



CROWDS & MACHINES

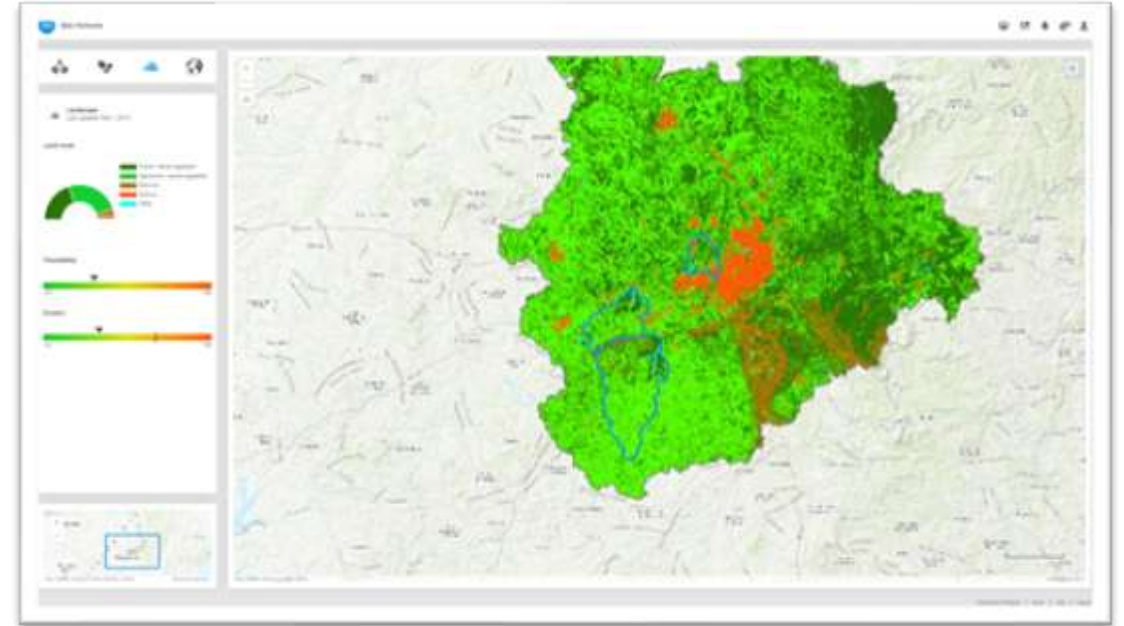
Crowds & Machines: overview

- Aim: to develop a demonstrator “Crowds & Machines” that provides strategic information concerning the impact of Covid-19 on food security and political (in)stability
- Crowds & Machines enables decision makers to track the impact of Covid-19, design scenarios and act on those scenarios effectively
- If successful, Crowds & Machines will assist governments, IGOs and international businesses during the outbreak of Covid-19 and prepare for the period when Covid-19 has been diminished
- Crowds & Machines is a project to demonstrate its feasibility and is funded by the European Space Agency



Envisaged capabilities

- Identify geographical hotspot areas of risk worldwide
- Assess the medium to longer term impacts of Covid-19 thereon
- Show indicators related to food insecurity and conflict-related events
- Support the design of adequate and effective policy response mechanisms



Enabling technologies

- Machine learning and causal modelling enable the processing of large datasets to identify relations between variables
- Crowdsourced analytics enables the analysis of large datasets and generates the training data for machine learning algorithms
- (Open) satellite imagery enables cost efficient global monitoring
- Determine associative and causal effects on conflict risk, as these effects originate from food insecurity and Covid-19



political (in) stability



Political instability monitoring

Our political instability monitor (please see next slide).

- The unit of analysis is the first-level administrative district.
- Predicts intrastate conflict probabilities for the time horizon of up to one year
- Employs a range of machine learning techniques (e.g., bagging, boosted, and stacked ensemble models)
- Ingests more than 1700 indicators from across a range of relevant datasets (e.g., UCDP, GDELT, ICEWS, Phoenix, TERRIER, GHSL, WDI, Gridded global datasets for GDP and HDI, EM-DAT).

Crowds & Machines relates the conflict probabilities to food insecurity and Covid-19 related data.



