FRONTEX

The power of informed decisions

Eurosur Fusion Services

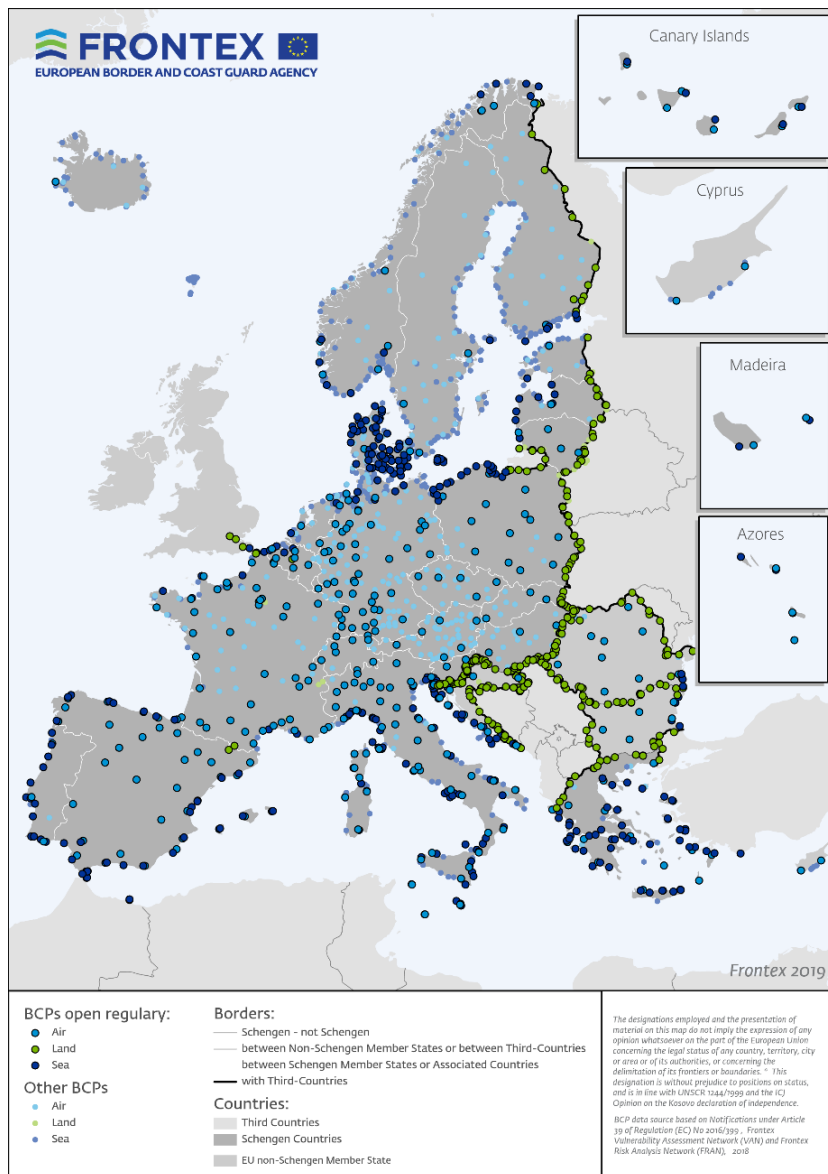Information Fusion Centre – Situational Awareness and Monitoring Division

Catarina Clemente

Senior GIS Analyst
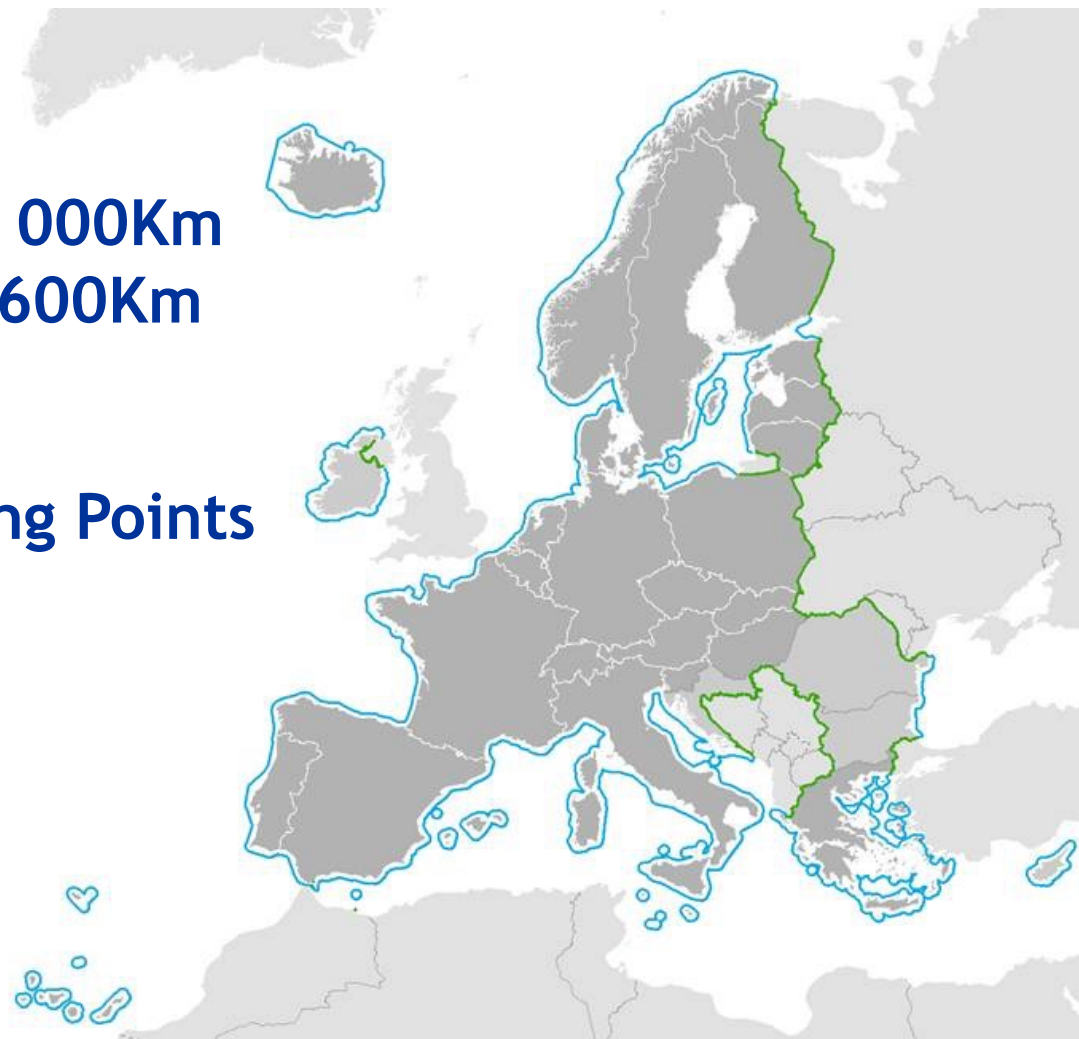
EUROPEAN BORDER AND COAST GUARD AGENCY

