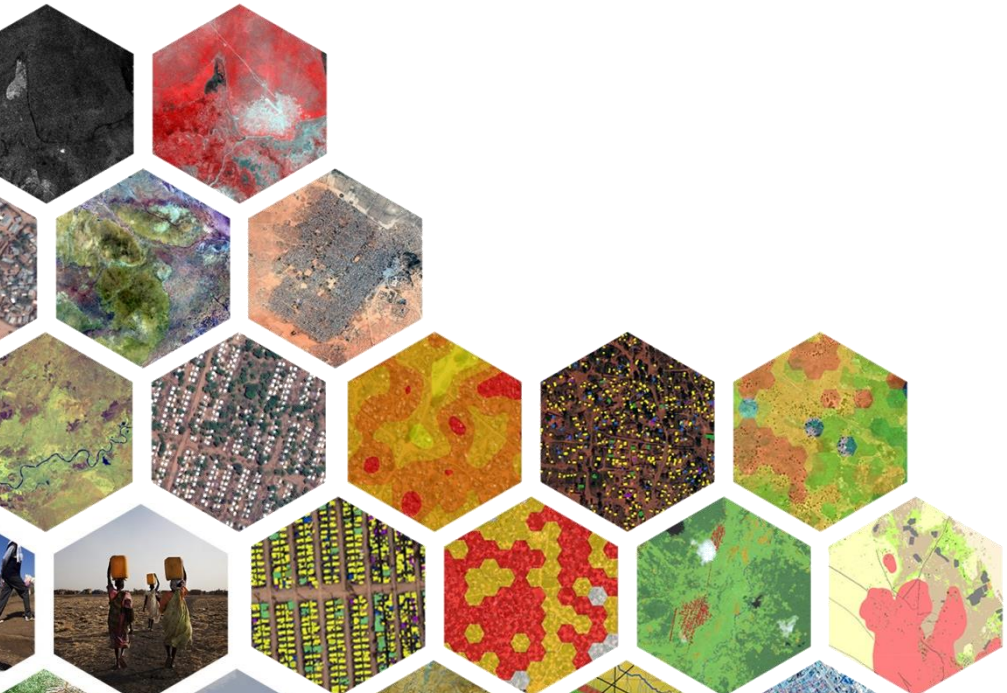
EO4HumEn

EO-based services to support humanitarian operations:
monitoring population and natural resources in refugee/IDP camps

How satellites can help to save lives
Vienna, Austria
23 February 2016

EO-based services to support humanitarian operations: monitoring population and natural resources in refugee/IDP camps



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UNIVERSITY of SALZBURG Z_GIS

FFG bmvit Bundesministerium für Verkehr, Innovation und Technologie

The EO4HumEn Project

- Support humanitarian operations by geospatial information products
  - Cooperation of University of Salzburg (Dep. of Geoinformatics - Z_GIS, Dep. of Geography and Geology), MSF Austria, University Tübingen (Dep. of Geography)
  - Oct 2013 – March 2016

- ‚Operational' service for refugee/IDP camps

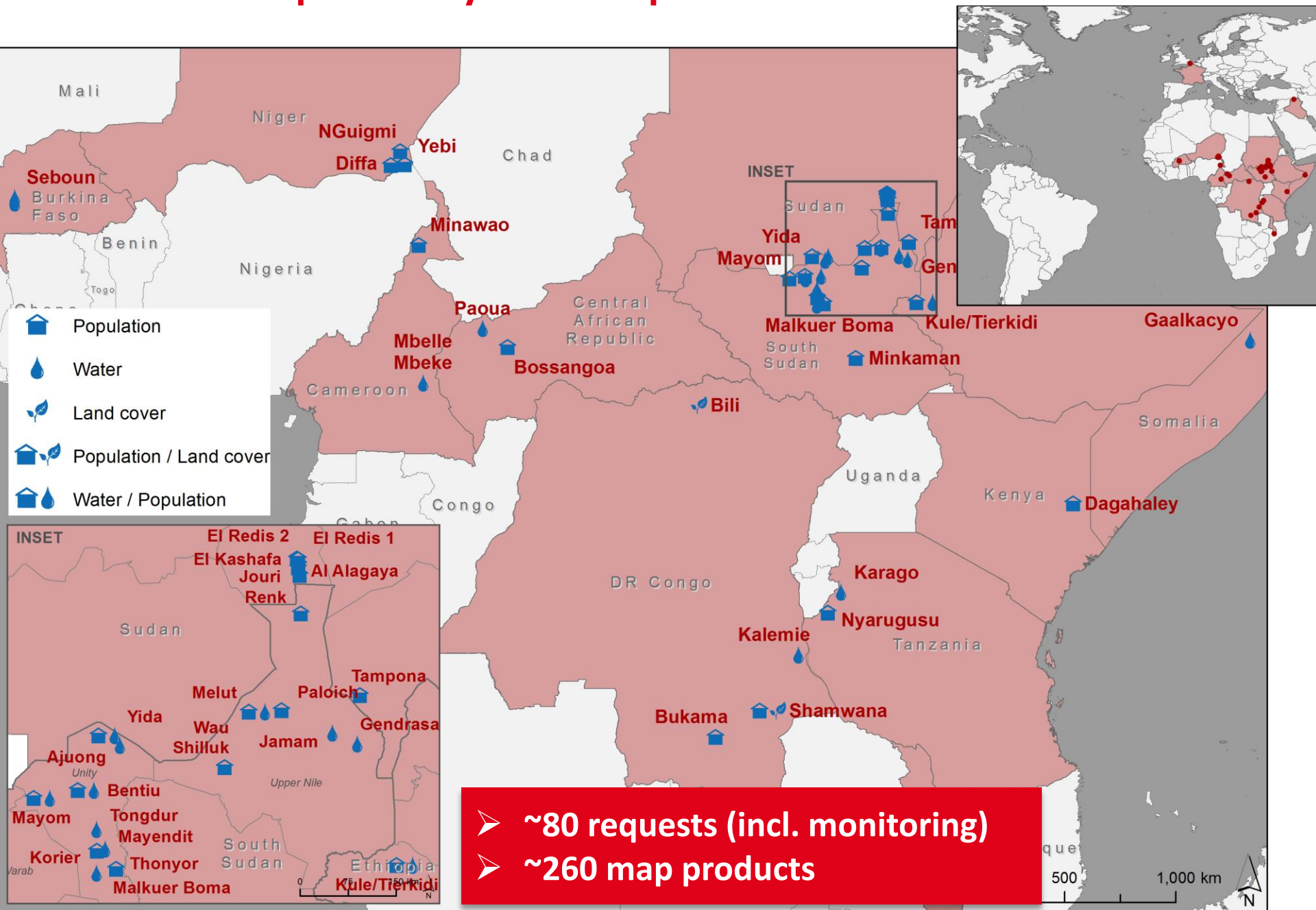
Population monitoring
supported by Karl Kahane Foundation since 2012,
further developments within EO4HumEn

