SATELLITE EO FOR GROUND EO

Pilot in Ethiopia

Project Report for ESA NoR (2023)

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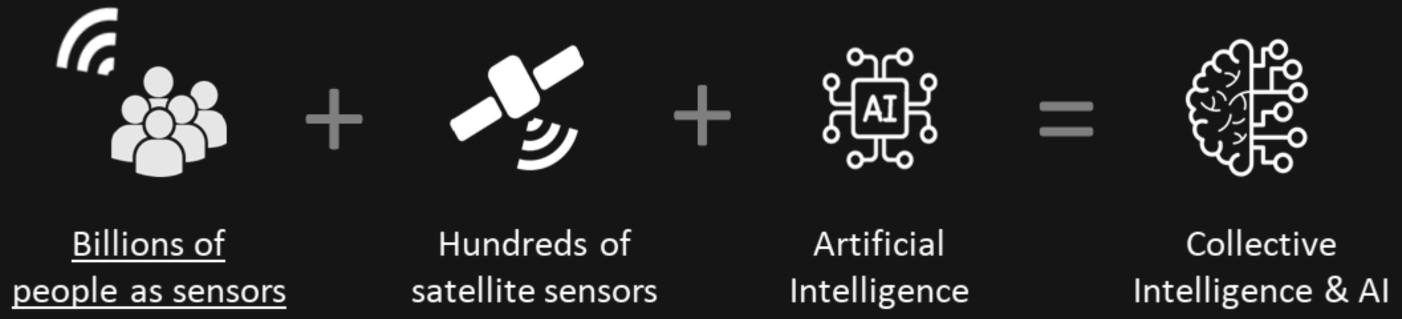
THE PROBLEM

Intelligent planetary-scale monitoring systems need satellite data and ground data, but the latter are lacking.

Despite the increasing monitoring capabilities of satellites, there is much that we don’t know about what is happening on the ground around the globe. This is true even for places that are critical for our understanding of emerging crises, such as droughts, or about places where we need to understand changes in local ecology.

Intelligent Planetary-Scale Monitoring Systems

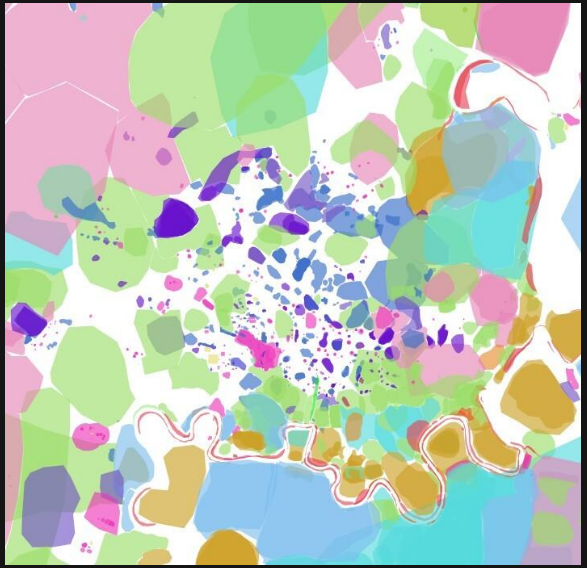


THE PROBLEM

70% of the rural areas in developing countries do not have data about how people live on the land.

On the left, Google Maps.

On the right, the same area mapped with smartphones by local people using our innovation.



THE OPPORTUNITY

By 2030, 95% of the world's population will be connected to the internet. This is an unprecedented opportunity to support rural people living at the margins to earn money by bridging the ground data gap and lead the change to sustainability.

THE OBJECTIVE

To democratise the access to satellite EO data and the (remunerated) production of ground EO data.

Local people on the ground need space technology (GNSS and EO) to generate high quality ground data, and intelligent planetary-scale monitoring systems need local people to bridge the global ground data gap.

TECHNOLOGY

Our innovation is a ground EO mobile app that is linked to WhatsApp and spatial DBs. **It integrates freely available VHR imagery and PlanetScope, Sentinel-2 and SPOT imagery.** Multi-temporal imagery is being used by agro-pastoralists to identify water sources and grazing areas in good condition in the region, where a food security emergency is unfolding and conflicts need to be resolved before they escalate.