Show results regarding next

☐ 1m

☐ 6m

☒ 12m

Pick model

☐ XGBoost

☒ Gradient Boosted Machine

☐ Random Forest

Colorcode countries by absolute or relative scoring

☐ Absolute

☒ Relative

☐ Categorical

Select focus region

☐ World

☐ Asia

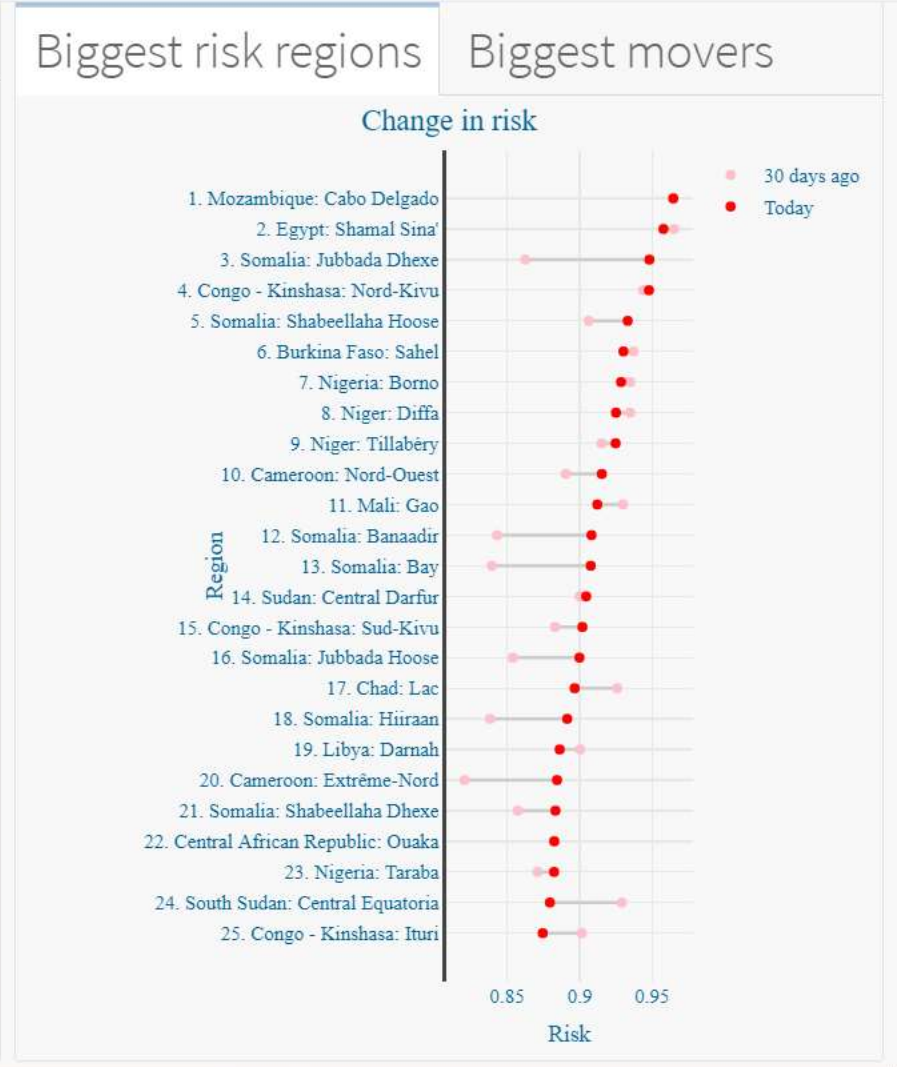
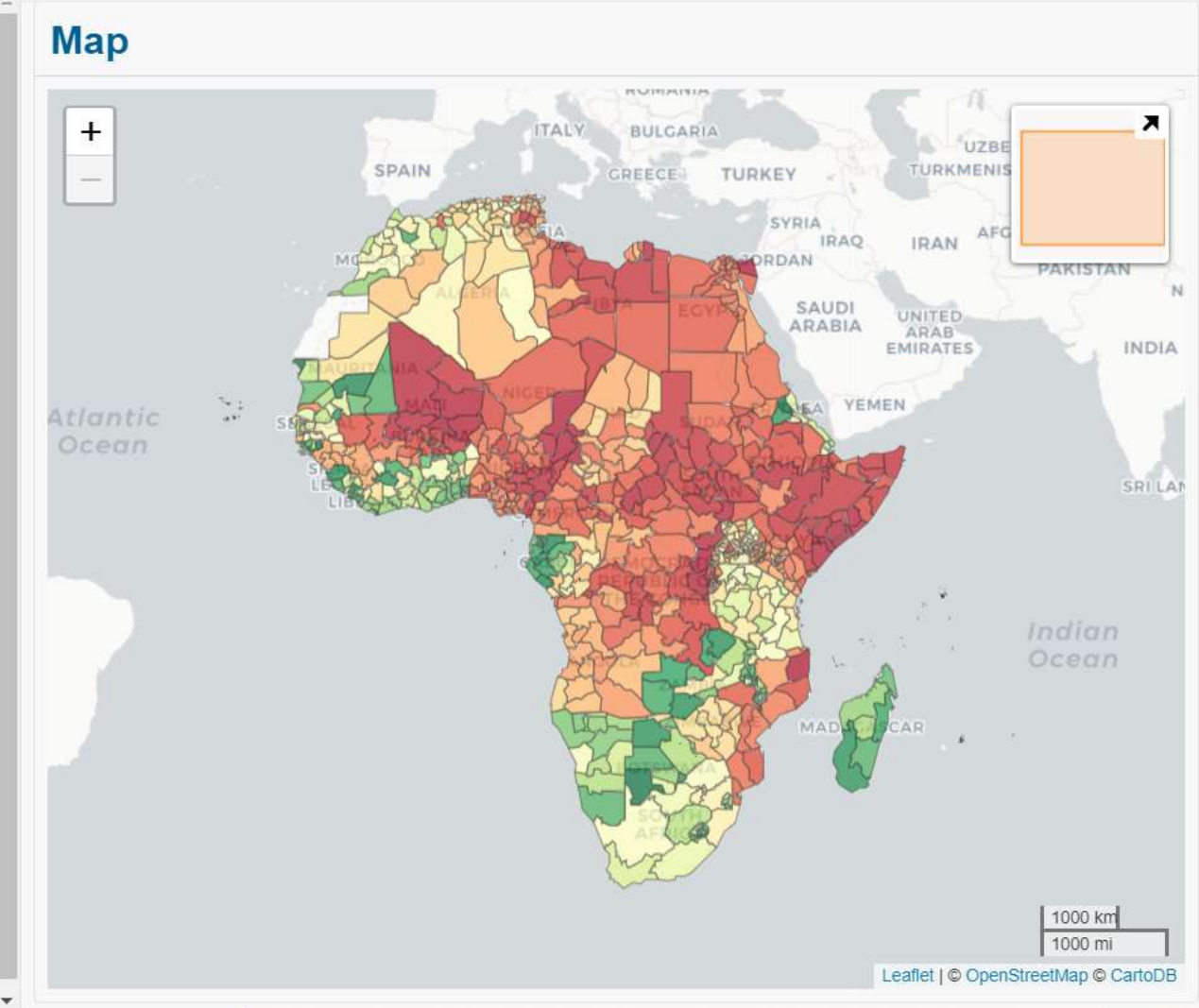
☐ Europe

☒ Africa

☐ Oceania

☐ Americas

Load!



