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GIS and satellite remote sensing to support humanitarian action

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Z GIS

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Refugee camp analysis and mission support

Population, water, environment

Long-term collaboration Z_GIS – MSF-AT

- 2008: participation at **exhibition** “Leben auf der Flucht”
- 2010: preparation of **Cooperation Agreement** (MoU)
- 2011 [ongoing]: **Operational services** for application of “*population monitoring tool*”, “*water exploration tool*” (funded by private foundation)
- 2013: Collaborative R&D Project **EO4HumEn** (funded by Austrian Space Applications Programme, ASAP-9, 2013-2016)

EO4HumEn

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

Z_GIS

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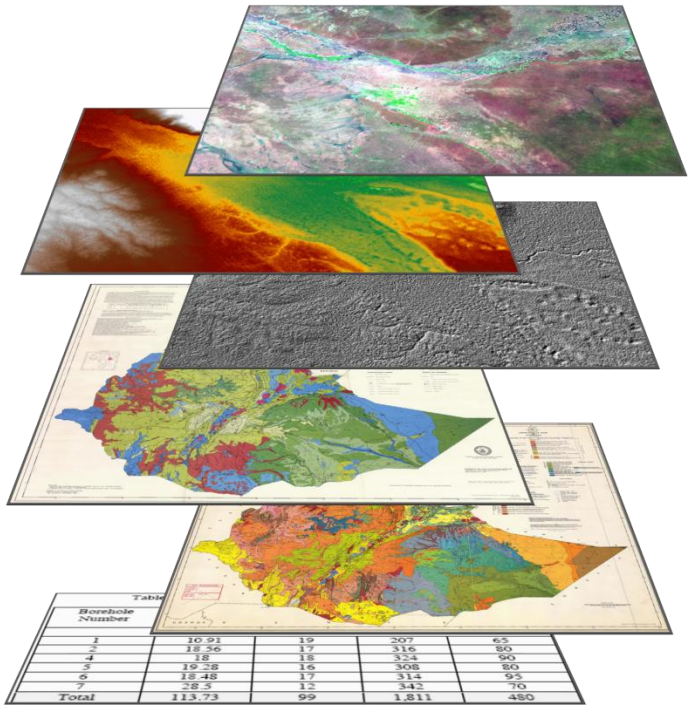
What is GIS and why are we using it?