- In development

Groundwater exploration

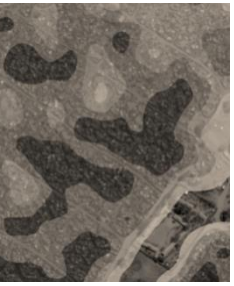
Environmental impact assessment

Information requests July 2011 – April 2015



- ~80 requests (incl. monitoring)
- ~260 map products

Population monitoring

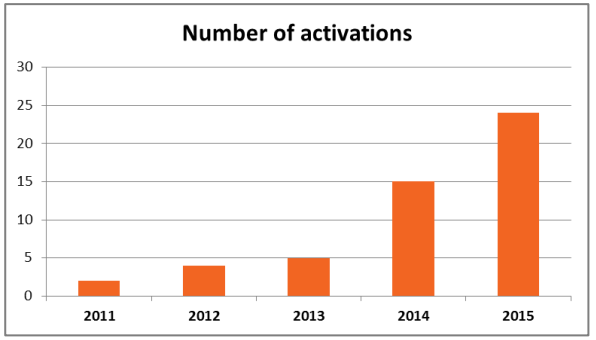


Population monitoring

- **Amount** and **spatial distribution** of different **dwelling types** in refugee/IDP camps based on **VHR satellite data**
- Initial research started in 2006
- 50 requests (~130 maps) in 12 countries since 2011, including regular monitoring
- Applied under various situations
  - MSF not yet on site
  - Camps in the setup phase (highly dynamic)
  - Semi-permanent camps, but still spontaneous influx

Peter Biro/IRC

MEDECINS SANS FRONTIERES
DOCTORS WITHOUT BORDERS



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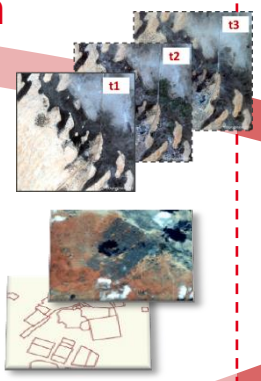
EO-based camp population monitoring

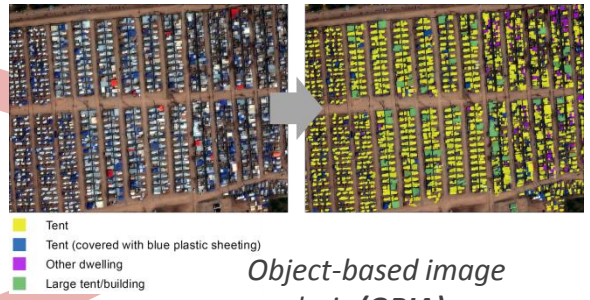
❶ User request

❷ Data integration

- (Multi-temporal) very high-resolution satellite imagery (orthorectified, pansharpened)
- Camp zoning, camp block information, camp infrastructure etc. [if available]



