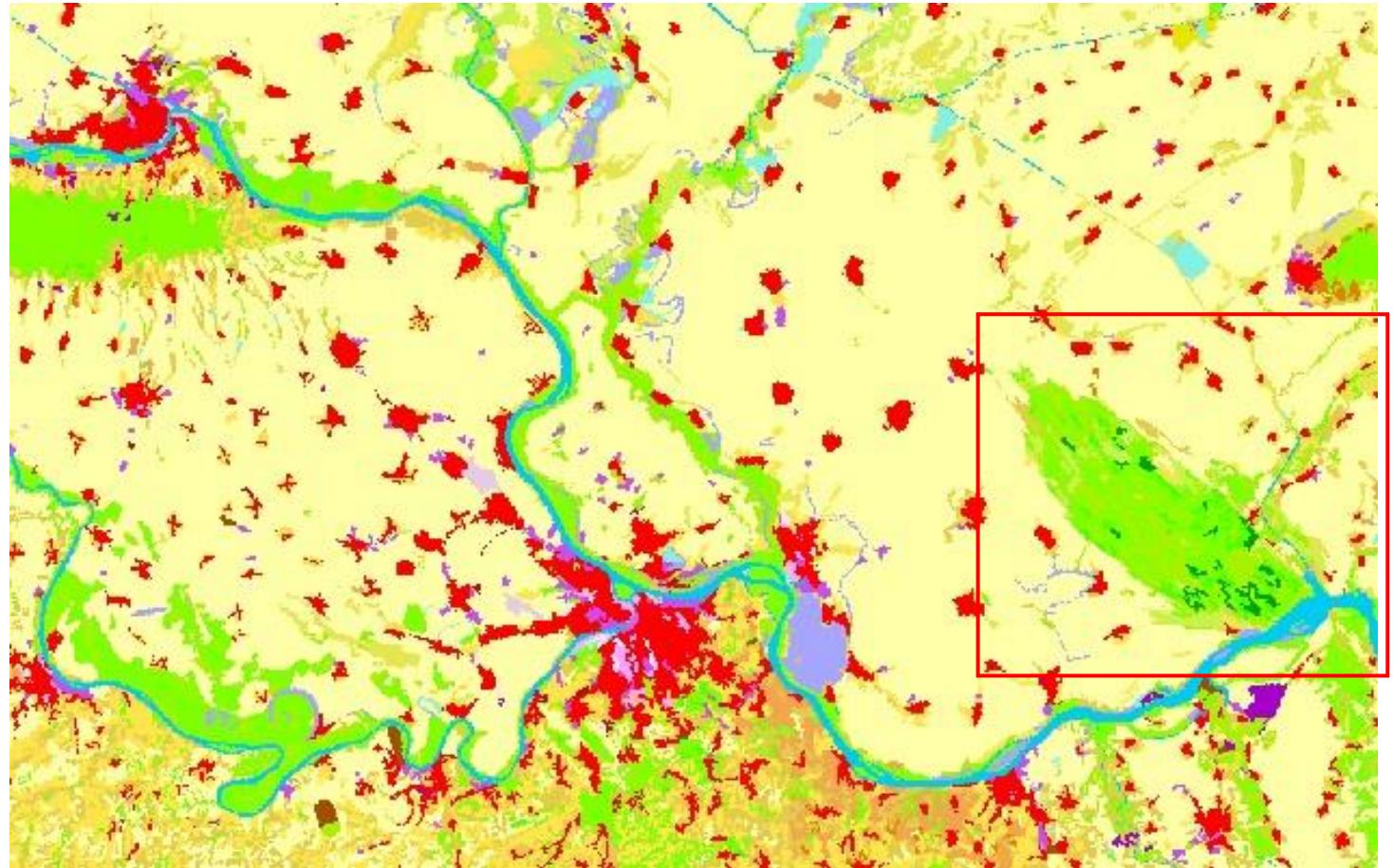
Deliblato sands - Nature protection

- Protected area since 1965
- Special nature reserve (SNR) since 2002.
- Category IV of International Union for Conservation of Nature (IUCN) classification Habitat and Species Management Area.
- Important Birds Area (IBA)
- Important Plant Area in Europe (IPA)
- Emerald Area
- Ramsar Area
- Potential UNESCO world heritage site



Land use – anthropogenic pressures

- **Surrounded by intensively used agricultural land and settlements**
- **Invaluable refuge area for numerous protected species**



History of human land use modification in the “European Sahara”

- **17th century:** sparsely inhabited and covered by natural vegetation
- **18th century:** population growth, wars, process of desertification
- **19th century:** the first reforestation efforts
- **20th century:** Reforestation
- **Today Deliblato sands is protected and managed by PE “Vojvodina šume”**



Deliblato sands in 1945 and in 2019.