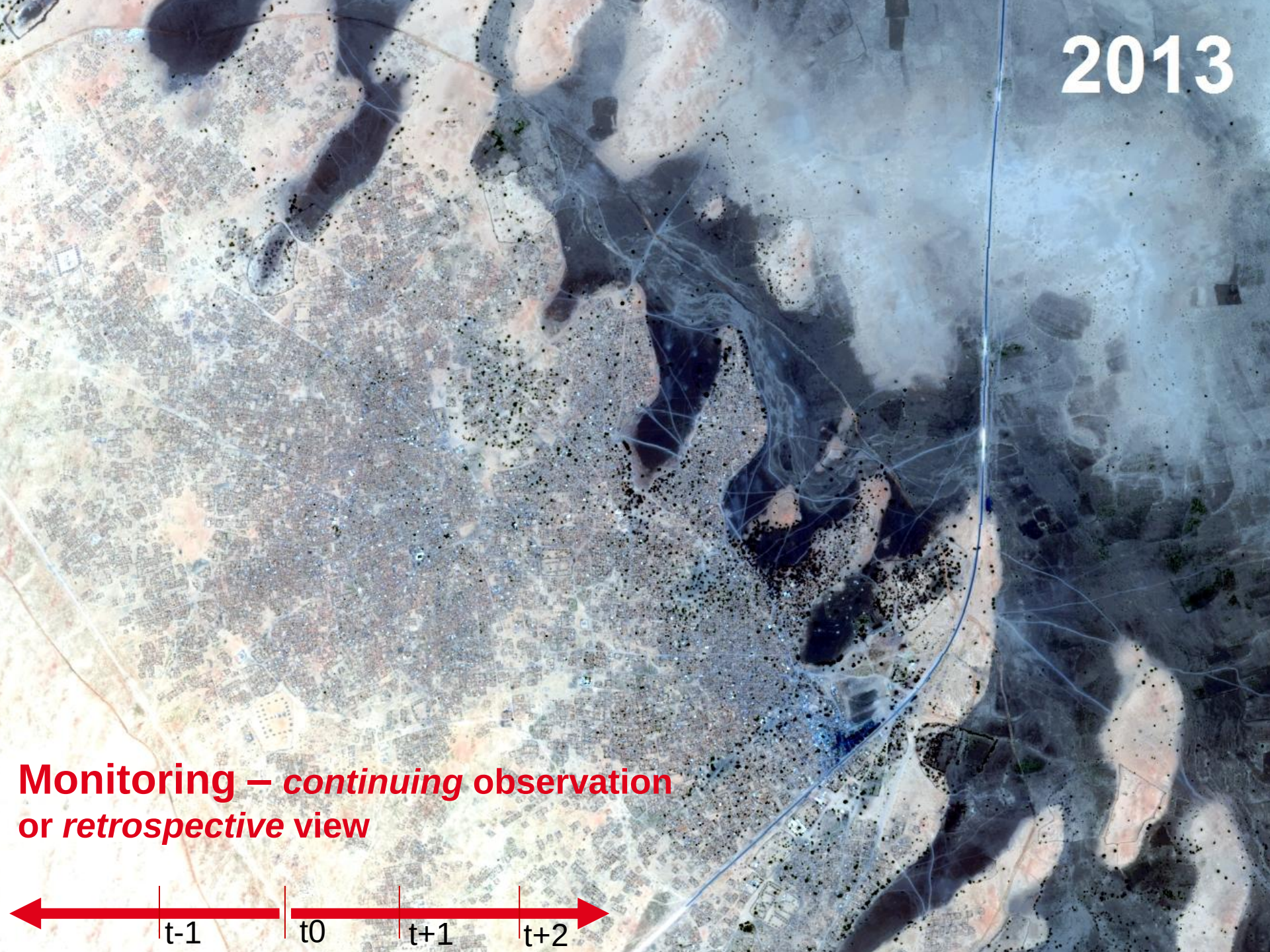
- A geographic information system (GIS) integrates hardware, software, and data for capturing, **managing**, **analyzing**, and **displaying** all forms of **geographically referenced** information.
- GIS allows us to **view**, **understand**, **question**, **interpret**, and **visualize** data as **maps**, **globes**, **reports**, and **charts**.

(www.esri.com)

- Aim: To derive **new information and support decision** by integrating data and performing spatial analysis



ZGIS


2013
Monitoring – *continuing* observation
or *retrospective* view
t-1
t0
t+1
t+2

What can we see on a satellite image?

tents

camp facilities

huts

fences

trees/bushes

agriculture

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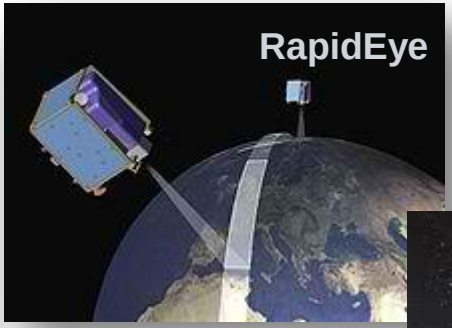
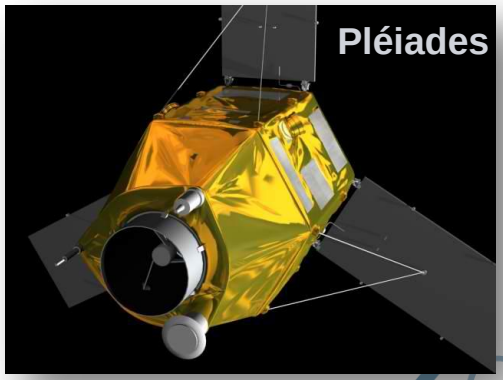
Earth observation (EO)

Space capacity (satellite sensors)



[selection!]