Show results regarding next

☐ 1m

☒ 6m

☐ 12m

Pick model

☐ XGBoost

☒ Gradient Boosted Machine

☐ Random Forest

Colorcode countries by absolute or relative scoring

☐ Absolute

☒ Relative

☐ Categorical

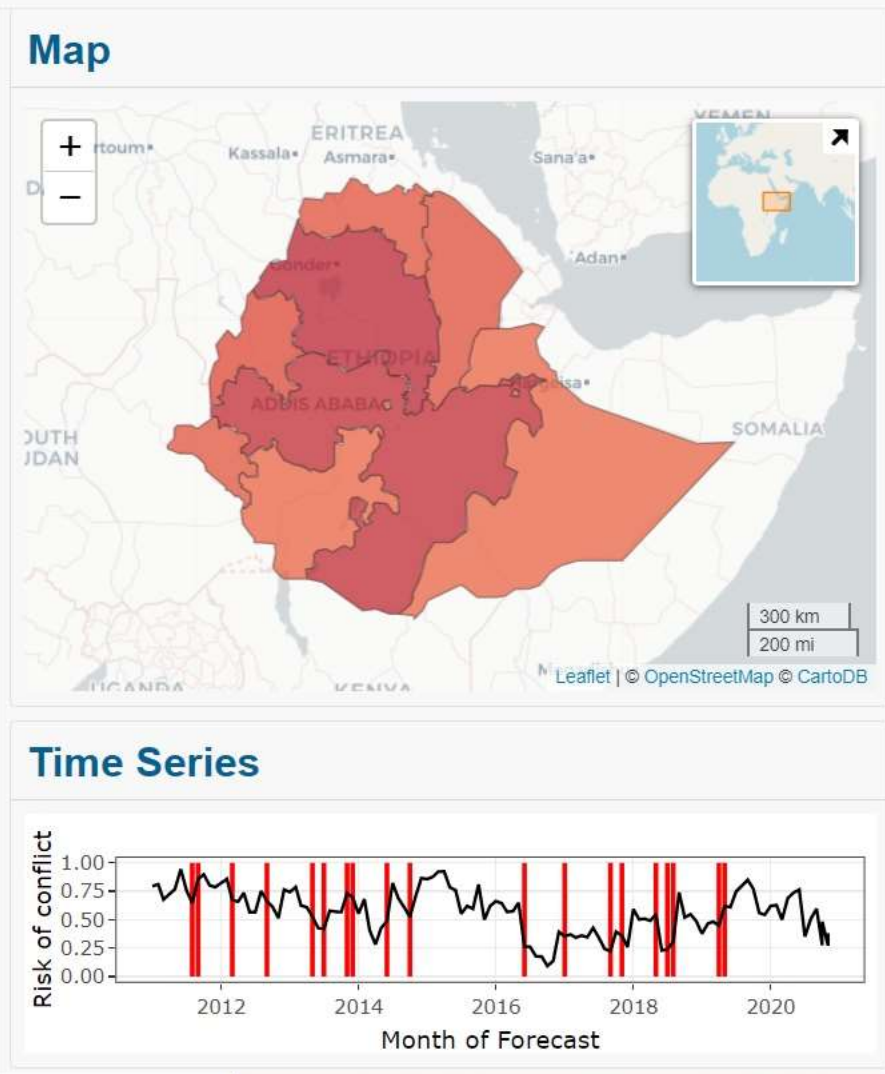
Select country

Ethiopia

Select First Administrative Region

Somali

Load!