Fire risk

- **DELIBLATO SANDS IS THE MOST FIRE PRONE AREA IN SERBIA** (number of fires, burned area, severity).
- Dry surface conditions due to sandy soil with high water permeability
- Warm and arid microclimatic conditions (+55 °C surface temperature in summer)
- Flammable coniferous vegetation
- Strong wind conditions
- Unfavorable conditions for effective firefighting – water shortage, remoteness and inaccessibility of the terrain



Wildfires

- **267 wildfires were recorded between 1948 – 2015.**
- **An area of nearly 12.000 ha was burned**
- **About 6138 ha of forest was destroyed**
- **The greatest fires were in 1973, 1990, 1996 and 2007**



Reforestation challenges

- **Climate variations – intensifying climate extremes (droughts)**
- **Deterioration of soil conditions, loss of organic matter**
- **Changes in land cover/use**
- **Wildlife / game damaging the vegetation**



Goals

- Establish and map dynamically the sensitivity and vulnerability of Deliblato sands to land degradation processes
- Monitor the ecological balance and stability of the area using available data on soil, climate, vegetation and remote sensing EO data in combination with the in-situ CiROCCO environmental observations.
- Assess drought and wildfire risk in near-real time
- Monitor air pollution levels

Air pollution monitoring

- **The area is a potential source of air pollution (open sandy surfaces, PM_{2.5} and PM₁₀)**
- **Deliblato sands also receive airborne pollutants from the surrounding urban and industrial areas**



SUSTAINABLE MANAGEMENT SUPPORT SYSTEM APPLICATIONS:

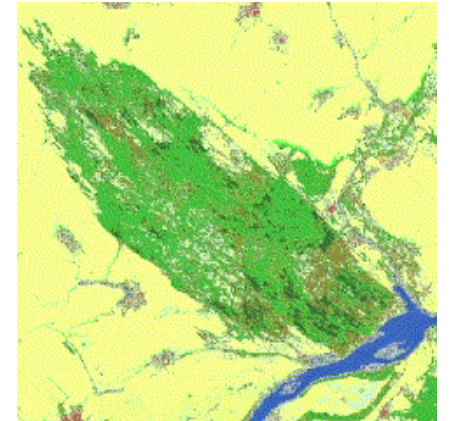
- **Land use management**
- **Strategic and operative forest planning**
- **Habitat monitoring**
- **Tourism management**
- **Plant species selection for reforestation**
- **Carbon stock, uptake capacity estimation**
- **Monitoring the effects of protective measures**



Integration of remote sensing products with measured data for monitoring and modelling



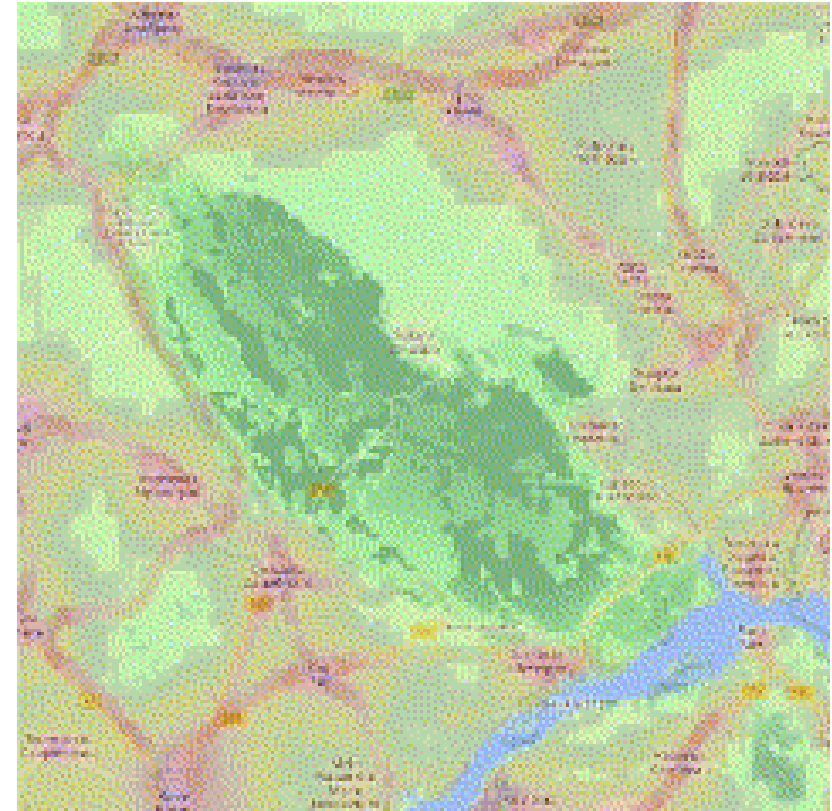
- Validation, interoperability, and synchronisation between in-situ and remote sensing systems in compliance with the GEOSS and Copernicus requirements
- Radar and optical satellite images (Copernicus Sentinel 1 & 2, Gedi, Planet) for monitoring land surface and vegetation changes, using vegetation and moisture indices.
- Machine learning and AI algorithms for classification and change detection