Together with the Member States, we ensure safe and well-functioning external borders providing security

EU/SAC External borders

Land ~10 000Km
Sea ~ 33 600Km

Border Crossing Points
Sea 710
Land 457
Air 608

THE AGENCY'S TASKS

GEOGRAPHIC INFORMATION SYSTEM
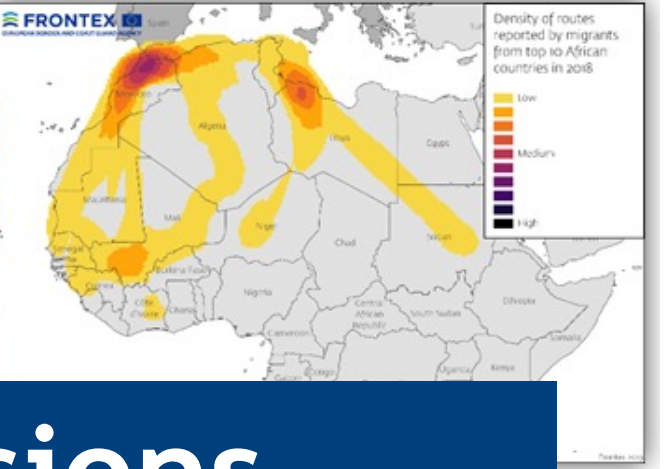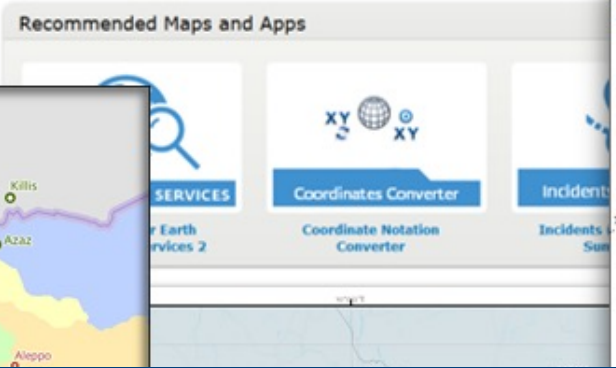
European Border and Coast Guard Agency

Coast Guard Functions

Training

Research and Innovation

Combatting cross-border crime

International and EU cooperation

Risk analysis and vulnerability assessment

Operations

Returns

Situation Monitoring

Respect for fundamental rights

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EUROPEAN BORDER AND COAST GUARD AGENCY

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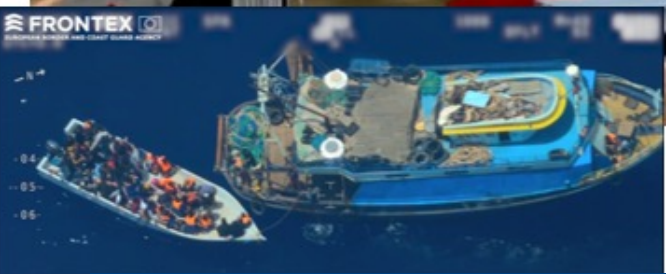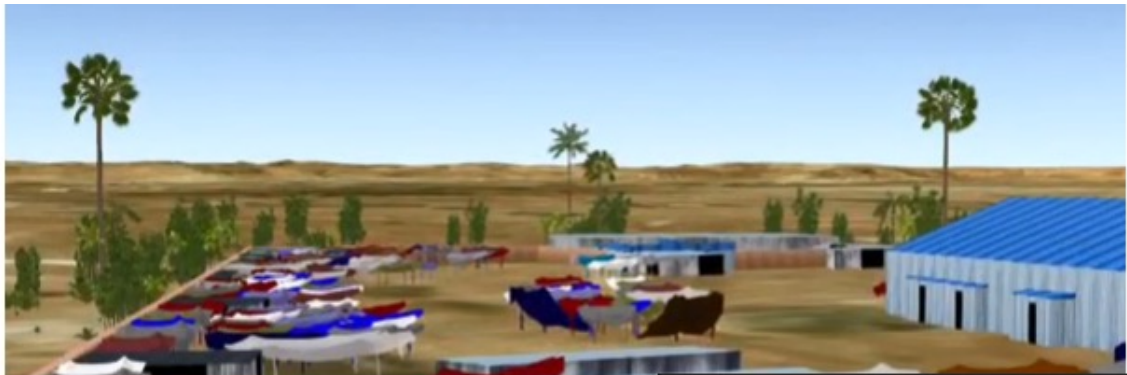
The power of informed decisions
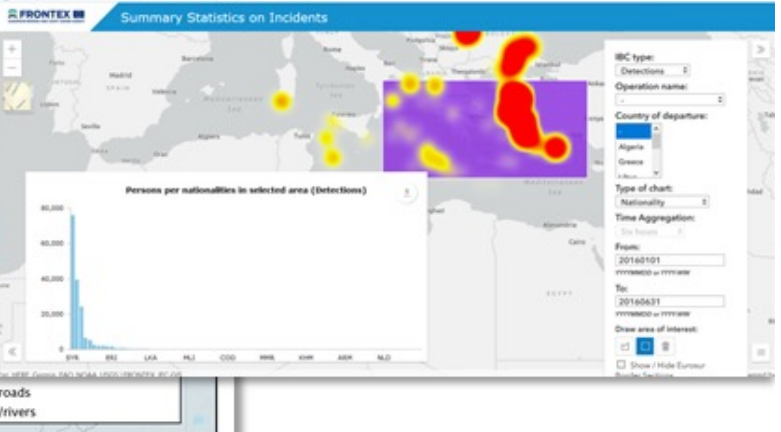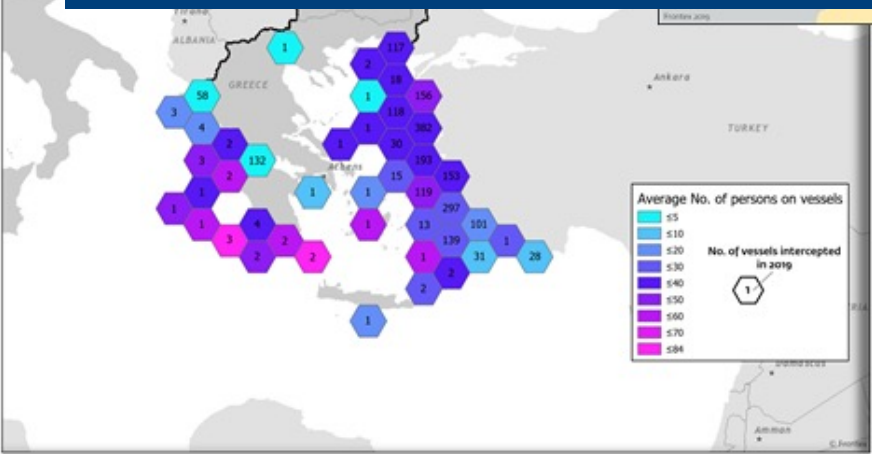
Geographic data required