❸ Dwelling extraction

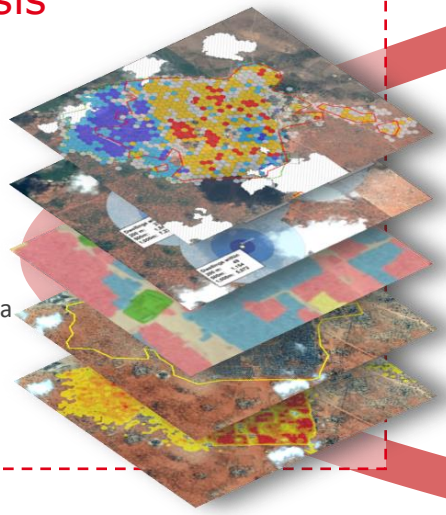


*Object-based image analysis **(OBIA)***

- different dwelling types

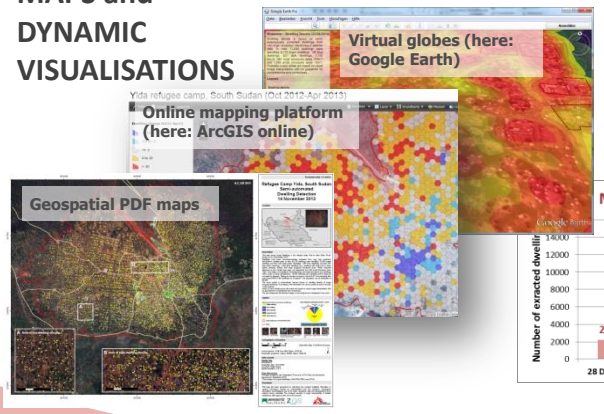
❹ Spatial analysis

- Dwelling density
- Camp outline
- Camp structure (e.g. based on distribution of different dwelling types)
- Distance analysis (e.g. amount of dwellings within a certain distance of latrines)
- Dwelling change (for multi-temporal data)



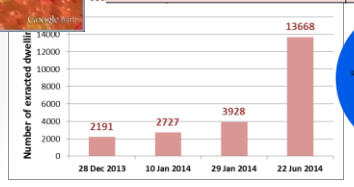
❺ Information delivery

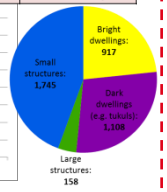
MAPS and DYNAMIC VISUALISATIONS



FIGURES and GRAPHS

		tukul	tent
Automatically extracted dwelling structures	Number of dwellings	7,670	5,687
	Total dwellings	13,357	
Population estimation	Scenario I	45,758	
	Scenario II	51,445	
	Scenario III	64,802	
Population figures from SpRC		>= 50,000	