Integration of remote sensing products for monitoring and modelling

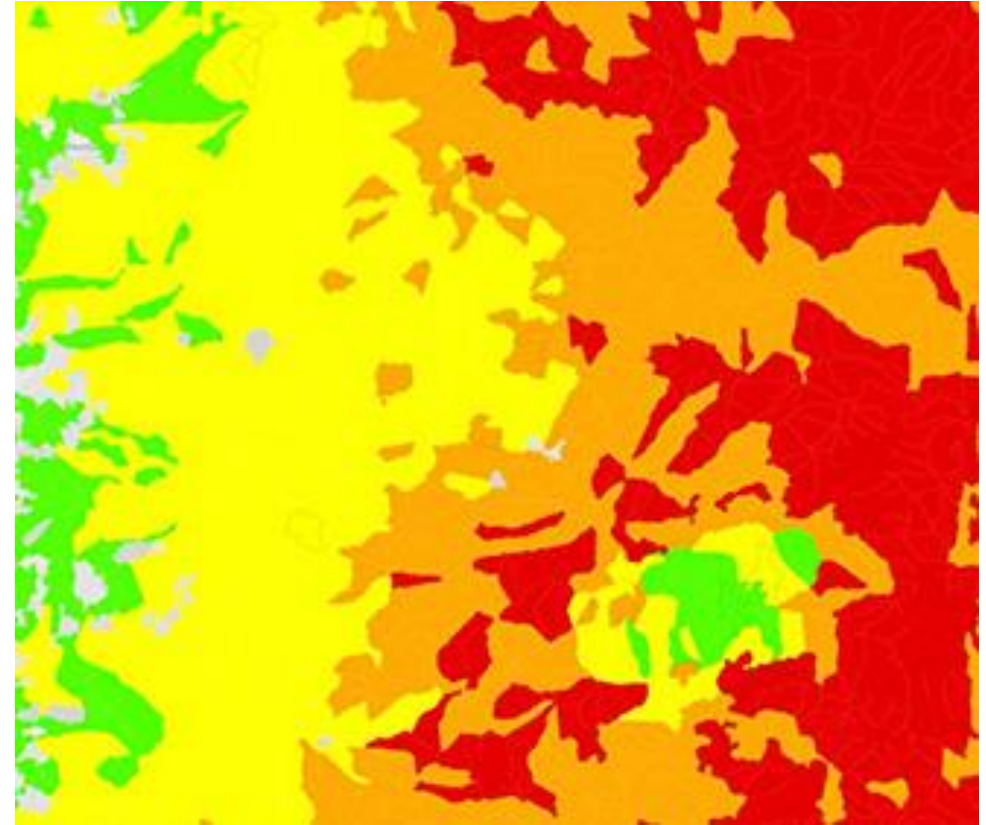


- land use / land cover dynamics
- land degradation
- anthropogenic pressures
- plant species composition
- environmental vulnerability



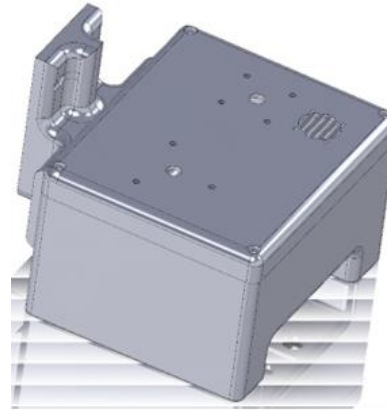
Drought and wildfire risk mapping

Based on integration of in-situ measurements, observations and remotely sensed data maps of drought and wildfire risk estimates will be produced and provided to stakeholders (local communities, managing authorities, emergency services, decision makers).