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Earth observation (EO)

Space capacity (satellite sensors)

- Different **requirements** on satellite imagery depending on application – '*quality*' is relative!
- **Spatial**, **spectral**, **temporal** resolution

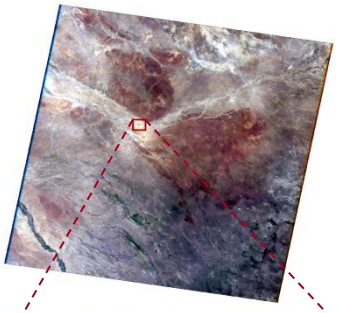
spatial resolution

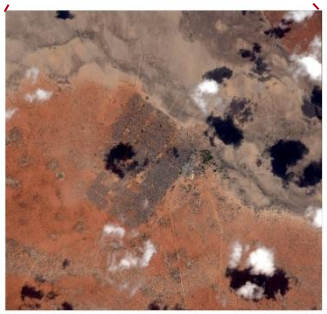
High resolution, e.g. Landsat (30 / 15m GSD)

Very high resolution , e.g. WorldView-2 (0.5 m GSD)

price/sqkm

1 scene ~ 33,000 sqkm





1 scene ~ 300 sqkm

coverage

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Refugee camp analysis and mission support

Population, water, environment

Support humanitarian organizations with **up-to date**, **targeted** and **reliable** information on …

(1) population numbers and densities

(2) potential groundwater reservoirs

(3) impact on the local environment

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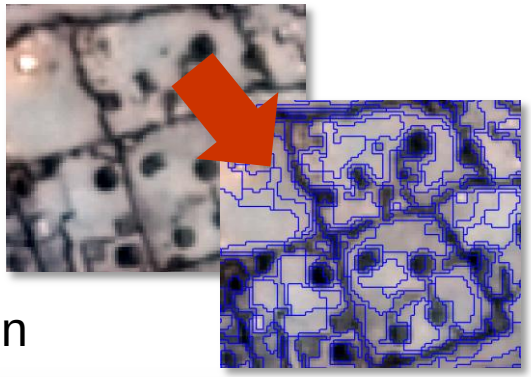
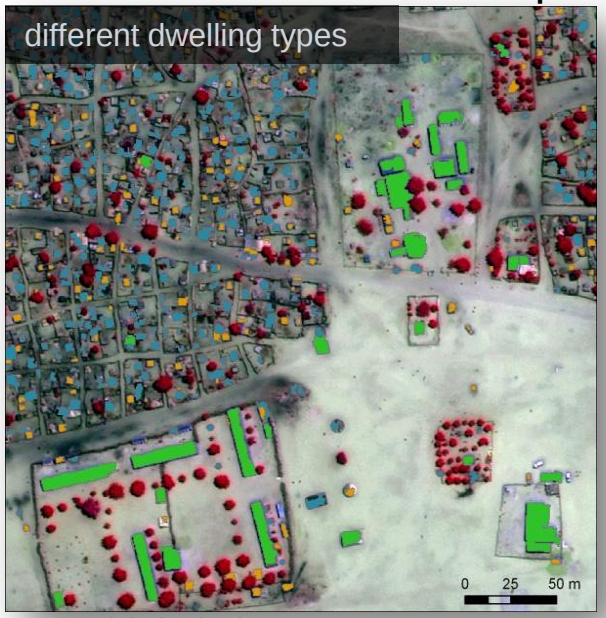
Population monitoring



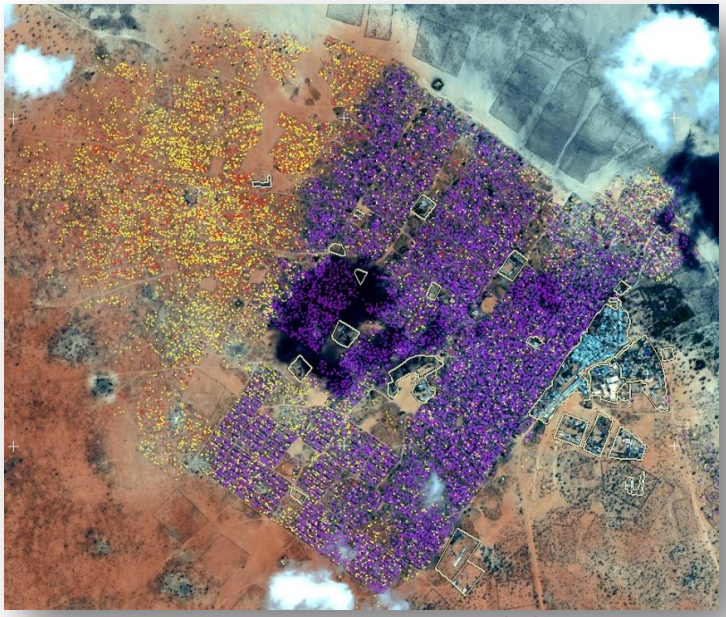
Automated **dwelling extraction**

- Extracting image objects and classifying different dwelling types (e.g. tents, huts) according to spectral, geometrical and context information
- analysis of large areas or different time stamps
- suitable for less complex test sites