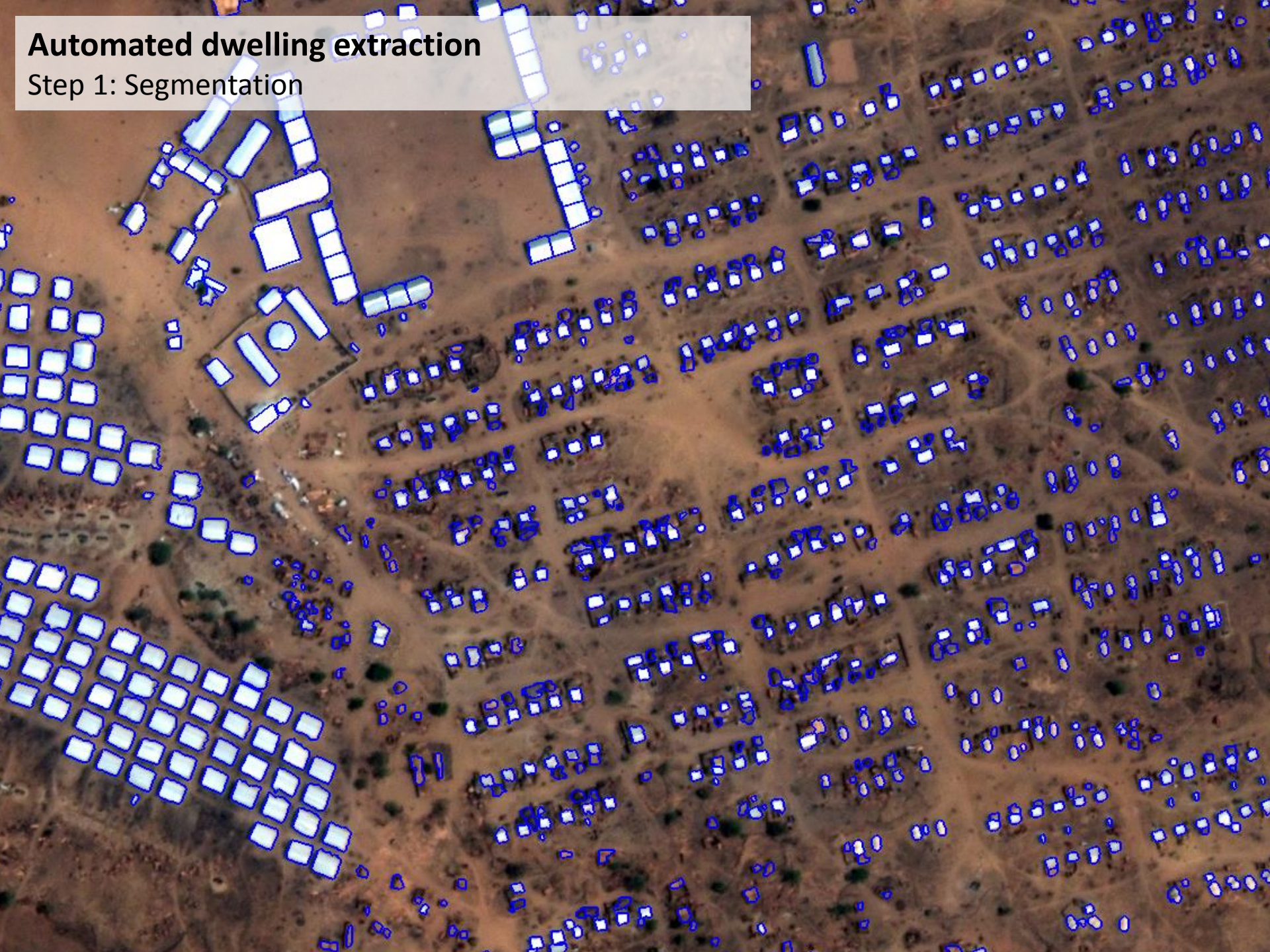




Integrated workflow for information delivery

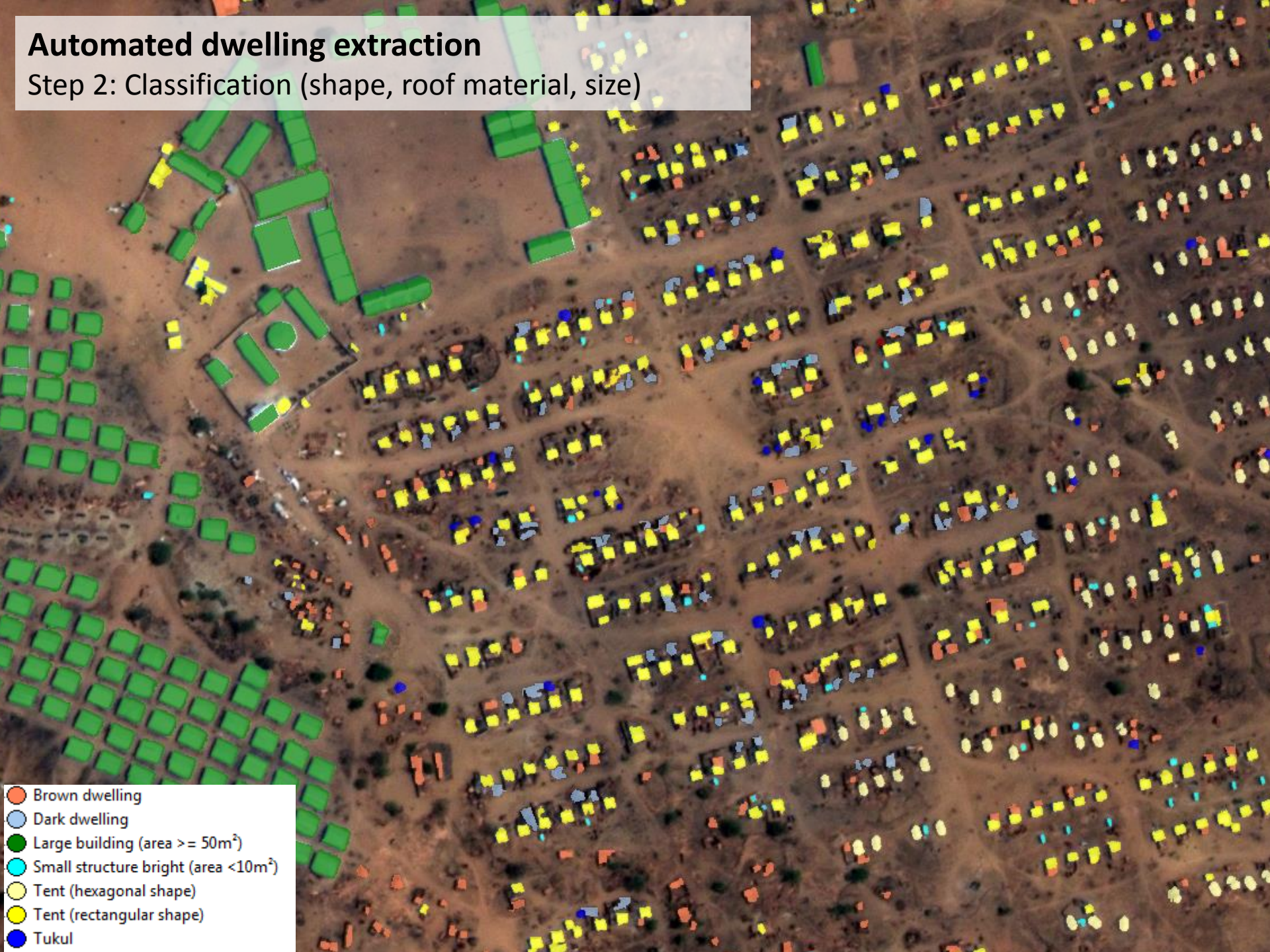
Up-to-date and custom-tailored information products

Automated dwelling extraction
reduce work effort for large camps or monitoring tasks