Both GNSS and satellite imagery are crucial for ground EO. Satellite imagery allows local people to demarcate the land in community gatherings, where people share knowledge and technology.

https://youtu.be/6xc4S5gNe1I?feature=shared

WITH THANKS TO

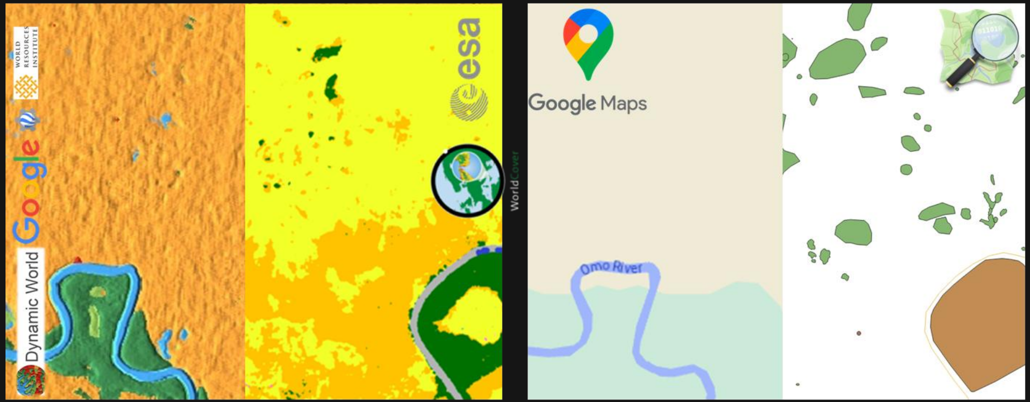
CARTO esa planet. SINERGISE NoR

LAND USER-GENERATED DATA

Understanding land use requires, fundamentally, land user-generated information.

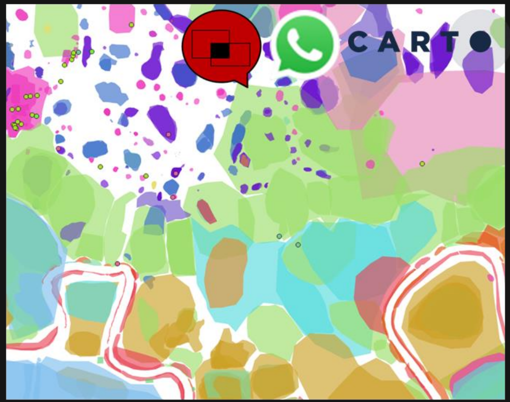
Remote mapping cannot capture information such as the use of a building, a pond or a (sacred) tree; or crop and livestock diseases; or biodiversity under the tree canopy; or where are the fuzzy boundaries of a grazing or hunting area. Our results demonstrate that the maps generate with our innovation are more timely, accurate (spatially and semantically) and complete than any other map in the area.