Eurosur Fusion Services

Information Fusion Centre – Situational Awareness and Monitoring Division

Katalin Bódis

GIS Analyst

Data requirement and level of generalization depend on purposes

Main tasks where our customs data visualized and analysed

1. Various measurements and statistical evaluations based on the length and types of borders;

2. General mapping, visualization in small scale: continents, group of countries, regions;

3. Large scale mapping data for monitoring the external land borders:

4. Border section classification.

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EUROPEAN BORDER AND
COAST GUARD AGENCY

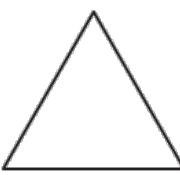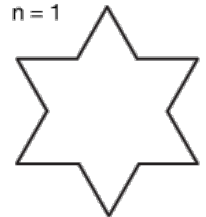# 1. Various measurements and statistical evaluations based on the length and types of country borders
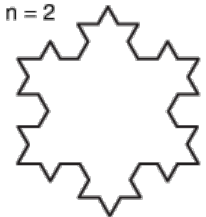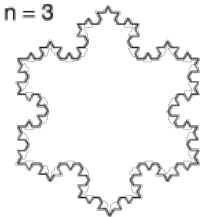
Data required:

Detailed border geometry:

- preferably *containing every single geodetic basepoint as a vertex* in the line.

1.1 An explanation: the **Coastline paradox**.

- Classic <u>theoretical</u> example: Koch snowflake.

	n = 0	n = 1	n = 2	n = 3
Number of sides (N)	3	12	48	192
Side length (S)	1	1/3	1/9	1/27
Perimeter length (P)	3	4	5.33	7.11

- Classic <u>practical</u> example: Coastline of Great Britain.

Length if measured by using

a) 100 km long units: ~ 2,800 km.
b) 50 km long units: ~ 3,400 km.

Difference:
approximately 600 km (~ 20 %) longer.

2. General mapping, visualization in small scale: continents, group of countries, regions

Data required:
Administrative boundaries: generalized but always expressing the actual political situation.

E.g.: Territorial disputes should be described.
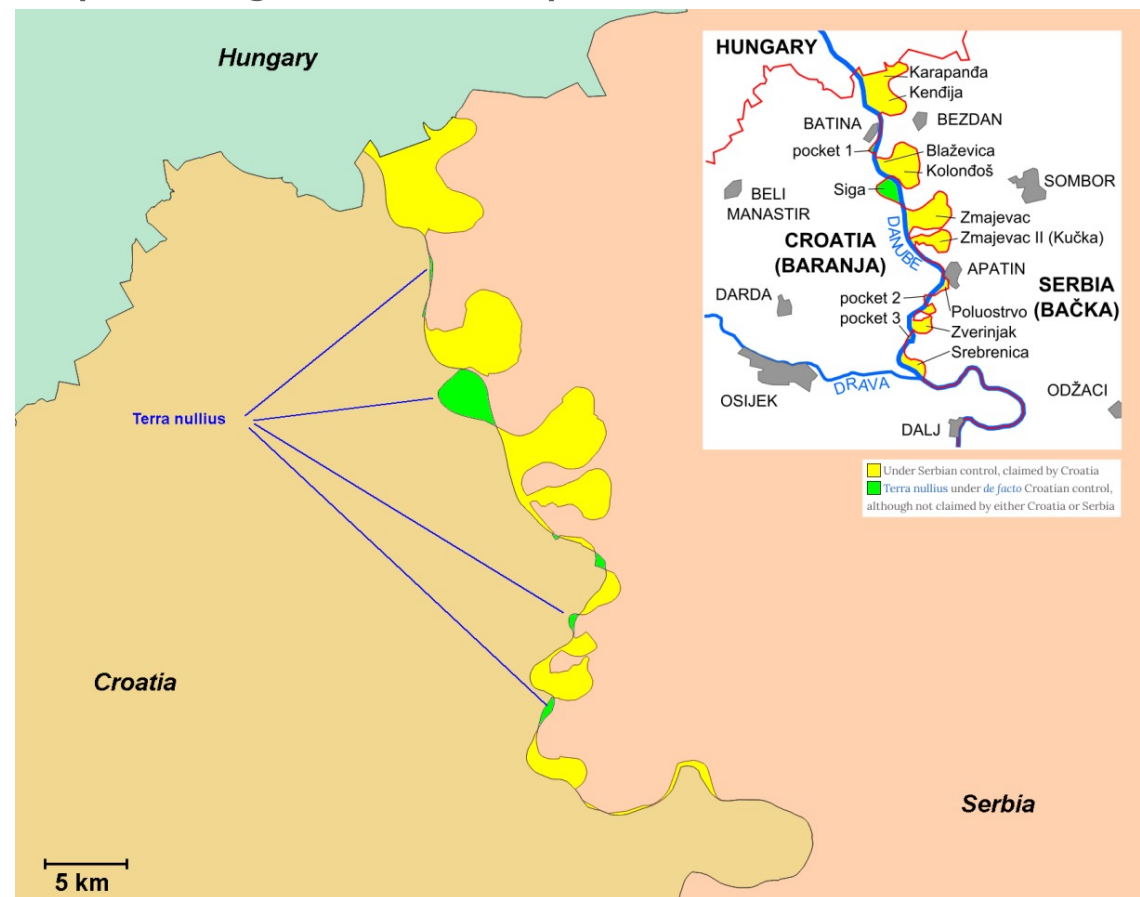
EU: Croatia and Serbia: the border is defined differently by the neighbouring countries.