Camp Djabal, Chad

Total: 23,400 dwellings (14,000 dwellings with corrugated iron roof, 6,600 tents, 2,800 huts)



Camp Dagahaley, Kenya

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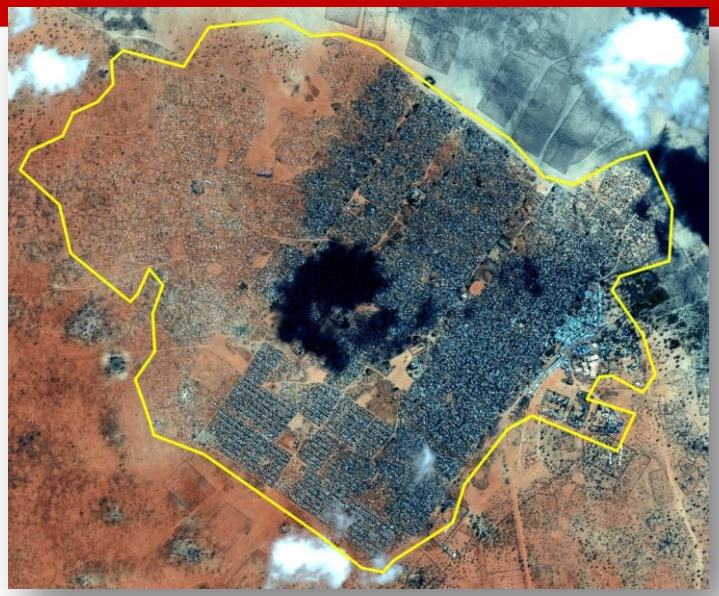
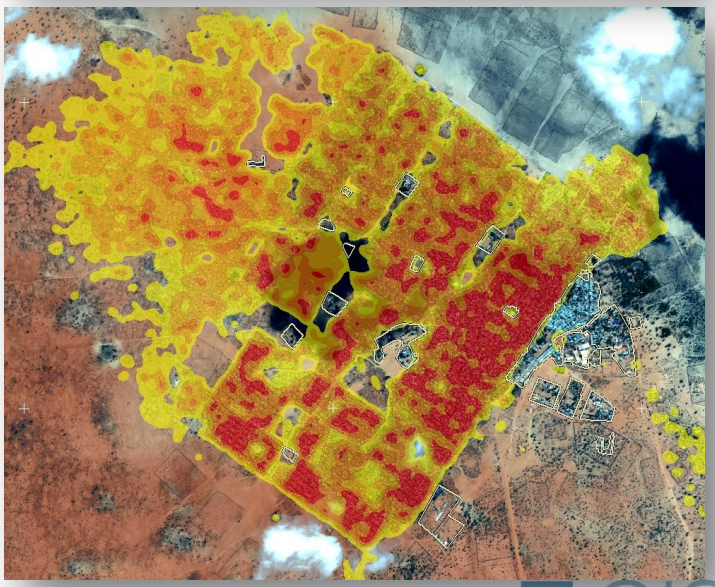
Population monitoring

❶ Camp **outline**
- Boundary delineated automatically
- Info required in rapidly expanding refugee/IDP camps

❷ Dwelling **density**
- calculated based on extracted dwellings
- provides a better overview on the spatial distribution of dwellings