Amhara

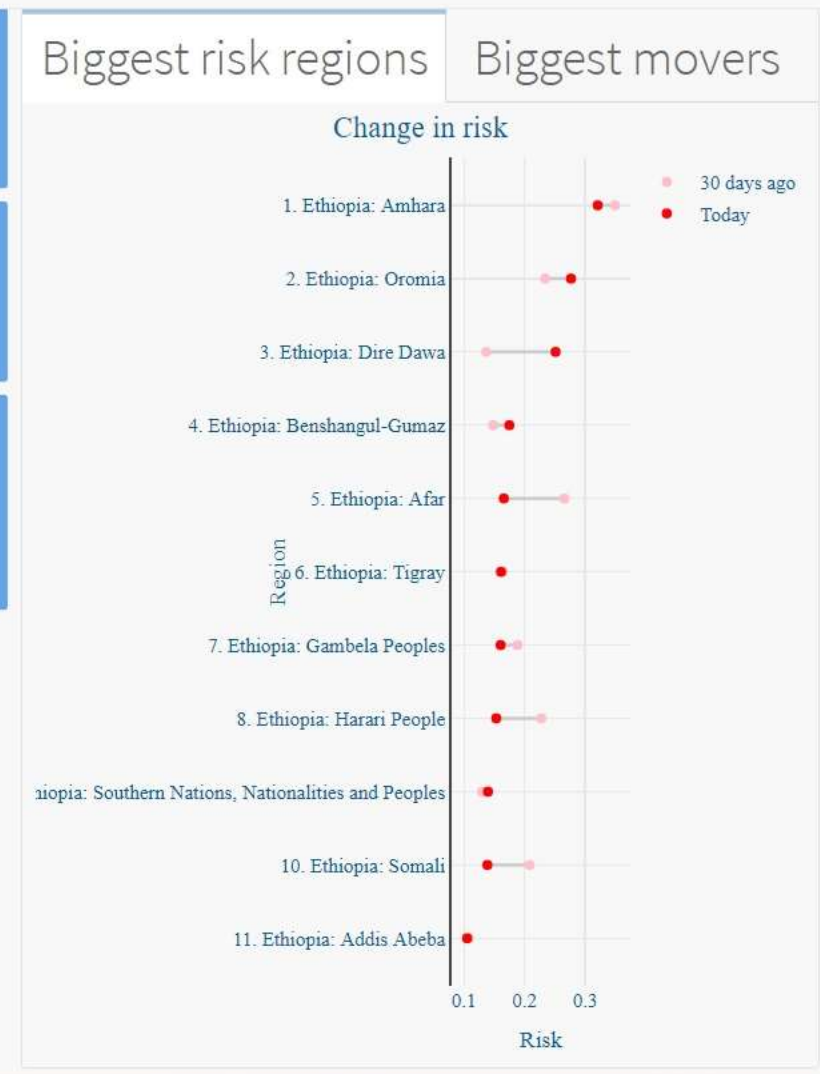
Most risky region

Addis Abeba

Least risky region

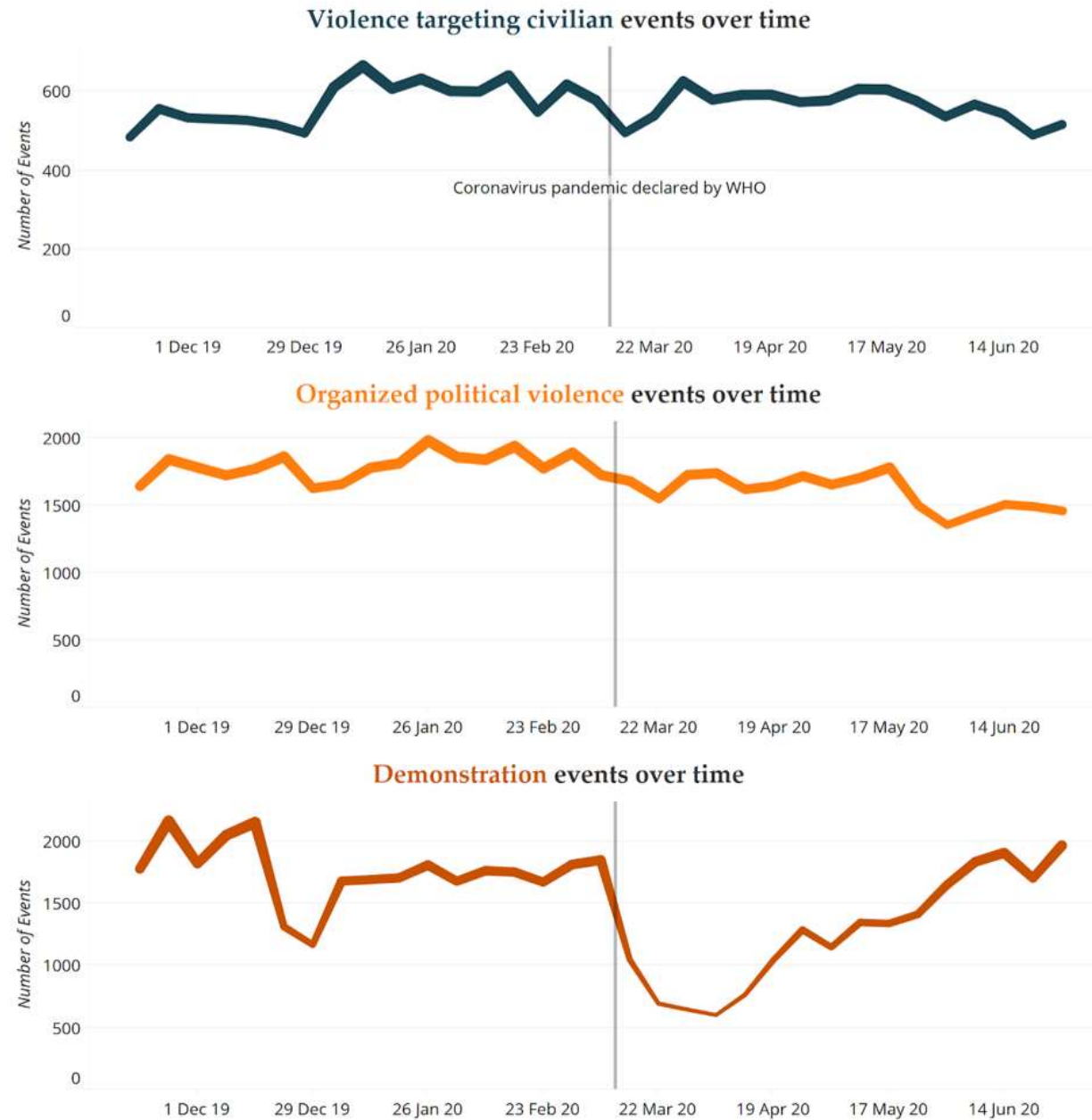
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Likelihood of conflict in any region



Disorder over time

(20 November 2019 - 30 June 2020)



Added Value

Enhancements to our political instability model will enable us to relate conflict risk to food insecurity and Covid-19 epidemic data as these phenomena change in time

What we can do with the insights?

1. Determine the degree to which food insecurity and Covid-19 data contribute to prediction of conflict risk
2. Examine if food insecurity and Covid-19 data pinpoint causes of conflict risk
3. Study to what degree causal explanations of conflict risk, as derived from food insecurity and Covid-19 data, can serve the purpose of pinpointing efficient conflict intervention strategies (i.e., to which degree these explanations lend themselves to security policy recommendations)



Food (in) security

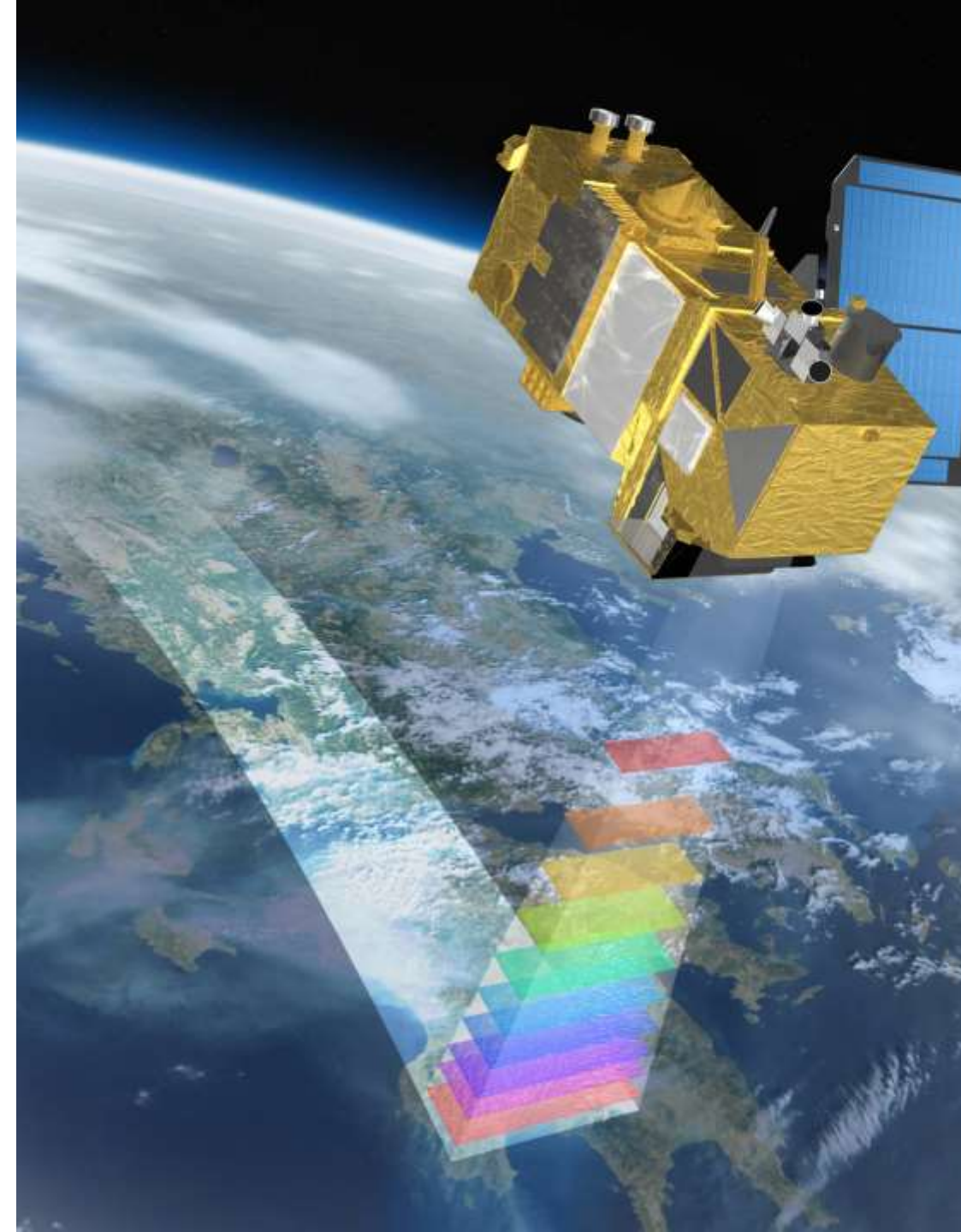


Food security monitoring

Objectives:

- Monitor food security and assess food security risks using technologies related to satellite imagery, machine learning and crowdsourced analytics
- A global system that provides information of every location in the world on sub-continental, national, and sub-national level
- Provides information on food security per season (short-term), and a forecast for 5 – 10 years (long-term)

It is an innovative project for which we will experiment with multiple approaches.