Yellow areas are claimed by Croatia.
Serbia: Danube is the border.

2. General mapping, visualization in small scale: continents, group of countries, regions

Additional data required:
Transport infrastructure: main roads, railways, airports, harbours etc.
Hydrography: main water courses and water bodies
Settlements: administrative status, population

Specific thematic details that are spatially in harmony with the main map components:
- border crossing points
- industrial facilities

Proper toponyms: attribute should contain also the standardized geographical names.

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2. General mapping, visualization in small scale: continents, group of countries, regions

Reports; Presentations; Briefings; Operational support

- Management
- Support of Frontex
- EU Member States
- Other Agencies
- Support of Third Countries
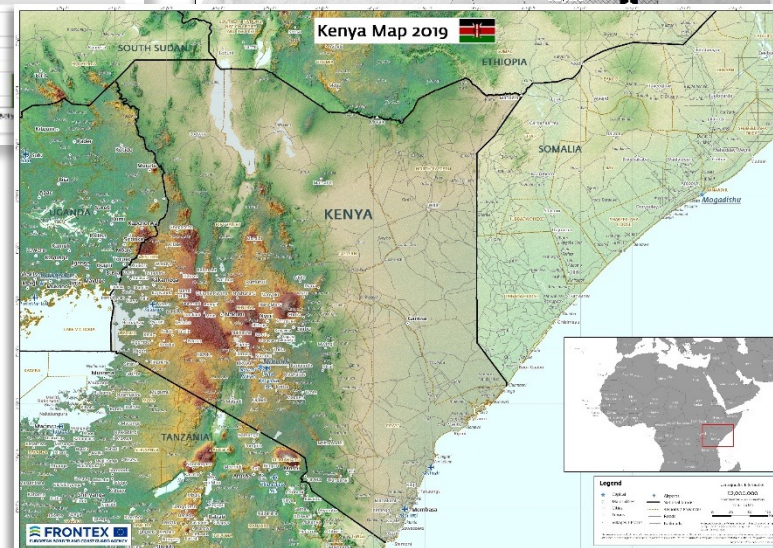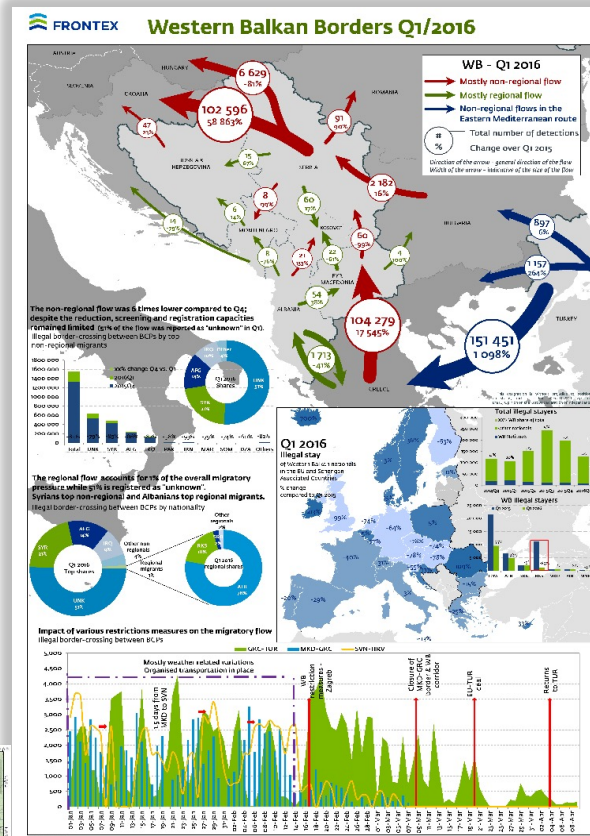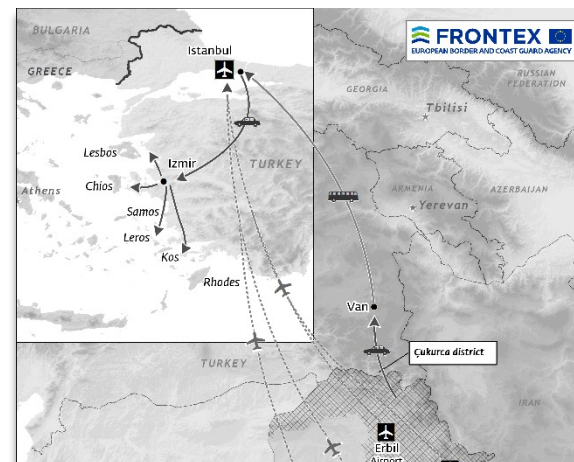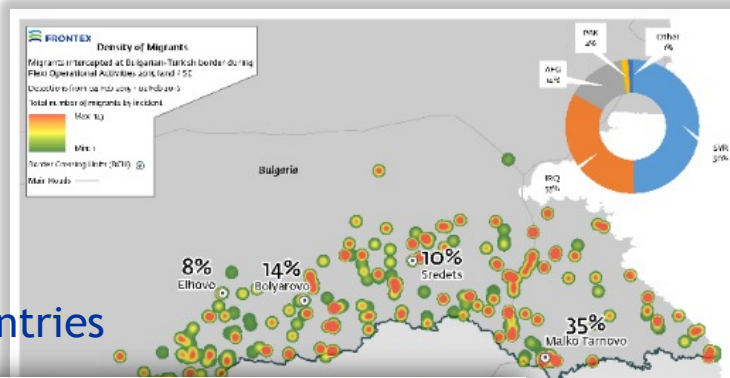
3. Large scale mapping data for monitoring the external land borders

Data required:
Administrative borders and detailed topographic content at the nominal scale 1:10,000.
EU/SAC external land borders,
Minimum 1 km, maximum 10 km border zone within the neighbouring countries.