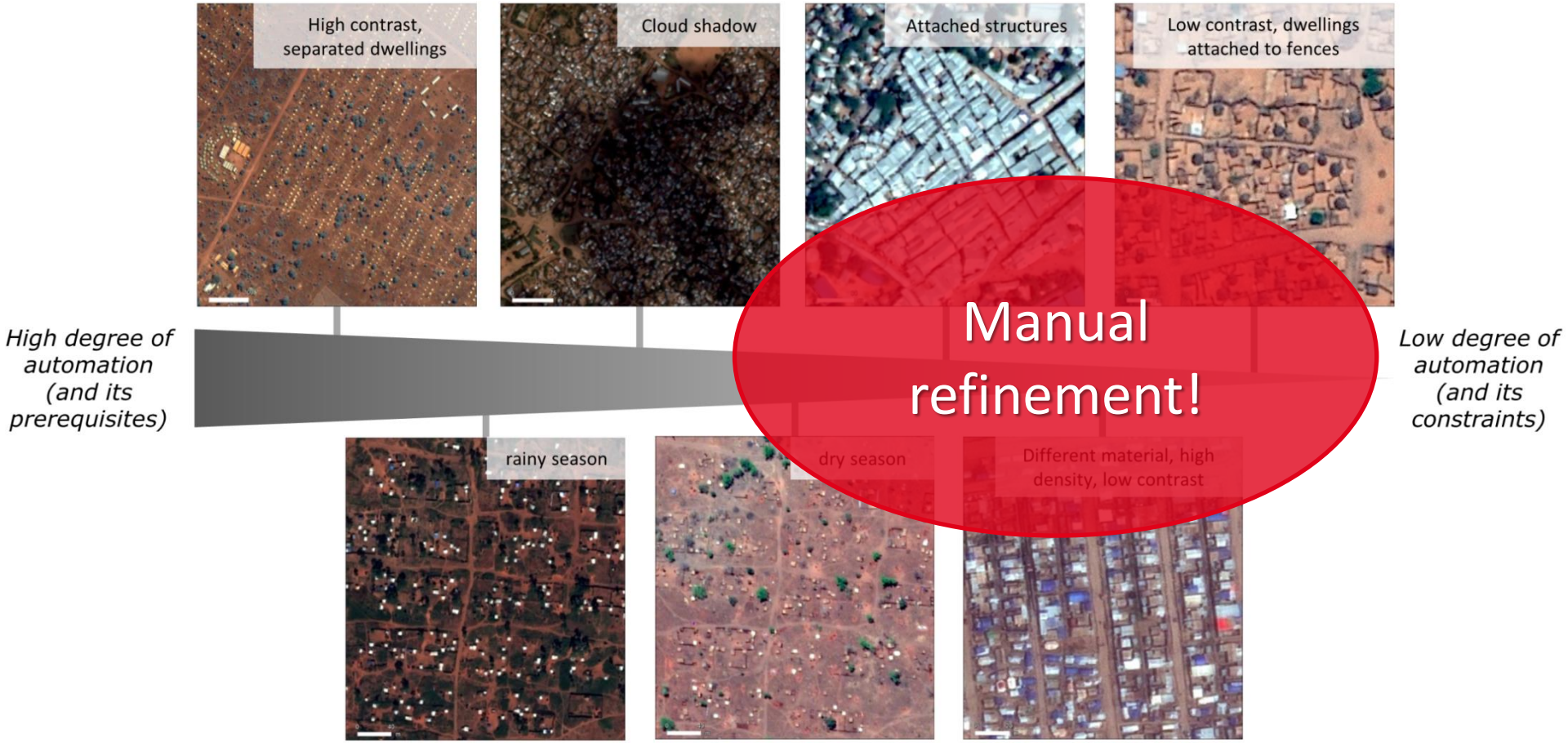

Automated dwelling extraction
Step 1: Segmentation

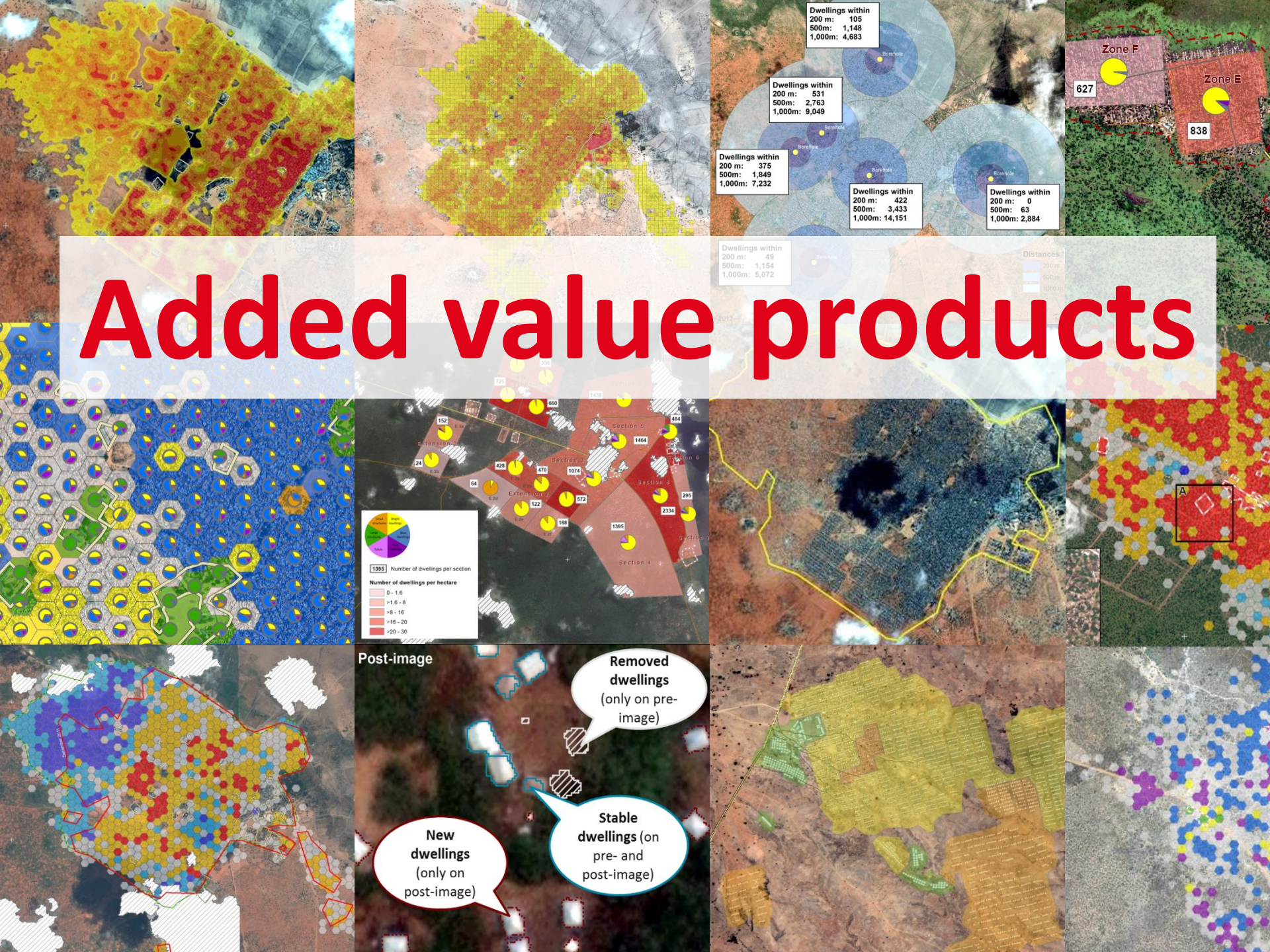
Automated dwelling extraction

Step 2: Classification (shape, roof material, size)



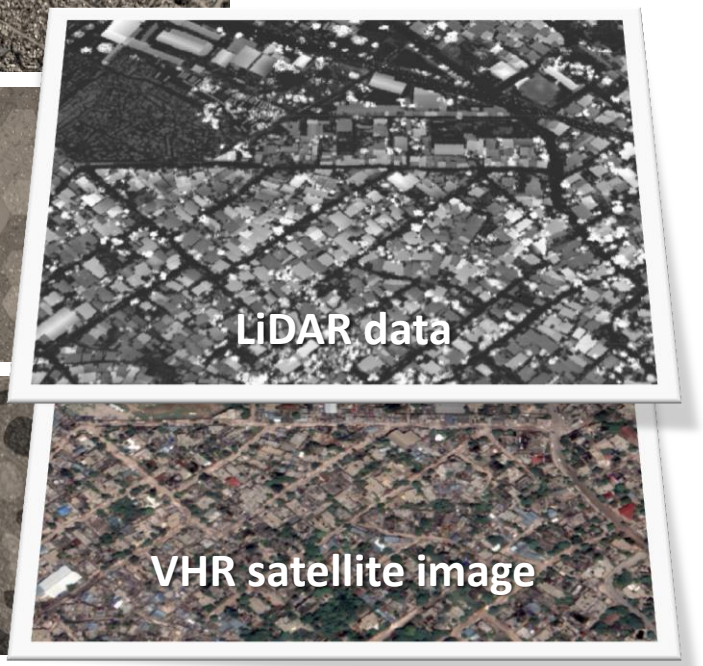
Robustness and degree of automation





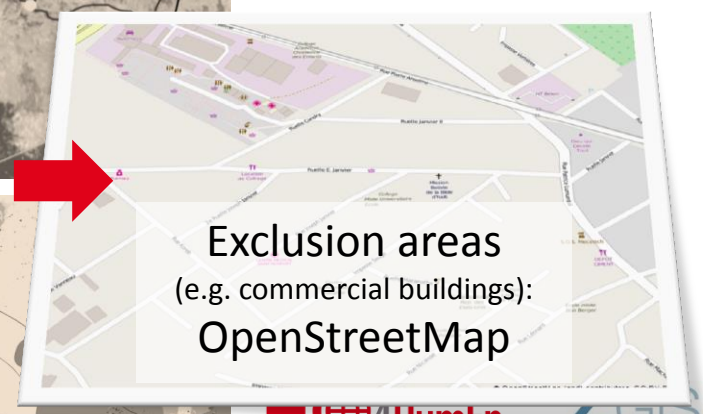
Added value products

Population estimation in urban areas



3D built-up area

Single buildings (average building footprint)



MEDECINS SANS FRONTIERES
DOCTORS WITHOUT BORDERS

Storey height

16%: 1 family/storey
65%: 4-6 families/building
10%: no residential
9% : 1 family/building
40%: 1- 2 persons/family
60%: 3.47 persons/family