Camp Dagahaley, Kenya

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Population monitoring

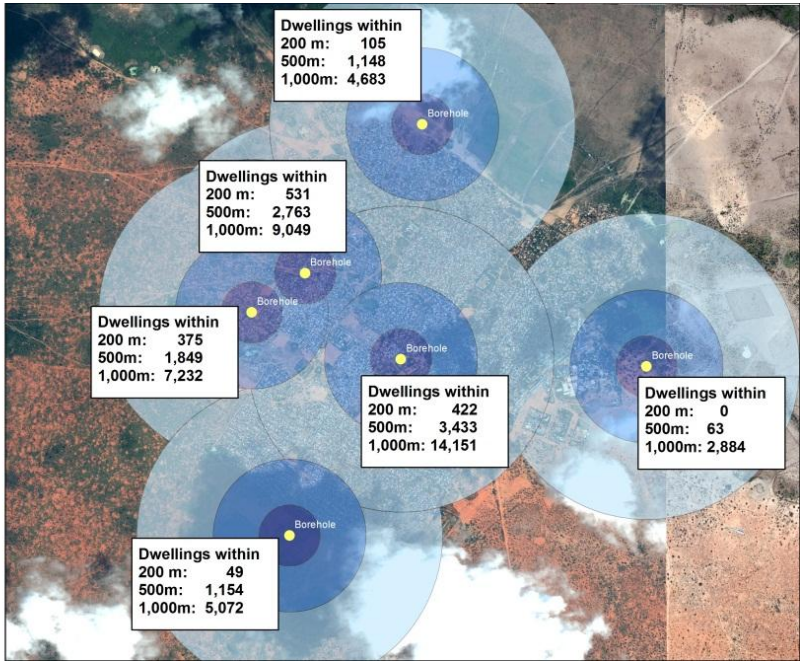
❸ Camp **structure**

- Based on different dwelling types (e.g. ratio of tents/huts as potential indicator for newly settled areas)

Camp Djabal, Chad

❹ **Distance** analysis

- How many dwellings are within a certain distance of a specific infrastructure (e.g. borehole)?



Camp Dagahaley, Kenya

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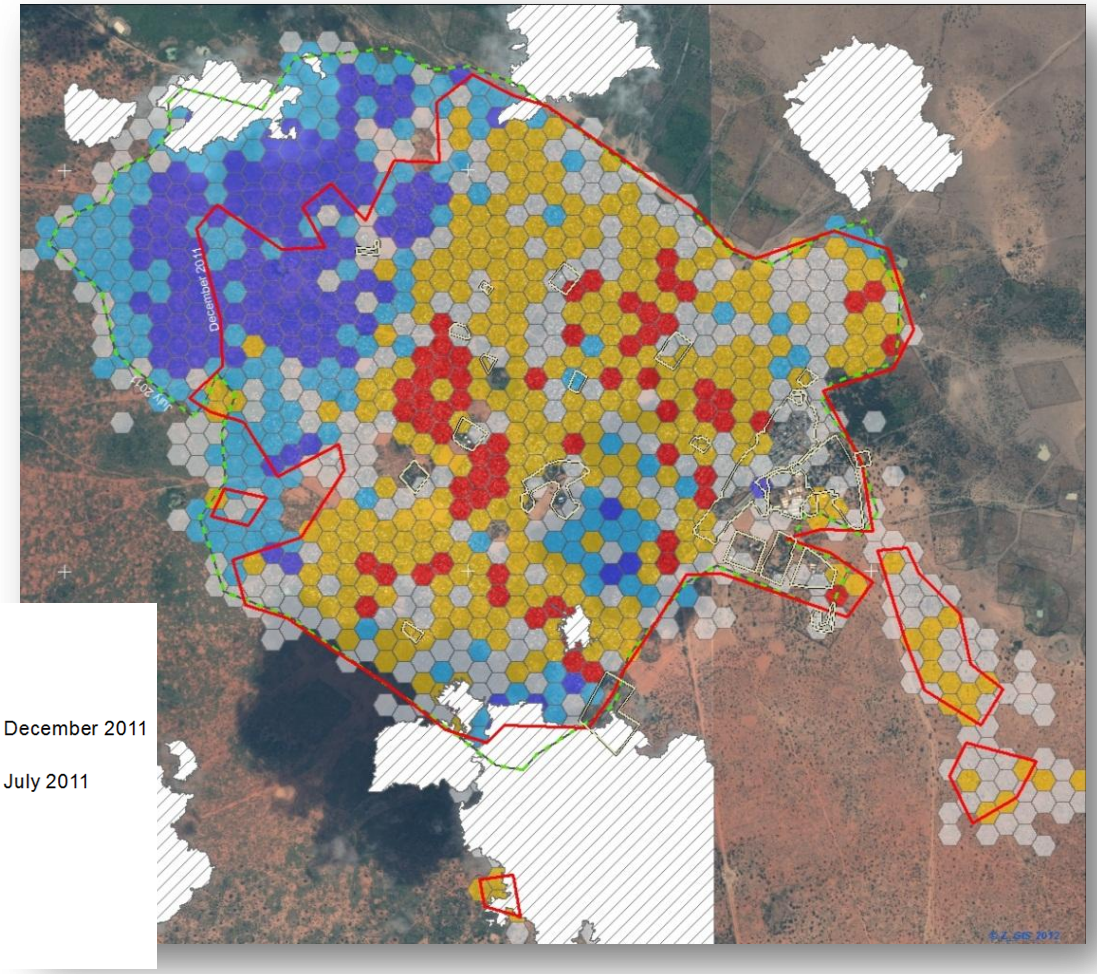
Population monitoring