Purpose:
Mapping additional observed/measured phenomena.

E.g.:
- Localization of incidents given by exact coordinates;
- Planning video surveillance systems;
- Mapping cross-border infrastructure.

250 m

Nominal scale: 1:10,000
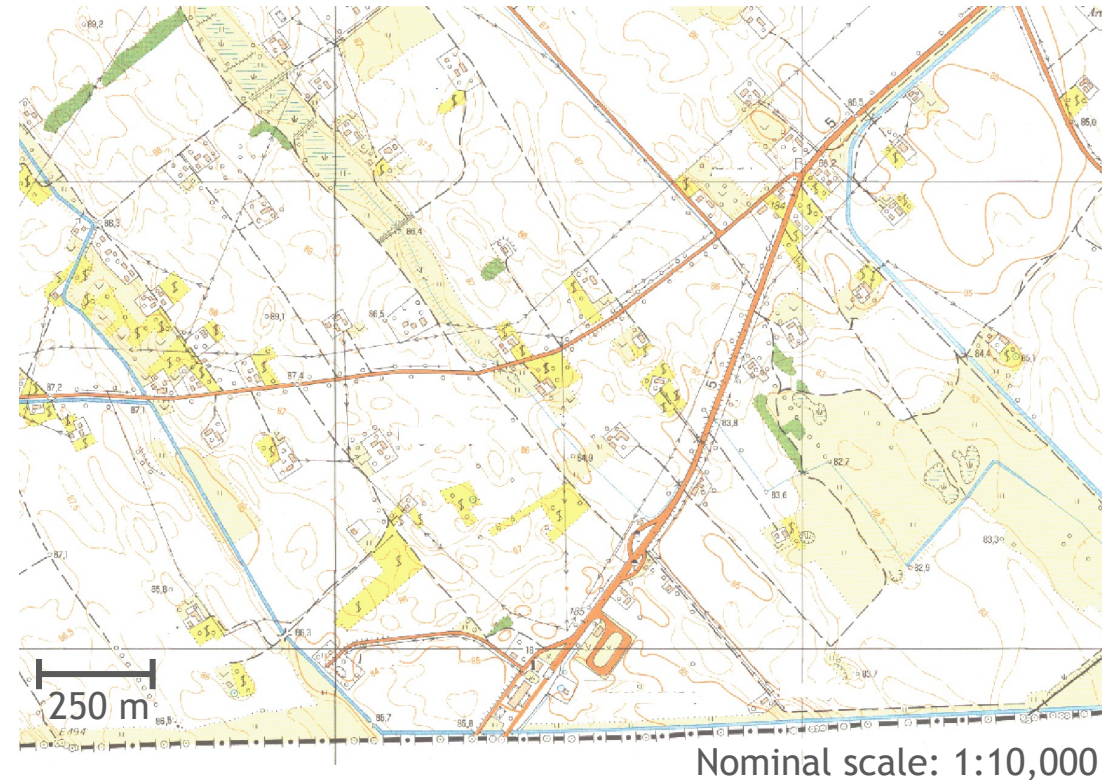
3. Large scale mapping data for monitoring the external land borders

Country borders from different sources

Border 1
Border 2
Border 3
Border 4

500 m

60 m

500 m
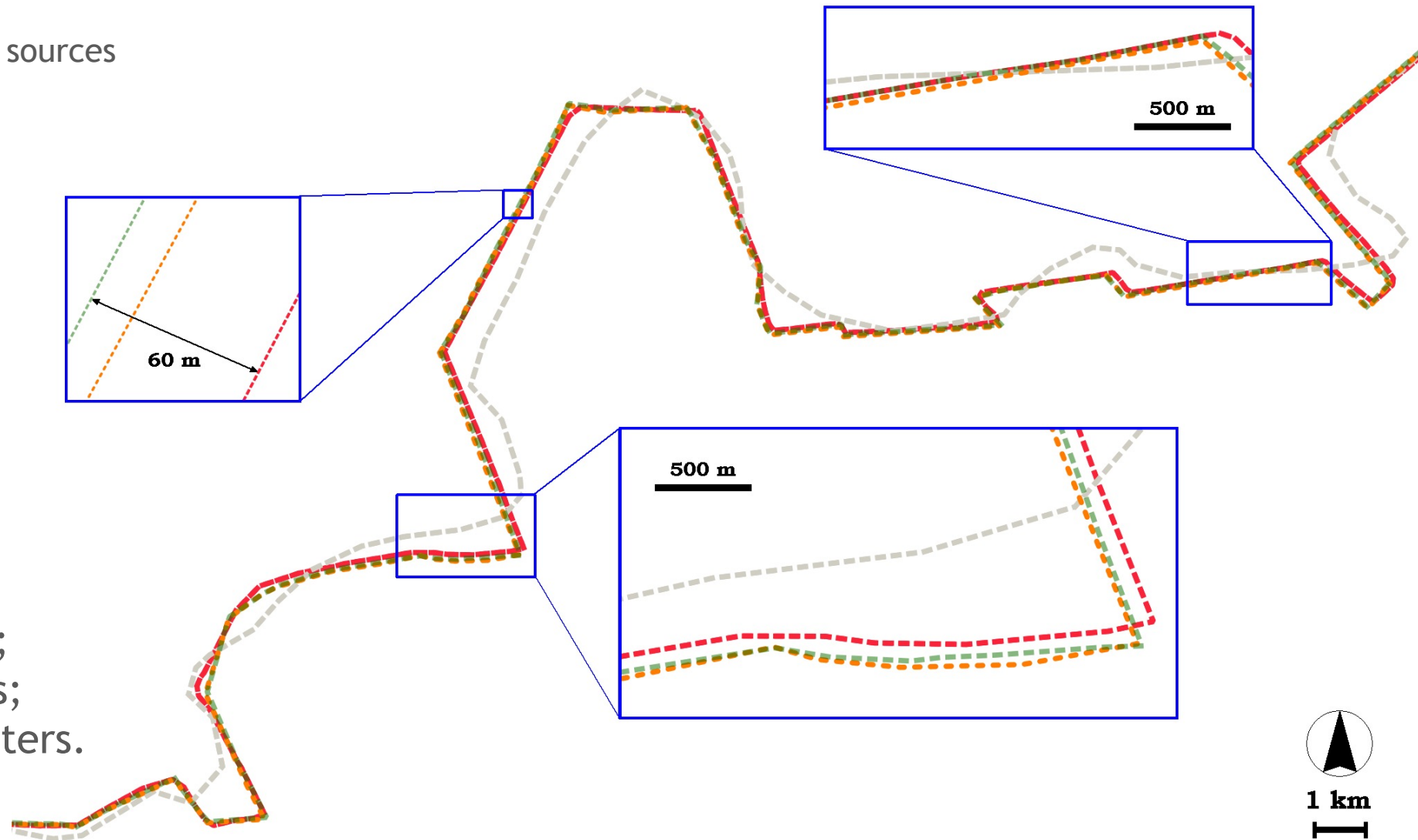
Task:
- Installation of cameras;
- Mapping hidden tunnels;
- Visualization illicit shelters.