Number of households per building

Average family size

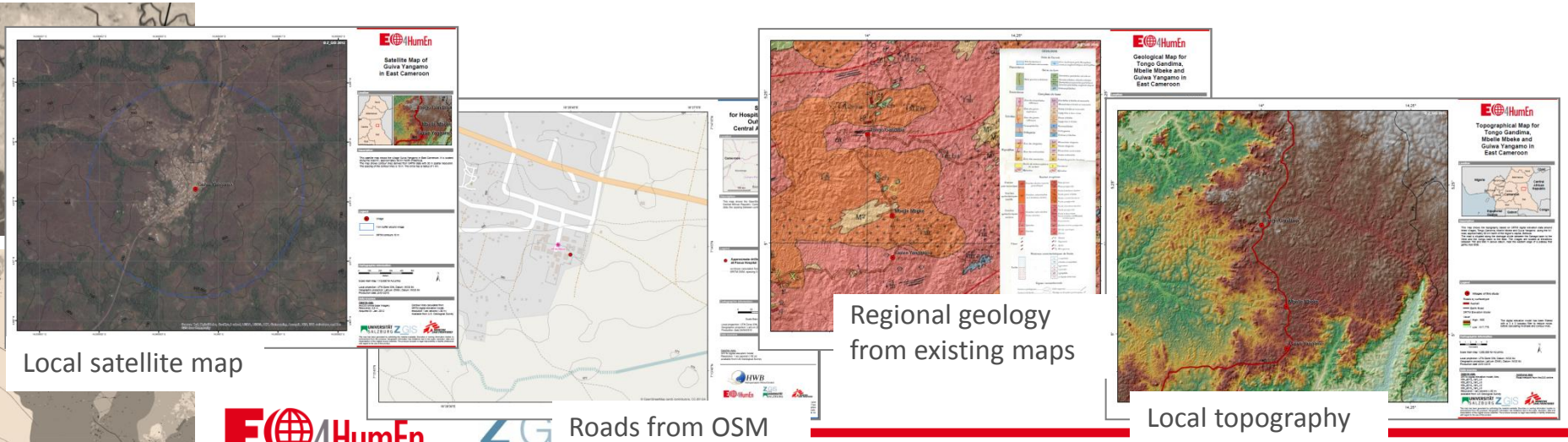
Groundwater exploration

Groundwater exploration

- Aim: support drinking water supply in refugee/IDP camps
  - Remote sensing data analysis can provide information on local hydrogeology
  - Close cooperation with field work essential
    → cooperation with *Hydrogeologists without Borders UK* (HWB-UK)

HWB
Hydrogeologists Without Borders

- 7 requests in 7 countries at 15 sites, 52 maps



Local satellite map

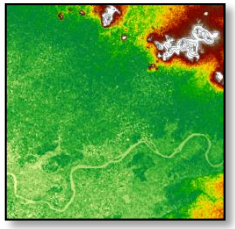
Roads from OSM

Regional geology from existing maps

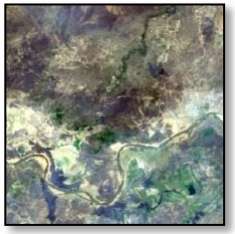
Local topography

Hydrogeological Mapping

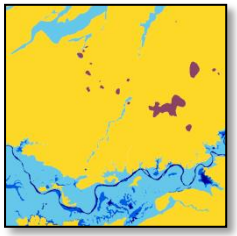
Digital Elevation Model



Satellite Imagery

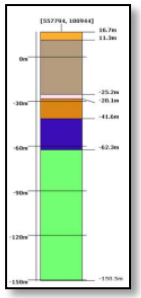


Satellite-derived geological map

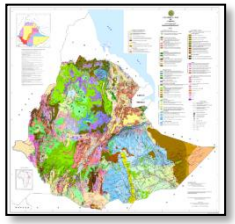


Road network

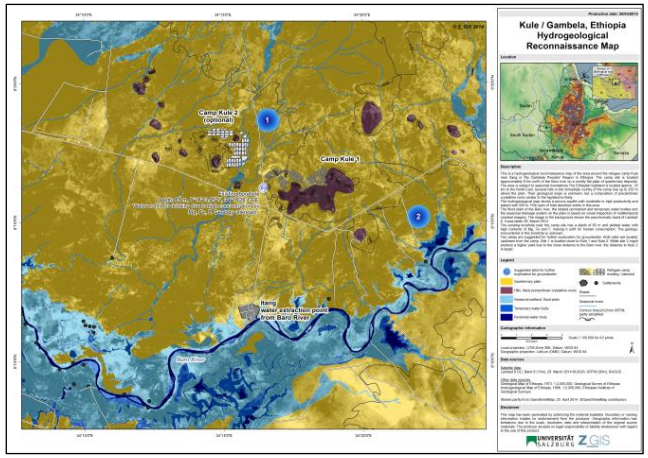
Available borehole data



Available geological maps



Hydrogeological Reconnaissance Map



+ Expert evaluation

Benefits

- reduced field work
- overview to pre-existing knowledge
- locations of potential drilling sites, or
- recommendations for further investigations

EO4HumEn ZGIS

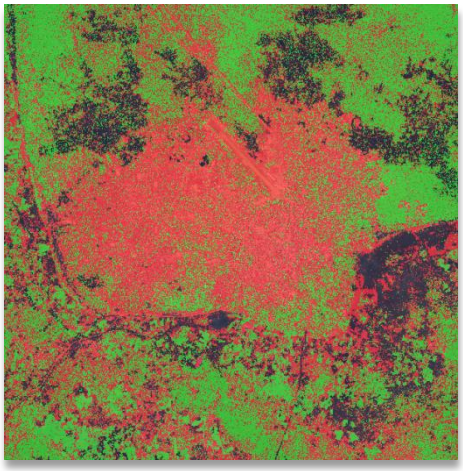
Environmental Impact Assessment

Environmental Impact Assessment

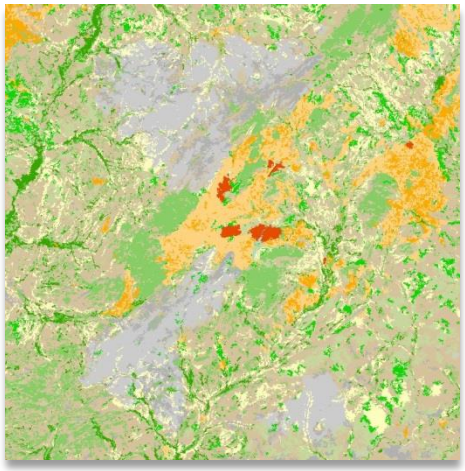
- Multi-temporal HR/VHR optical satellite data
- 3-stage approach