Remote mapping



by machines & map users

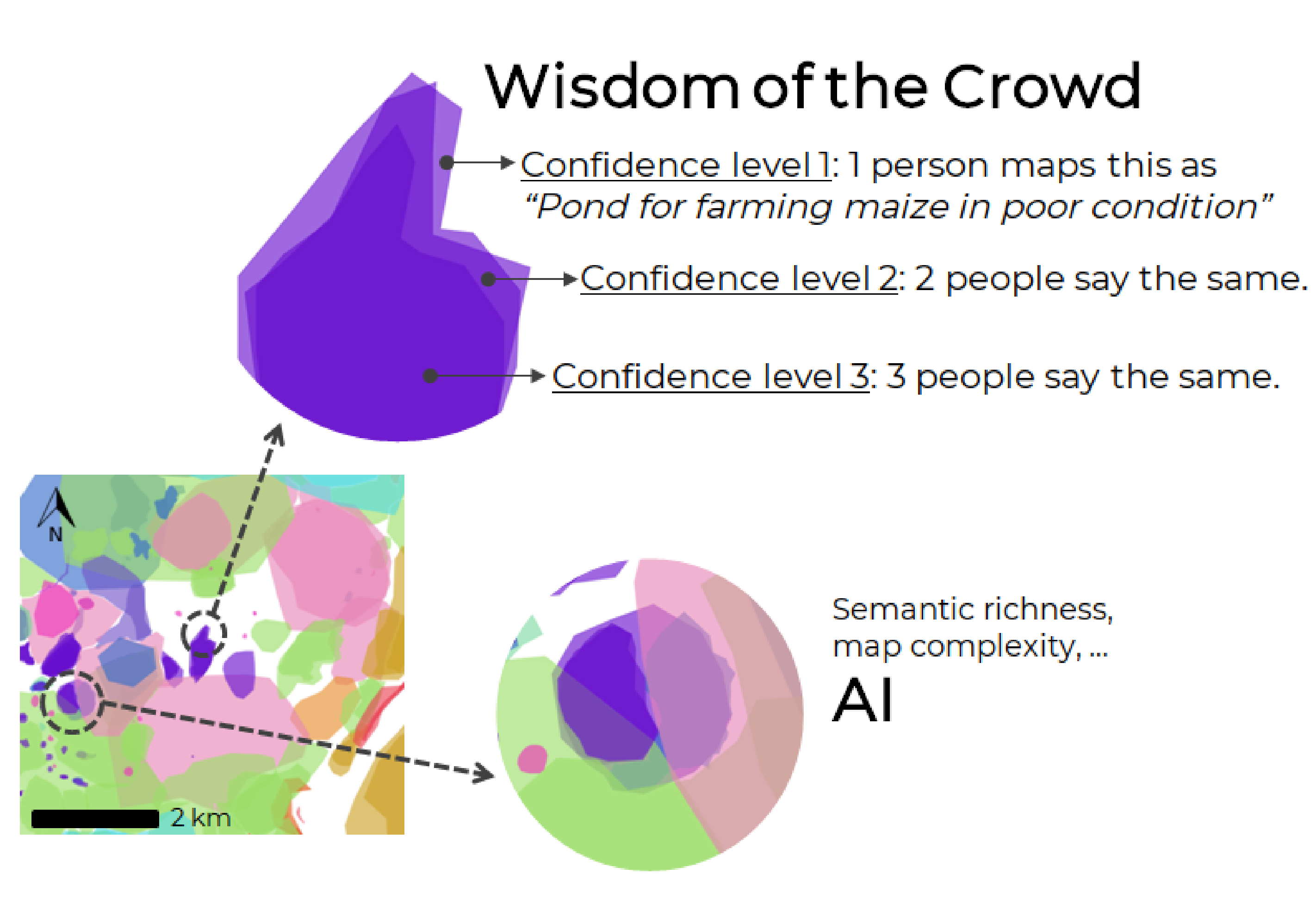
Onsite mapping



by land users

DATA QUALITY

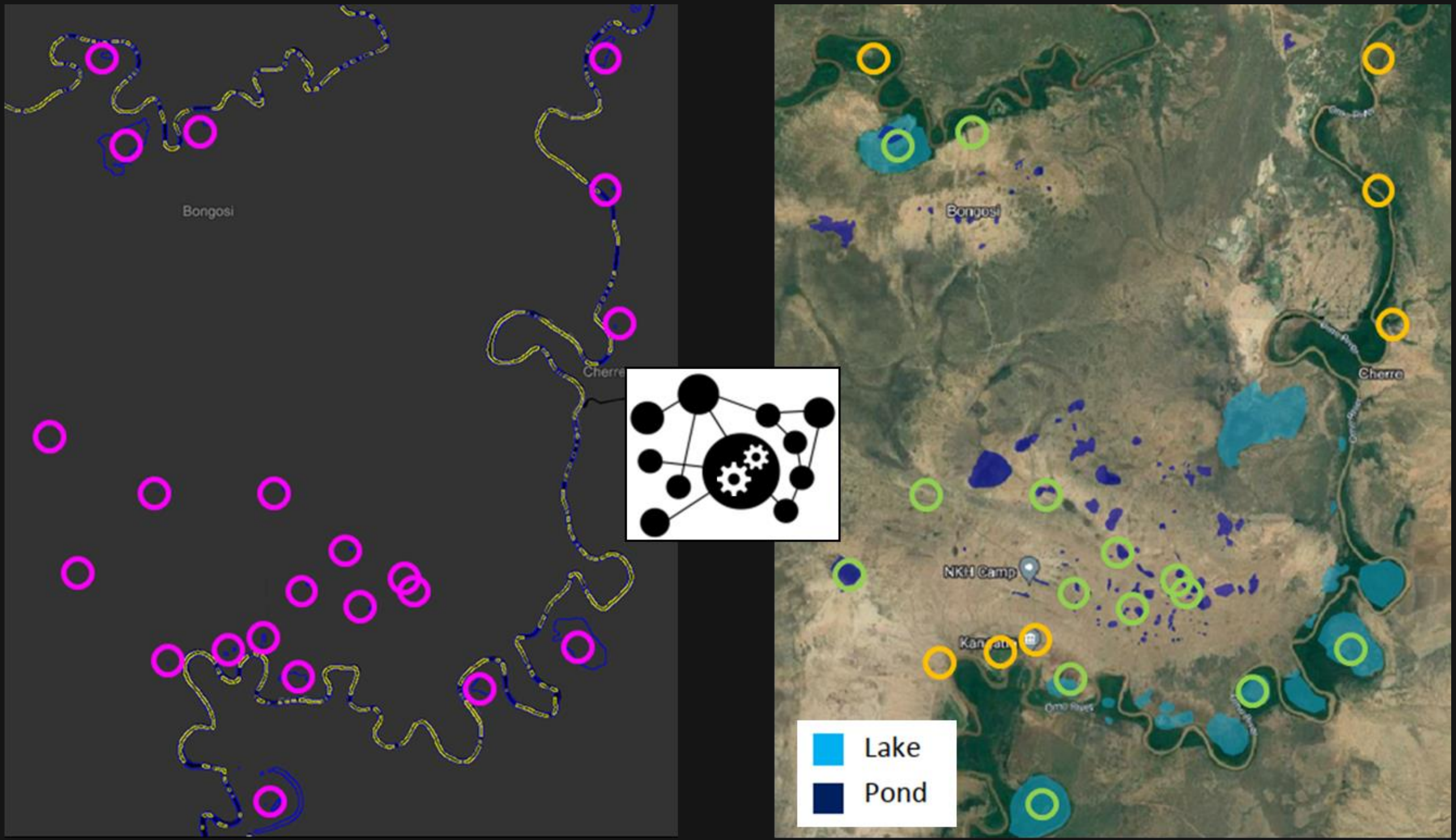
Wisdom of the crowd concepts and methods are appropriate to embracing semantic richness and ensuring data quality. As shown in the figure, the more people contributing to a map, the better the map.



RESULTS: WATER

If the land user-generated map (right) was used here as reference data (not vice versa), then the accuracy results of the Global Water Watch map would be: 14 true positives objects (i.e. water on the reference layer mapped as water), 8 false positives objects (i.e. no water on the reference layer mapped as water), and **77 false negatives objects** (i.e. water on the reference layer not mapped as water – see all the blue polygons without a circle in the map on the right).

In other words, the machine-generated map omits the majority of water sources for farming and animal watering that were mapped by local people.