1 km

3. Large scale mapping data for monitoring the external land borders

Photo: Police.hu

Photo: Police.hu

Country borders from different sources

Border 1
Border 2
Border 3
Border 4

Cameras

Tunnels

Shelters

250 m

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3. Large scale mapping data for monitoring the external land borders

Maps should be suitable for adding more details:
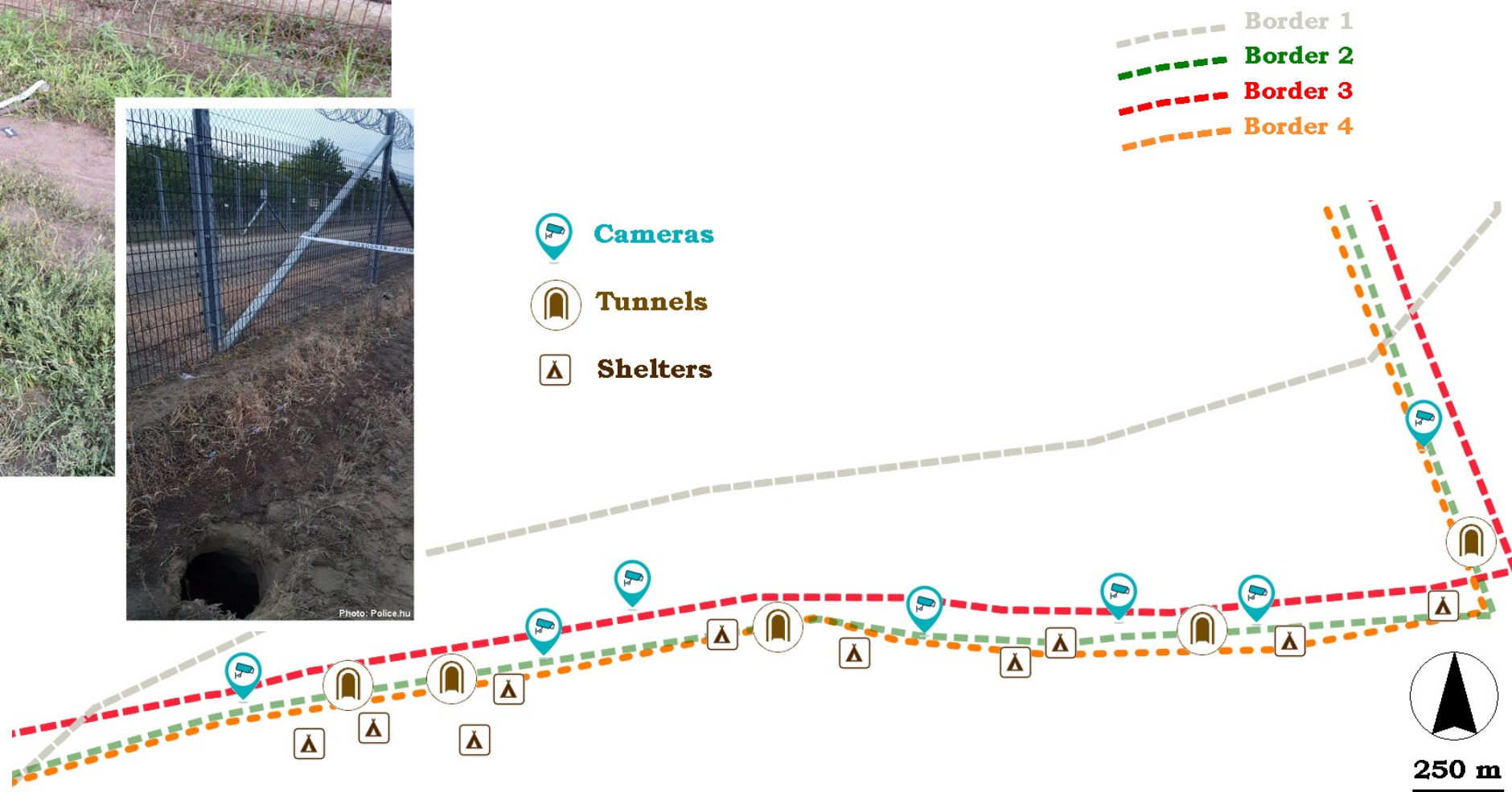
- *Detecting, mapping, monitoring and analysing land objects and human activities*
  - Localization of incidents given by exact coordinates;
  - Mapping ground and underground infrastructure might be used illicitly;
  - Identifying shelters, tracks, trails, changes in the landscape (e.g. soil disturbance, debris);
  - Surveying and mapping entry points of cross-border tunnels made for smuggling;
  - Tracing movements of vehicles, pedestrians;
  - Detecting, identifying, apprehending and removing individuals etc.