❺ Camp **evolution**

- Changes of single dwellings between two images from different times
- aggregated to hexagonal units for an overview



Camp Dagahaley, Kenya: Changes between July 2011 and December 2011

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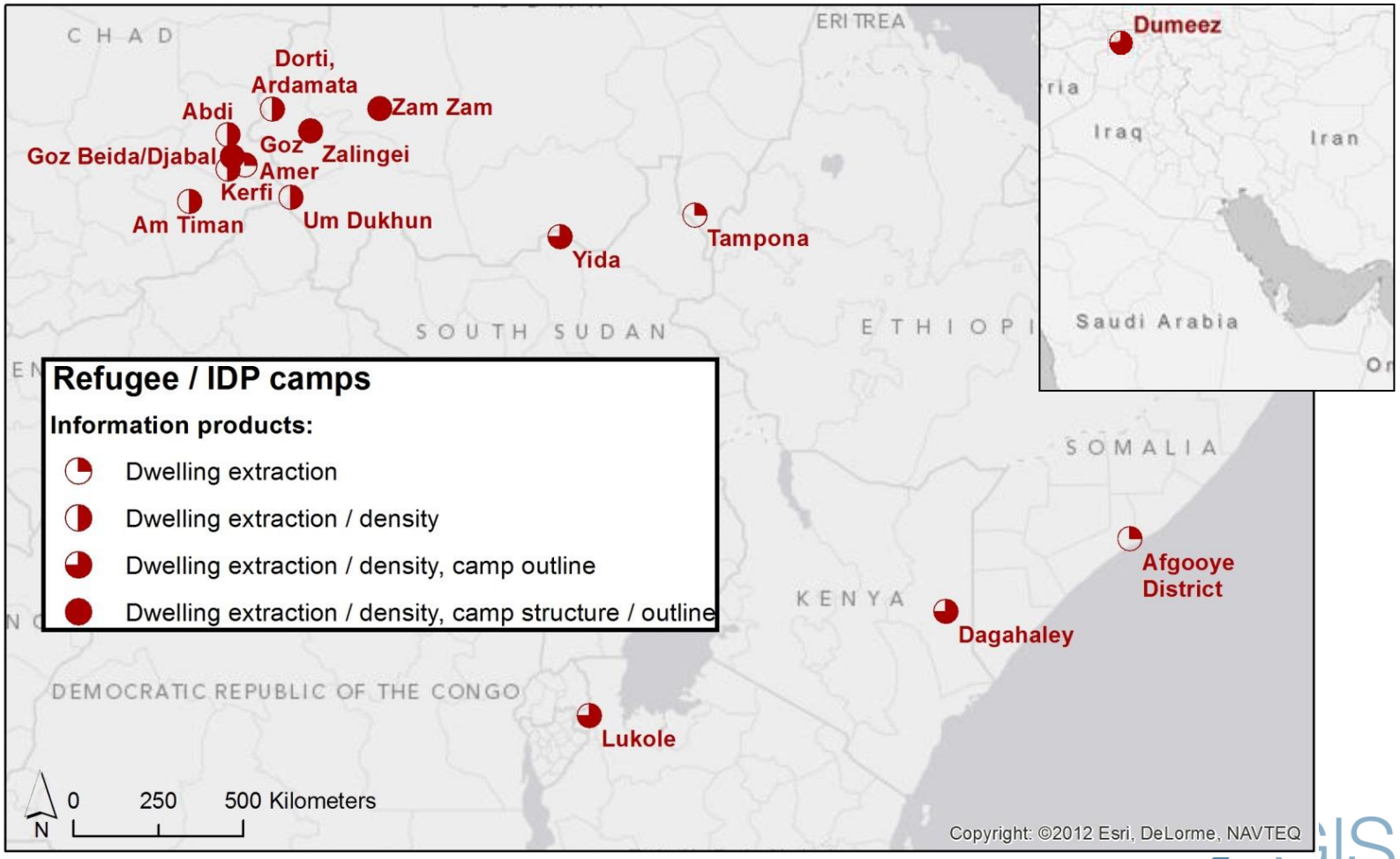
Population monitoring