Seasonal monitor (short-term)

Volumes of crops produced:

- With satellites we indicate the amount of crops that are grown
- Based on historical satellite data we compare the historical amount that is produced with the actual data and show deviations and anomalies. => hotspots for food (in)security

Types of crops, income and market volatility:

- Based on crowdsourced analytics, machine learning and satellite data we know what crops are produced
- Market price data provides information on the price of the crops, volatility and income of farmers



Long term monitor (5 – 15 years)

Climate impact and land suitability:

- Based on climate models, social indicators, weather data, and satellite images, we assess the impact of climate (change) on agriculture
- Trends in climate and land provides information on the suitability of the locations for the crops

Social-geography:

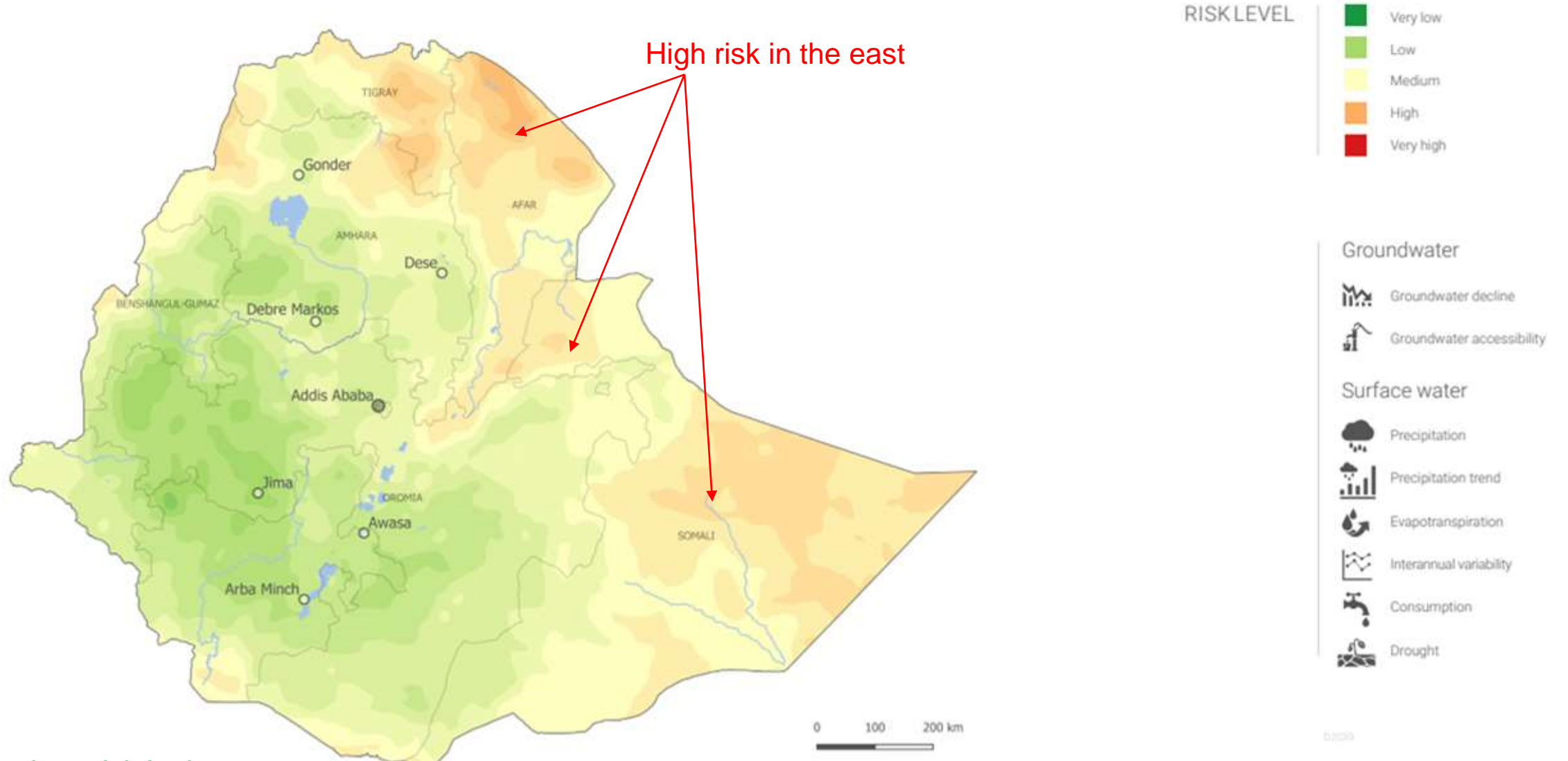
- Based on census data, we assess population density and population growth
- Risks of local food and water shortages are provided based on population characteristics and amount produced (satellite based)