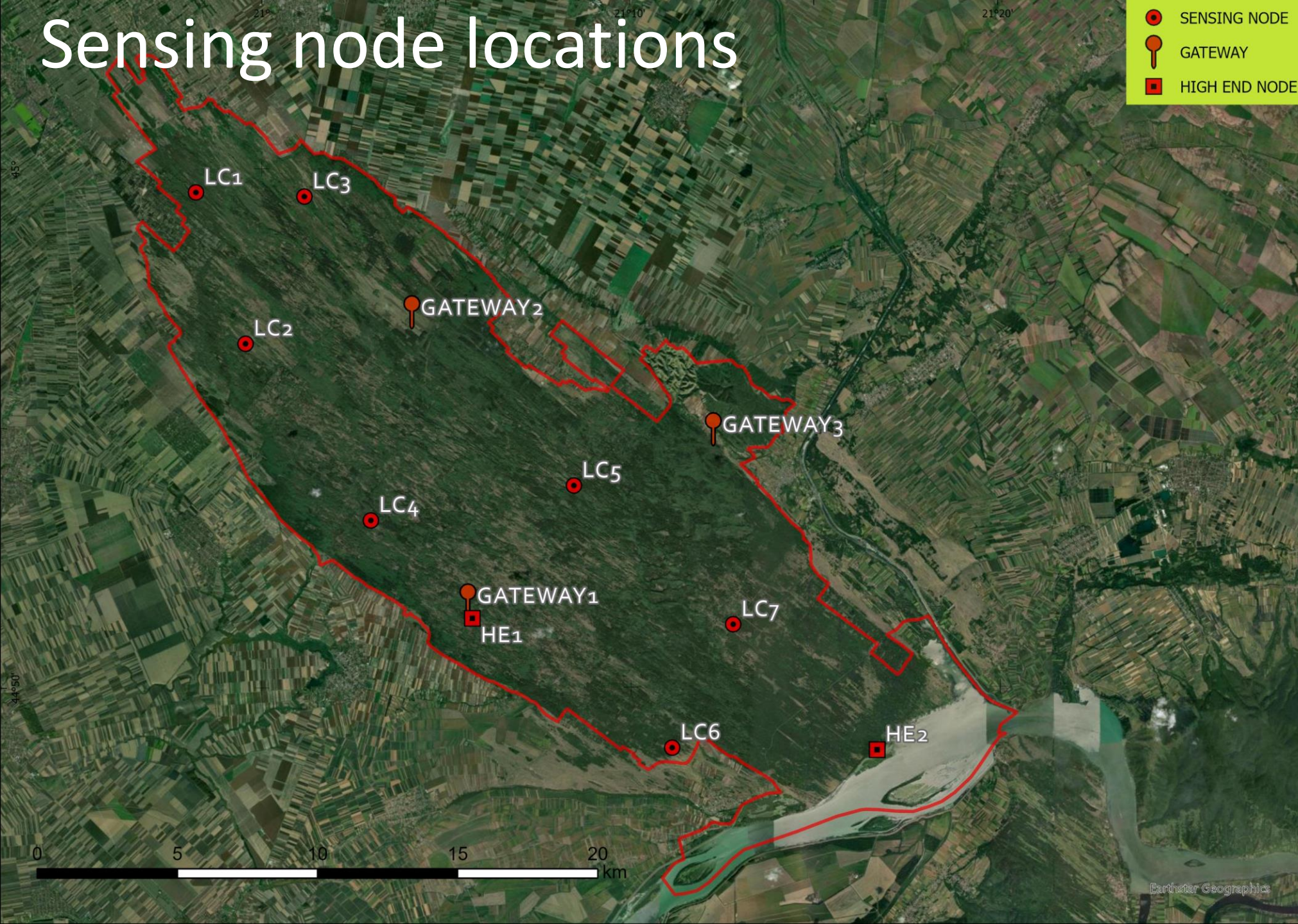
CiROCCO system sensing node

1. Air temperature
2. Atmospheric pressure
3. Air humidity
4. Soil humidity
5. Sand/soil temperature
6. Wind direction
7. Wind speed
8. Solar radiation
9. CO_2
10. $\text{PM}_{2.5}$
11. PM_{10}



Sensing node locations

- SENSING NODE
- GATEWAY
- HIGH END NODE



THANK YOU FOR YOUR ATTENTION!