Sites and services (since 2008)



[Tiede et al. 2013, modified]

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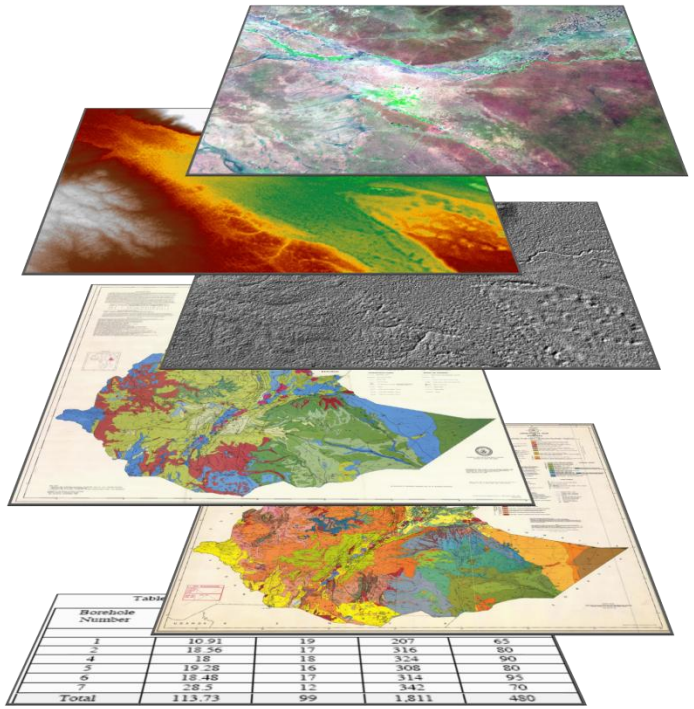
Water exploration
potential groundwater borehole sites

Integrated geospatial data layers

- **Satellite imagery** (e.g. Landsat, freely available, also time series),
- **Digital elevation model** (ASTER, SRTM, free available)
- **(Hydro-)geological** maps
- **Drilling** and **yield data** (if available / accessible)



Borehole Number				
1	10.91	19	207	65
2	18.56	17	316	80
4	18	18	324	90
5	19.28	16	308	80
6	18.48	17	314	95
7	28.5	12	342	70
Total	113.73	99	1,811	480