ETHIOPIA — OVERALL WATER AVAILABILITY RISK

Based on data between 1990-2019



Low risk in the west

High risk in the east



ΔΗΜΕΤ ΗΕΦΝΔΥ

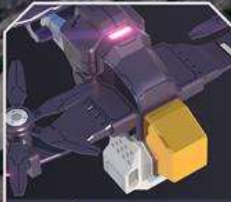
LEVEL 2 5,987,234 / 8,000,000



+ 19,504,350

+ 19,504,350

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SU-360



SU-360

LEVEL 2



B-01

LEVEL 2



B-01

LEVEL 1



SU-360

LEVEL 3



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LEVEL 3



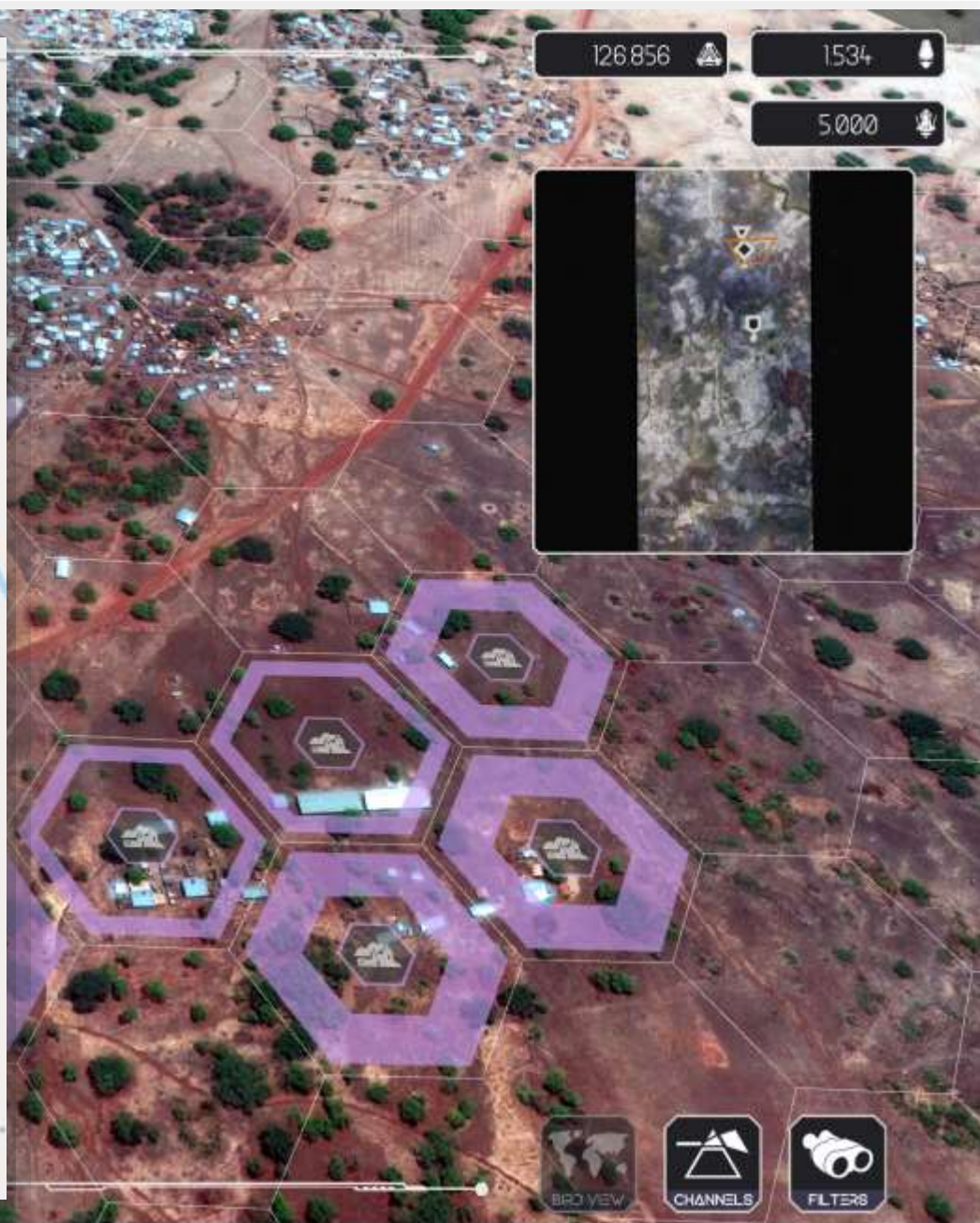
BIRD VIEW

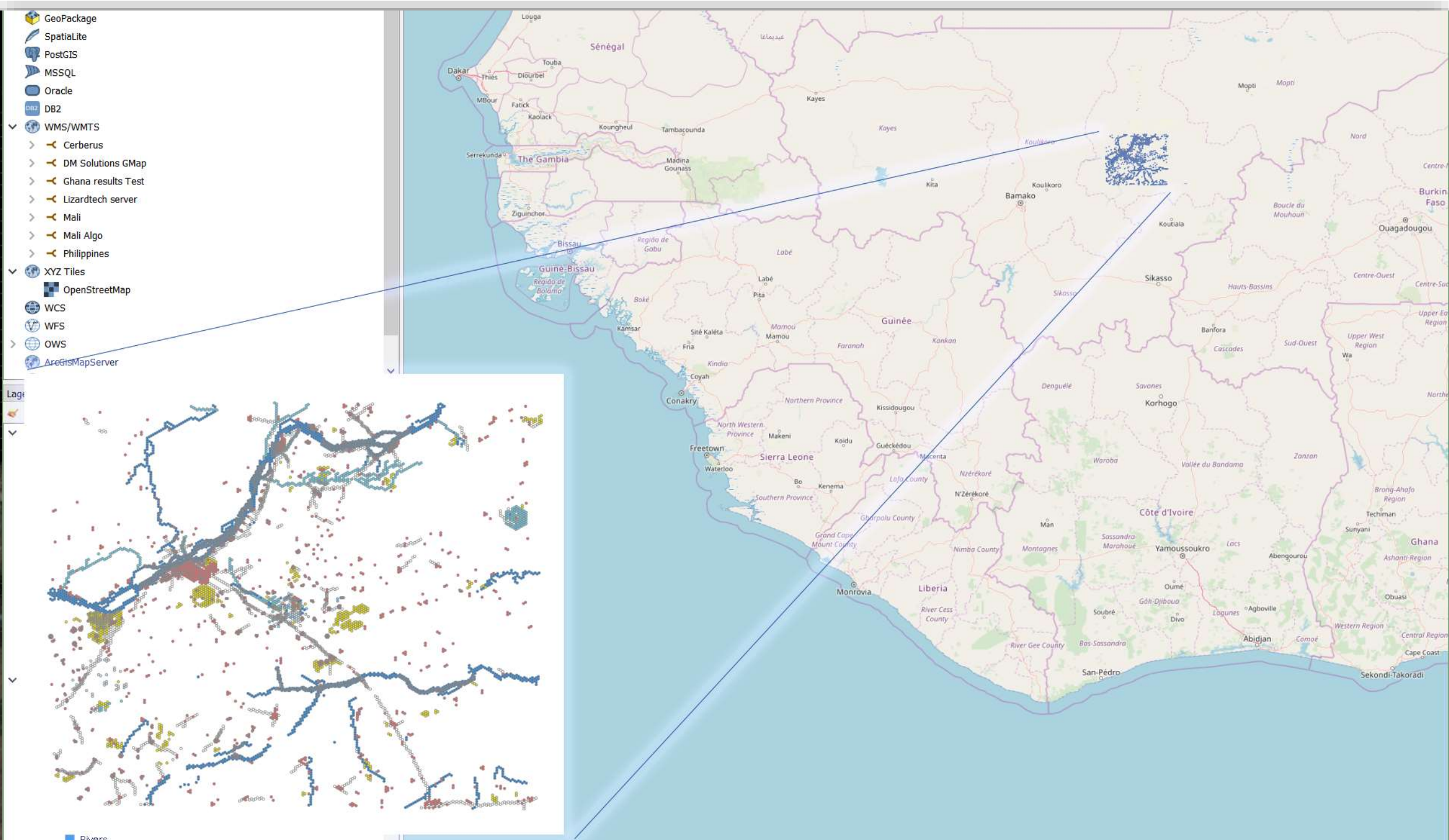


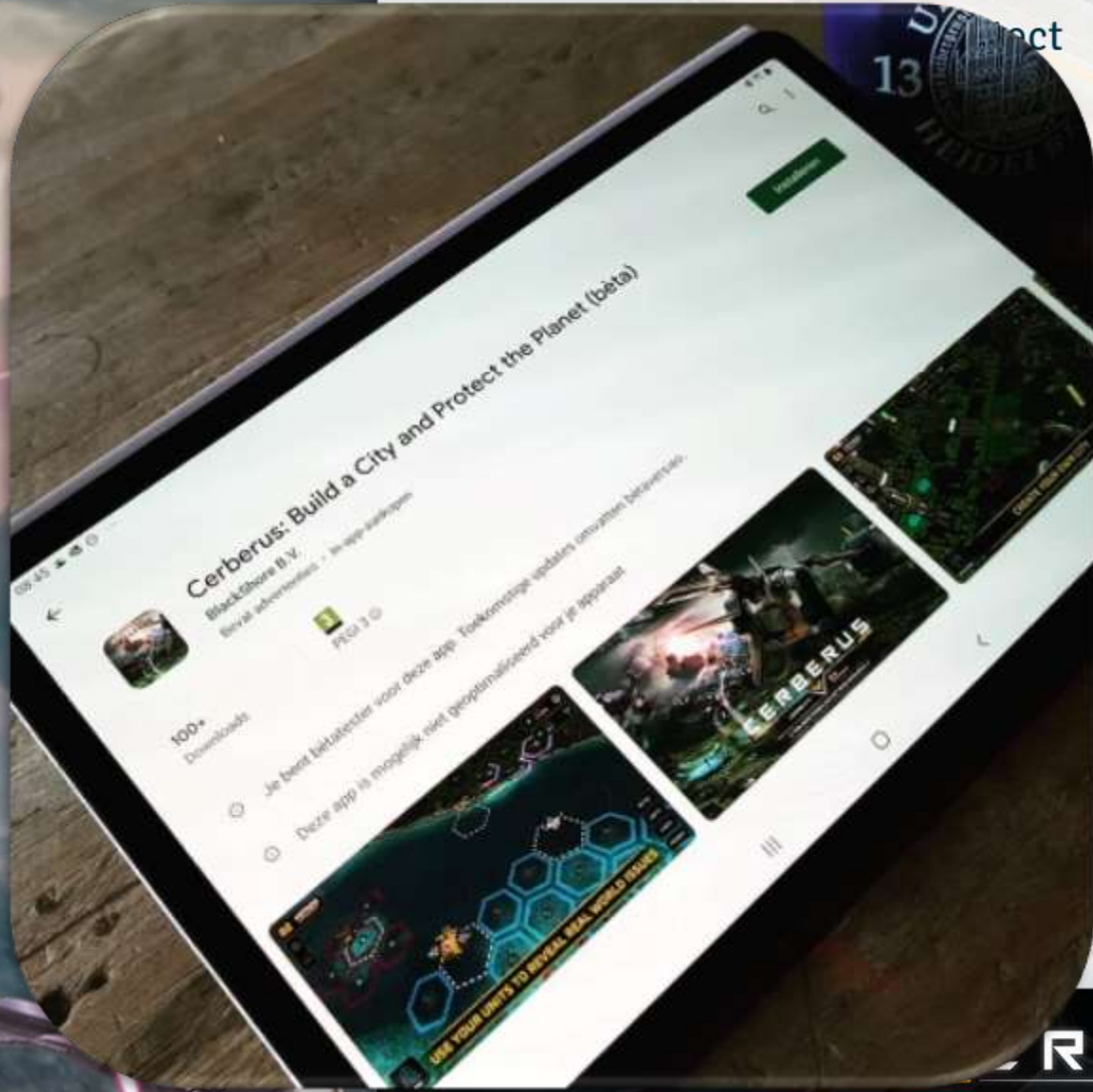