- *Design, installation, operation and maintenance of Surveillance Systems*
  - Planning fixed or mobile video surveillance systems;
  - Mapping Intelligent Signalling Systems;
  - Spatial distribution and coverage of smart camera systems, rangefinders;
  - Delineation of the network and range of different sensors etc.

- *Mapping characteristic land objects*
  - Transport infrastructures, linear objects and connected facilities;
  - Stations, towers, buildings, other landmarks;
  - Border control points etc.

- *Trend analysis, modelling and impact assessment*
  - Large scale mapping of observed phenomena;
  - Surveyed data merging with products of Imagery Intelligence at high resolution;
  - Decision support using Geospatial Intelligence.

4. Border section classification

1-10 km border zone both sides of the EU/SAC external border line.
Complex methodology;
Classification can change by time, even seasonally.

Most of the thematic components are covered by the **Copernicus program**.

Marine   Atmosphere   Land   Security   Emergency   Climate

4. Border section classification

4.1 Digital Elevation Models (DEM) - various sources and spatial resolution:
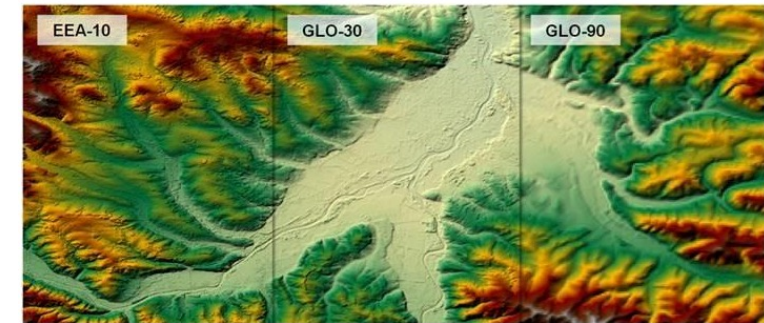- SRTM-based products: ~ 100 m;
- EU-DEM 1.0, 1.1: 25 m;
- COP-DEM: 10 m EU, 30 m, 90 m Global.

Additional data required:
For terrain modelling, a derived product without vegetation canopy would be useful.

Specific areas / quick measurements:
- Lidar survey
- Drone-based geometrically calibrated camera: Digital Terrain Model
- 3D building models

Copernicus DEM data at the three available spatial resolutions: 10m (left), 30m (centre) and 90m (right)
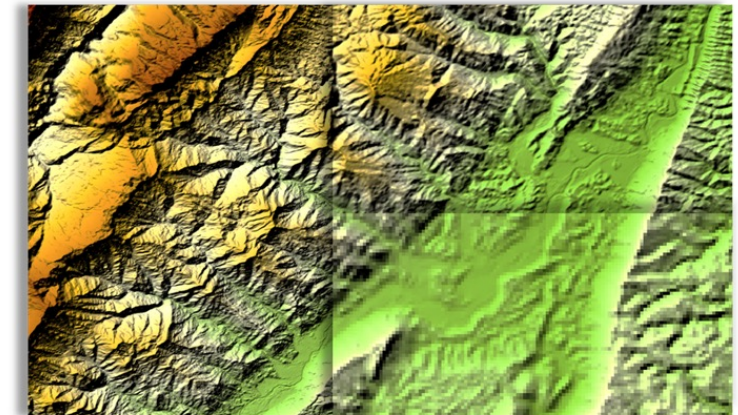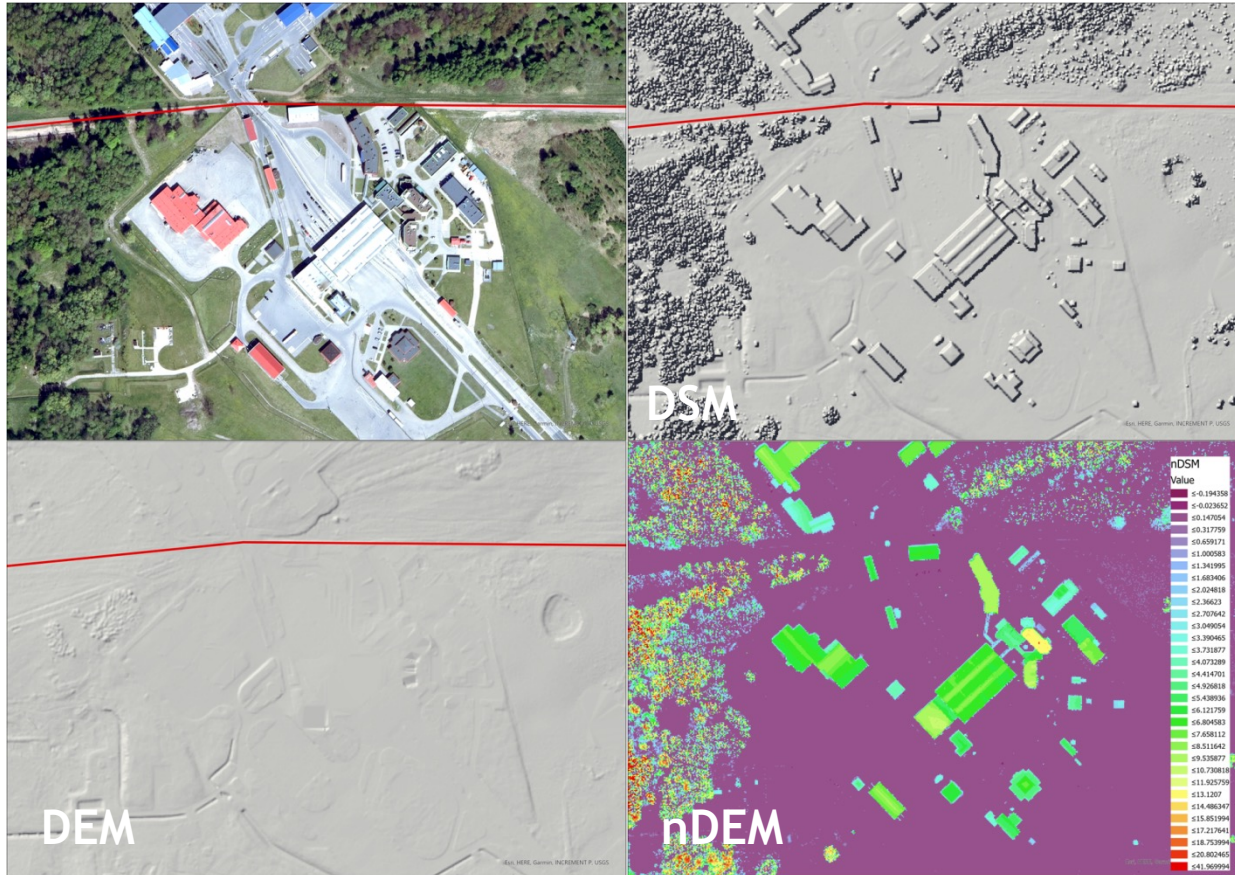