8 sites, 53 maps

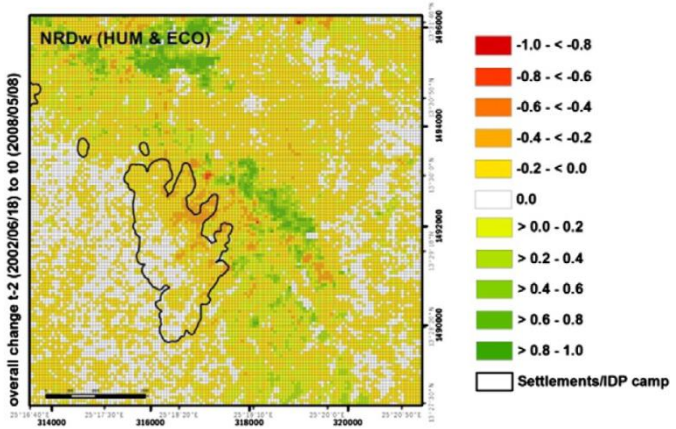
1.stage: Vegetation mask (+ change)



2.stage: Detailed analysis of land use / land cover (+ change)

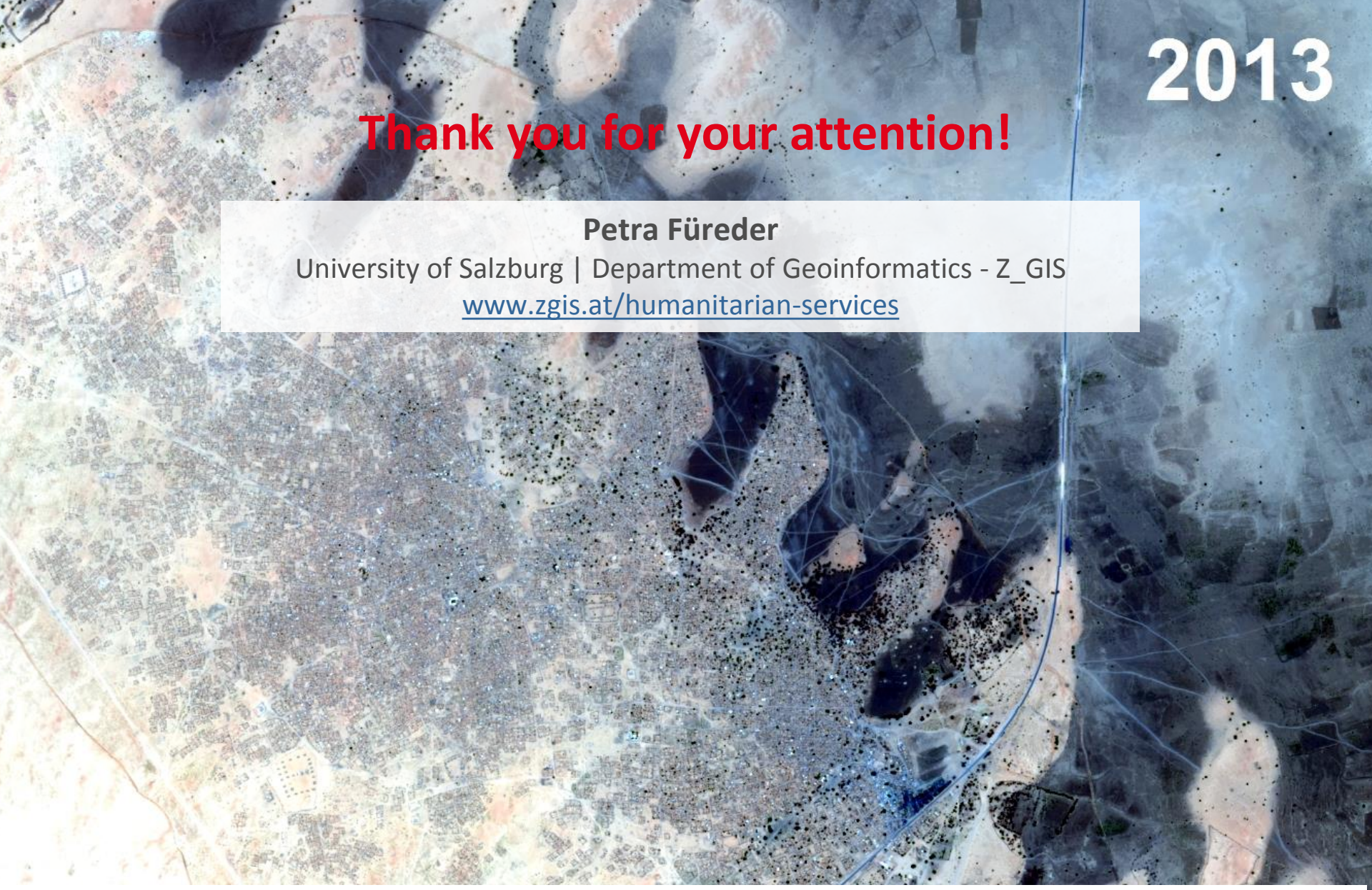


3.stage: Evaluation of impact on human well-being and ecosystem integrity



Degree of automation

Degree of expert input



Thank you for your attention!

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www.zgis.at/humanitarian-services

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FFG

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MEDECINS SANS FRONTIERES
ÄRZTE OHNE GRENZEN

KAHANE FOUNDATION