CHANNELS



FILTERS







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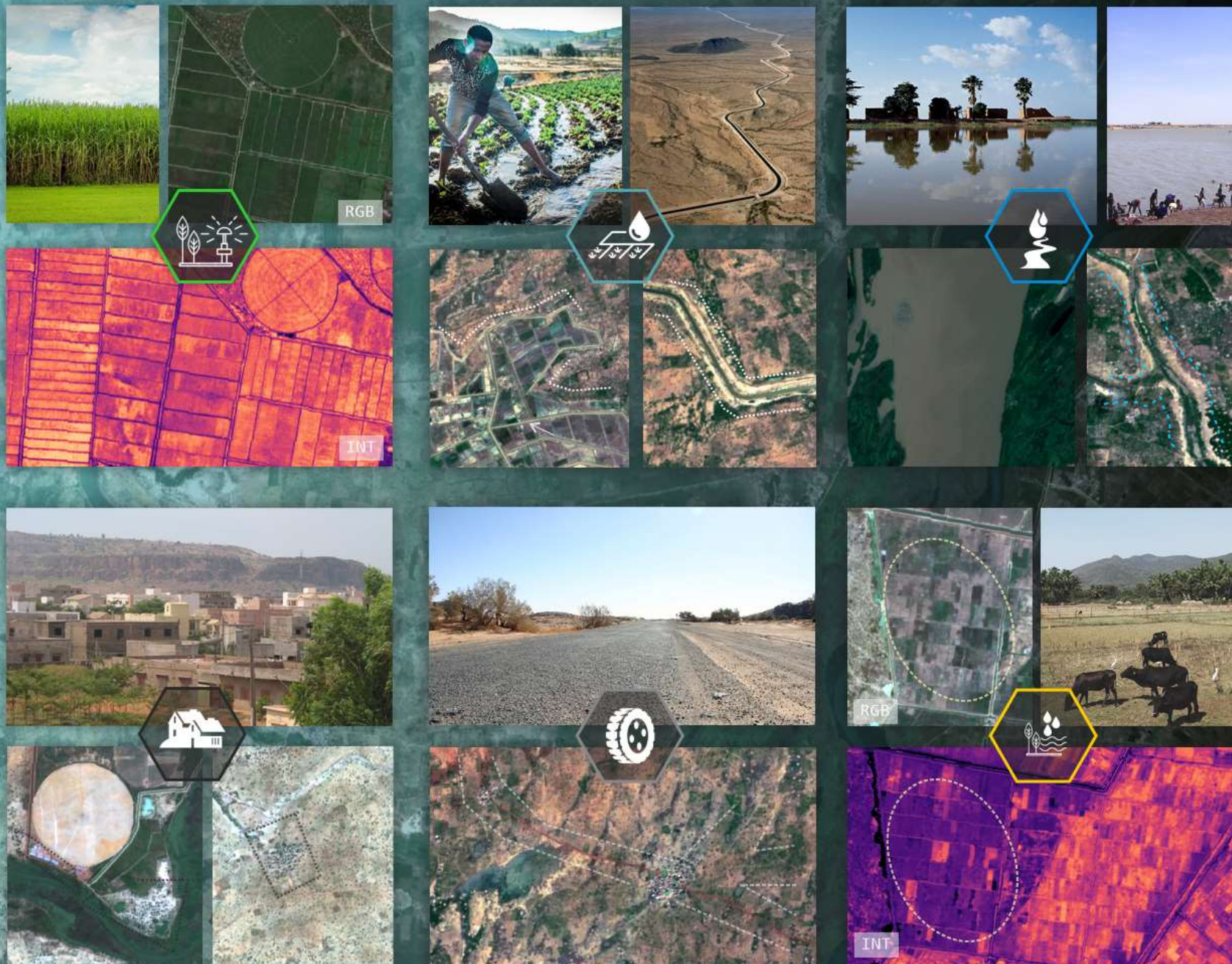
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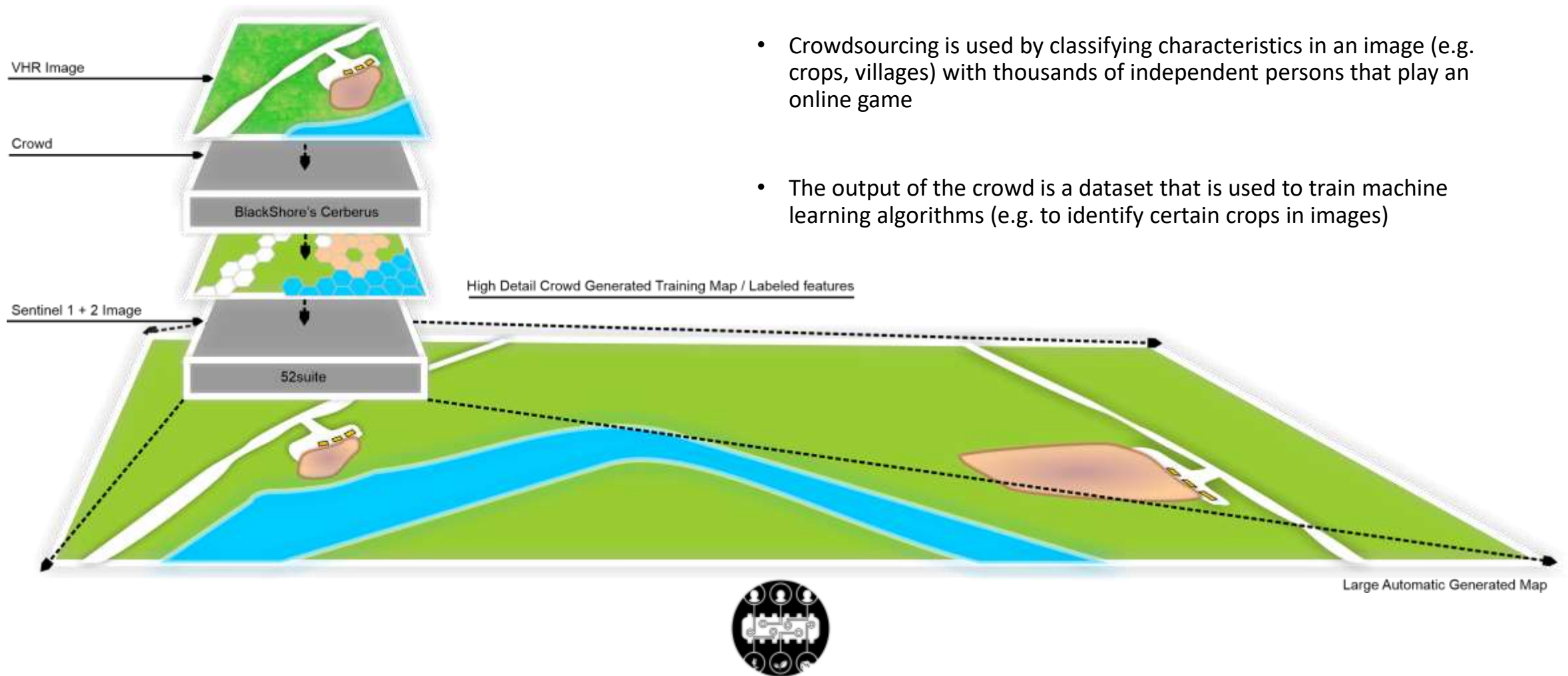
A land below sea level: Do you have what it takes to help the Dutch?



BAMAKO REGION, MALI "DESERT CONTROL"



- Machine learning is powerful to find relations in large datasets and identify objects in (satellite) imagery
- Datasets are needed to train machine learning algorithms
- Crowdsourcing is used by classifying characteristics in an image (e.g. crops, villages) with thousands of independent persons that play an online game
- The output of the crowd is a dataset that is used to train machine learning algorithms (e.g. to identify certain crops in images)



What's next?

- Engage with (potential) users
- Develop a first prototype of the system
- Test in Ethiopia





52°impact



A MAXAR COMPANY



Unique expertise related to food security, political stability, satellite imagery, machine learning and crowdsourced analytics in one consortium



Q & A



CROWDS & MACHINES