'Reference data' True positive False negative

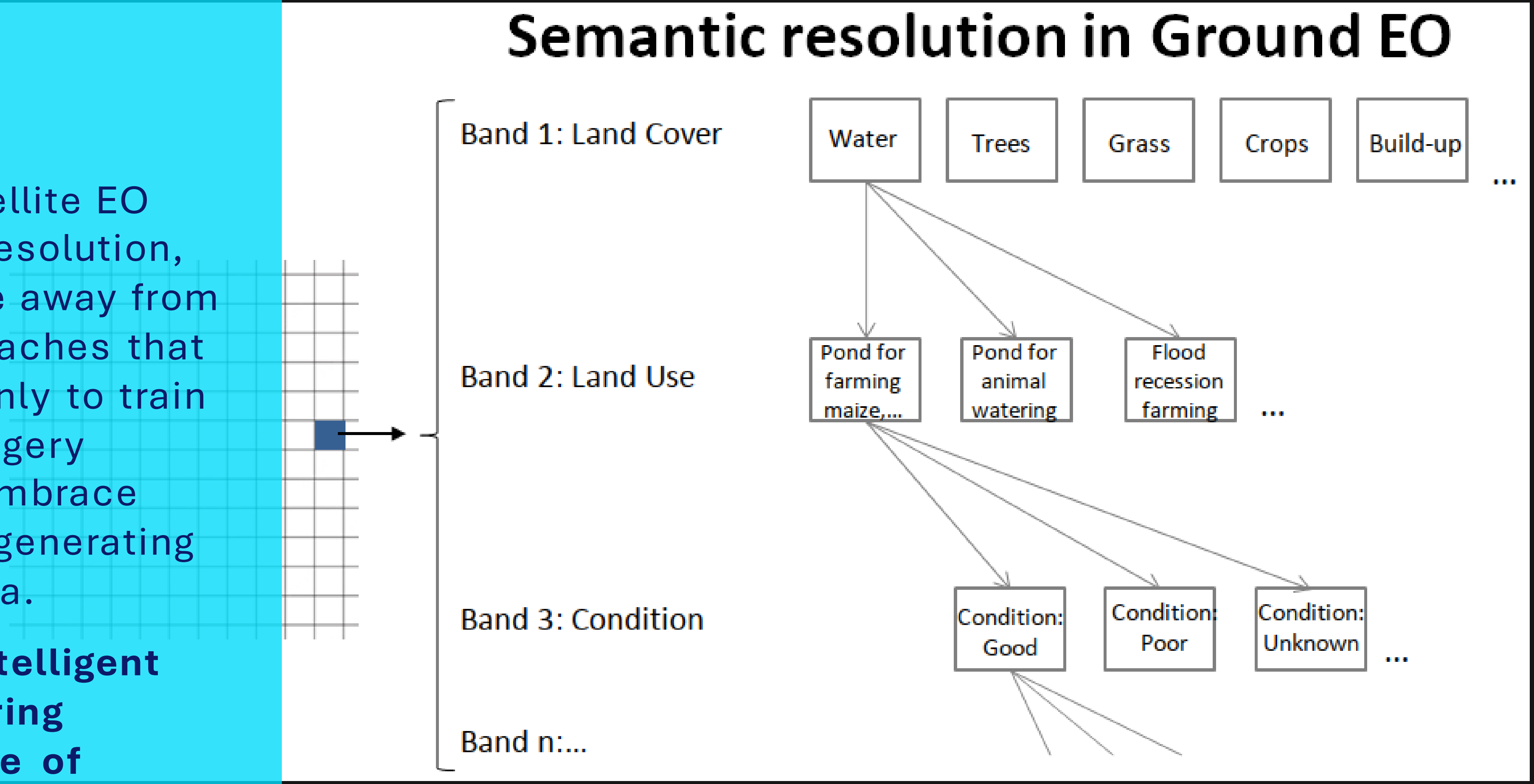
Source: Global Water Watch

Source: Land users

SEMANTIC RESOLUTION

In the same way that satellite EO embraces high spectral resolution, ground EO needs to move away from highly reductionist approaches that use ground (truth) data only to train and validate satellite imagery analysis algorithms. To embrace semantic richness when generating and analysing ground data.

To transition towards intelligent planetary-scale monitoring systems that are capable of zooming in and in and in…



IMPACT: ETHIOPIA PROJECT

- Monitoring food insecurity to improve early warning systems.
- Monitoring water bodies and grazing areas to prevent conflicts and improve resilience of pastoralists.
- Monitoring the condition of water infrastructure to ensure access to clean water and irrigation schemes.
- Monitoring crops to address farming issues and improve sustainable land use practices.
- Evaluating the condition of health and veterinary stations to efficiently allocate medical resources and prevent pandemics.
- Documenting land use rights to prevent future land grab scenarios or to ensure fair compensation if resettlement.

FUNDERS

PARTNERS

WITH THE SUPPORT OF

WAY FORWARD

Transitioning from 10 years of academic research with local communities in developing countries to an impact-driven startup.

GroundX is a spinout of UCL.

GROUNDX

Launching a Ground Earth Observation Programme

WITH THE SUPPORT OF

UCLB

UCL Innovation & Enterprise

THANK YOU

Contact

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Other resources

Wisdom of the Crowd in the Age of AI

Satellite EO for Ground EO: Pilot in Ethiopia

An extreme citizen science approach for digital mapping in Ethiopia

Extreme Citizen Science around the World