Copernicus DEM Instances EEA-10 (left), GLO-30 (upper right) and GLO-90 (lower right)
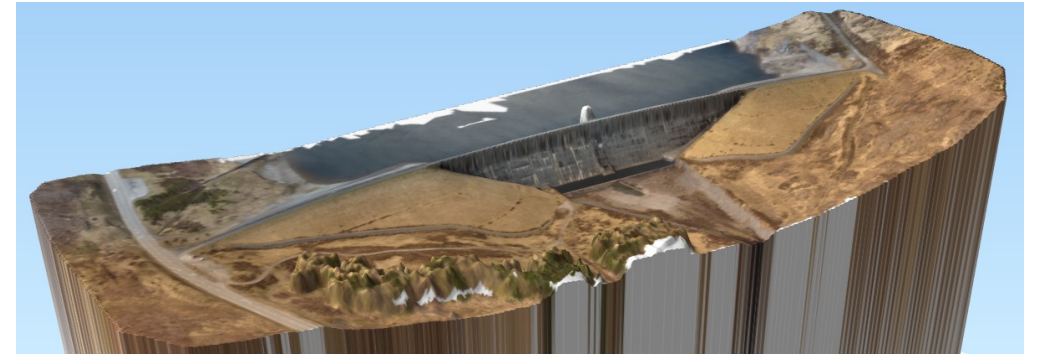
Source: Copernicus

4. Border section classification

4.1 DEM, specific needs, Lidar, Drone-based DSM, 3D models: locations, capacity, conditions

Source: Lidar survey, Bałazy, R.
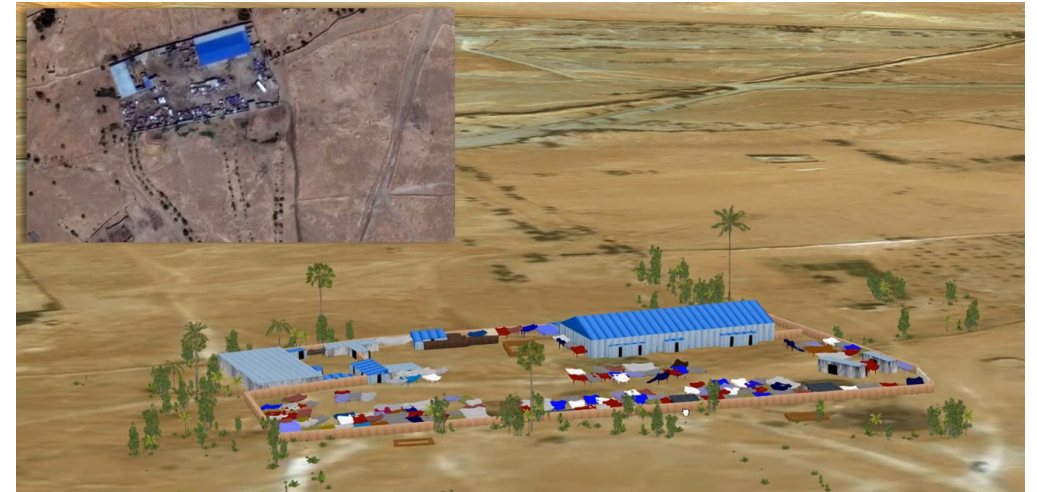
Credit: Barton, G.

4. Border section classification

4.2 Hydrography of the border zone

Data required:
Detailed geometry of water courses and water bodies with describing attributes.

- Physical characteristics of the rivers and lakes;

- River shoreline character type;

- Hydro-meteorological characters (length of ice cover, length of flooding period);

- Artificial water surfaces (reservoirs, canals);

- Connected infrastructure (power plants, dikes, bridges, embankments etc.).

4. Border section classification

4.2 Hydrography of the border zone: River shoreline character type

Danube, HU

Danube, CR-SR border

Maritsa/Evros/Meriç, GR-TR border

Haapajoki, FI-RU border

4. Border section classification

4.3 Land cover
- Copernicus Land Cover data sets are available in 100 m resolution (Europe, Global).
- Seasonal changes would be interesting for border characterisation.

Croplands (pink)

Cropland with and without vegetation

Furrows in the field

Arable land on a slope

Abandoned crops

Maize field

Deep furrows in the field

Frozen, snowy surface

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EUROPEAN BORDER AND
COAST GUARD AGENCY

4. Border section classification

4.4 Settlements and population

Harmonized data sets <u>are available</u>:

- European Settlement Map (ESM),
    Reference year 2015. Built-up areas at a spatial resolution of 2 m.
- Global Human Settlement Layer (GHSL),
    Humanity's imprint as of 2018 at a spatial resolution of 10 m.
- GHS Population Grid (GHS-POP),
    Multitemporal (1975, 1990, 2000, 2015), 250 m, 1 km.

Additional information:
    Demography, demographic transition and settlement structure of specific AOI.

4. Border section classification

4.5 Transport infrastructure

<u>Data required:</u>
In addition to the main road network, a detailed, structured and harmonized data sets of tracks, trails, fords, check points etc., preferable in topological data model.

Currently: ArcGIS StreetMap Premium and Open Street Map repository.

Policy view

Sources, updates, data access

<u>Sources</u> can be open access or commercial data provider, if the content is verified.

Good experiences with dynamically developing Volunteered Geographic Information (VGI):
  Reliable content and quick access.

<u>Required frequency of updates:</u>
We need the latest data describing **always the current situation**.

<u>Data access:</u>
Due to ICT security restrictions and the mapping and analytical demands of Frontex, the data sets are preferably available in-house after download.