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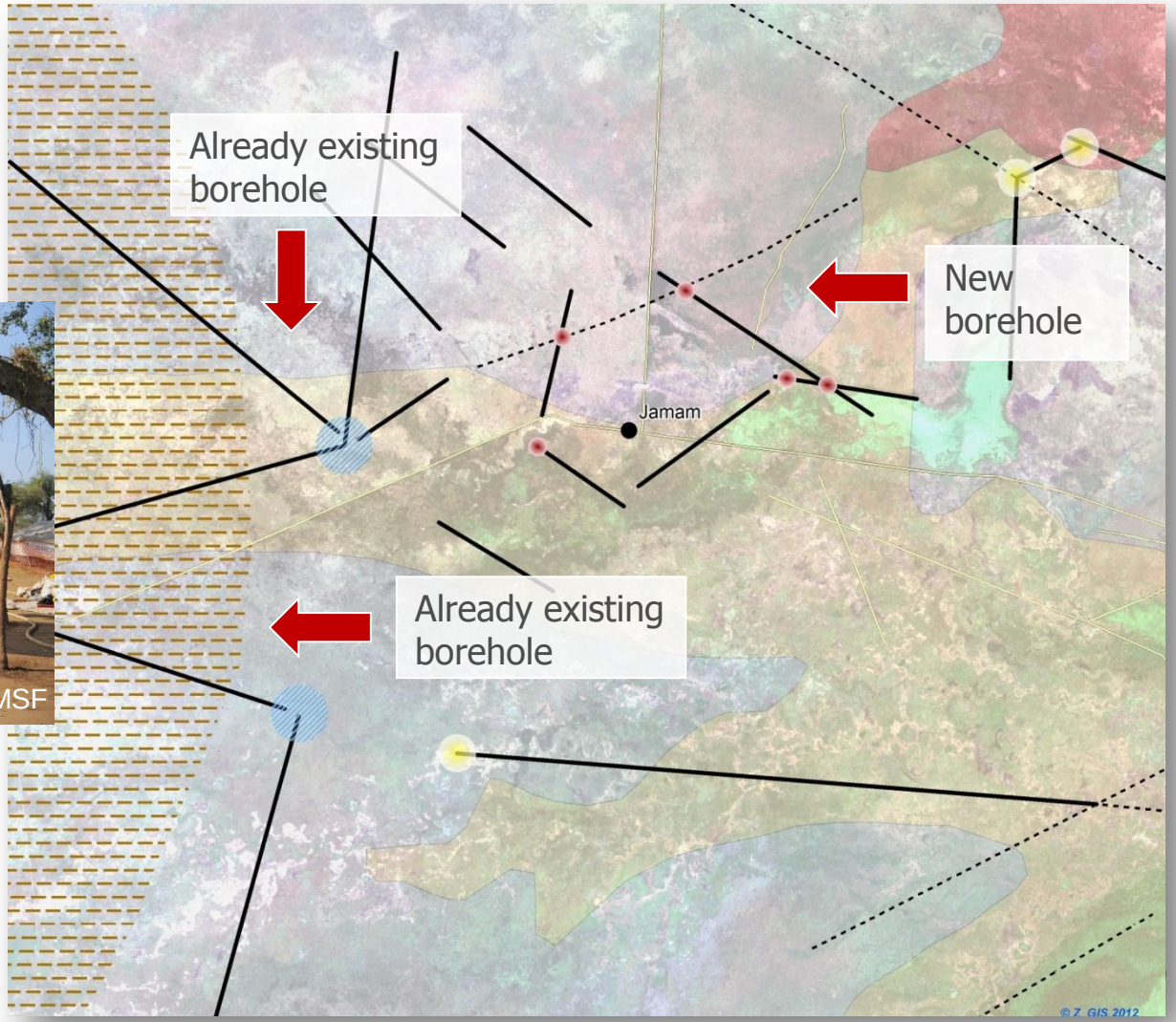
Water exploration

potential groundwater borehole sites

Example
Jamam, South Sudan



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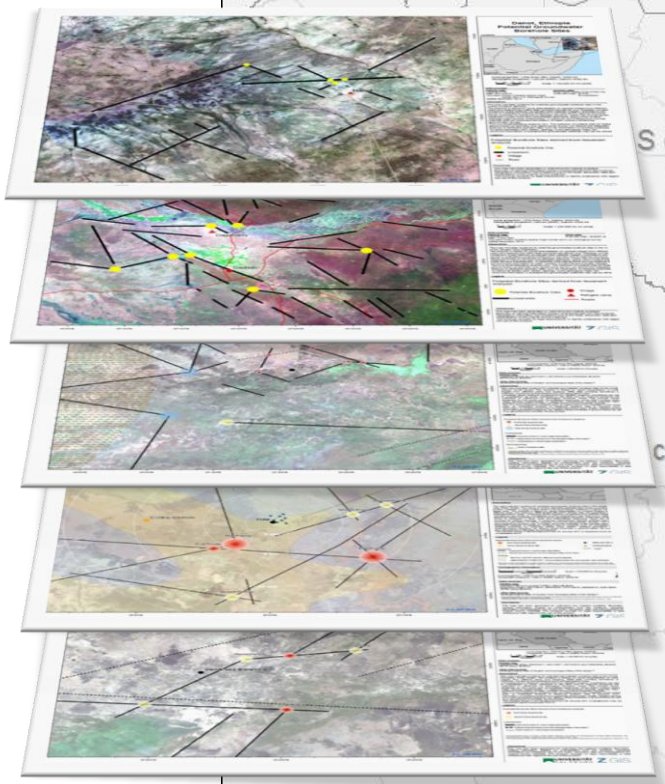
Water exploration

potential groundwater borehole sites



Sudan
Melut
Jamam
Yida
Mayom Ajuong
Gendrasa
Malkuer Boma
Ethiopia
Danot
South Sudan
Somalia
Uganda
Dagahaley
Kenya
Rwanda
Burundi
Tanzania
Kalemie
N
0
250
500 km

Delivered service products (2011-2013)

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Thank you very much for your attention!

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