Geospatial Big Data

Understanding The World at a Scale Like Never Before

See more of the Earth

Content leader:

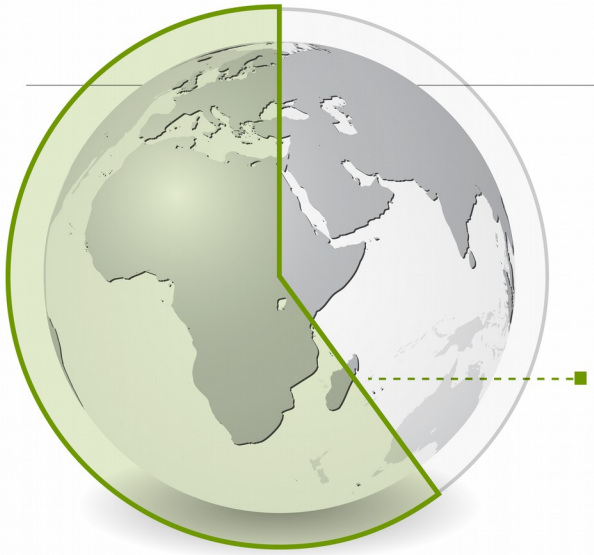
x8 and counting

Archive contains the equivalent of over 8 times Earth's surface

More access:

x4

satellites + aerial



Faster refresh:

60%

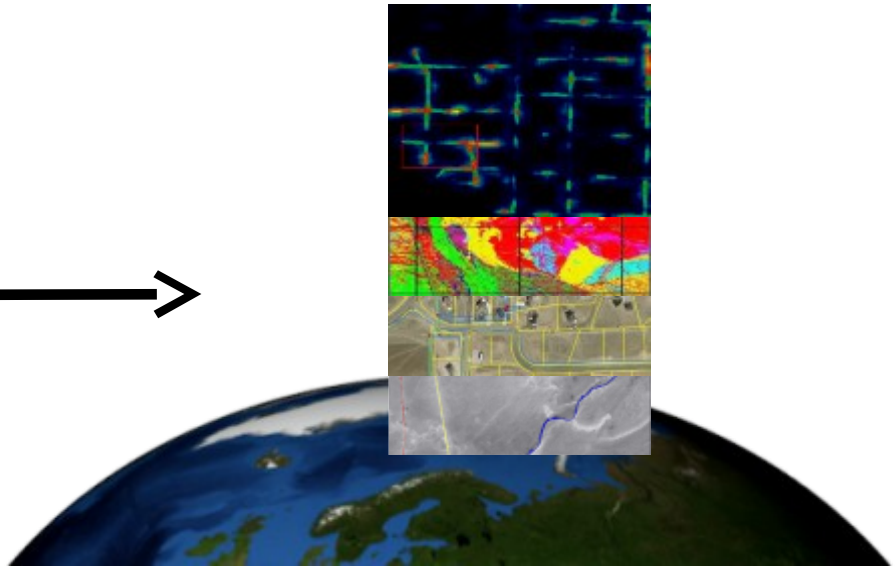
monthly

Collection Capability – Last 3 Days

Collection Capability – Last 2 weeks

Geospatial Big Data

Extract information from imagery at scale…



How can I identify the largest concentrations of new refugees for successful supply delivery?

How can I identify damaged structures in the wake of a storm, in hours rather than days?

How do I create a highly accurate map of my nation most efficiently?

Given the volume of material extracted, what is the estimated life of the mine site?

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Transforming Data to Information

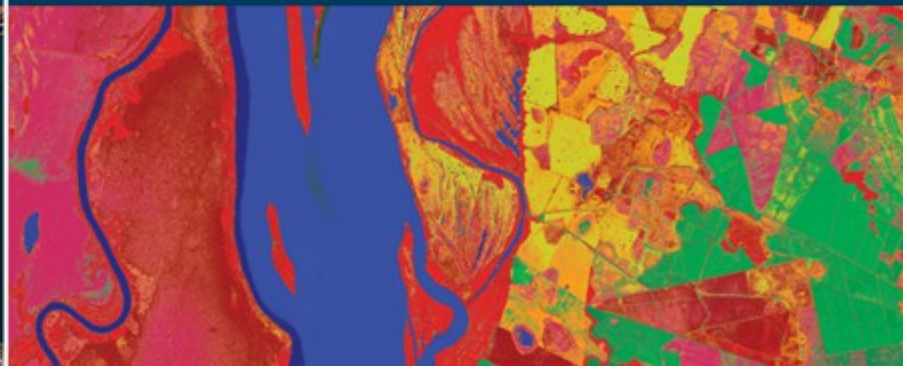
Information

Imagery Providing Context

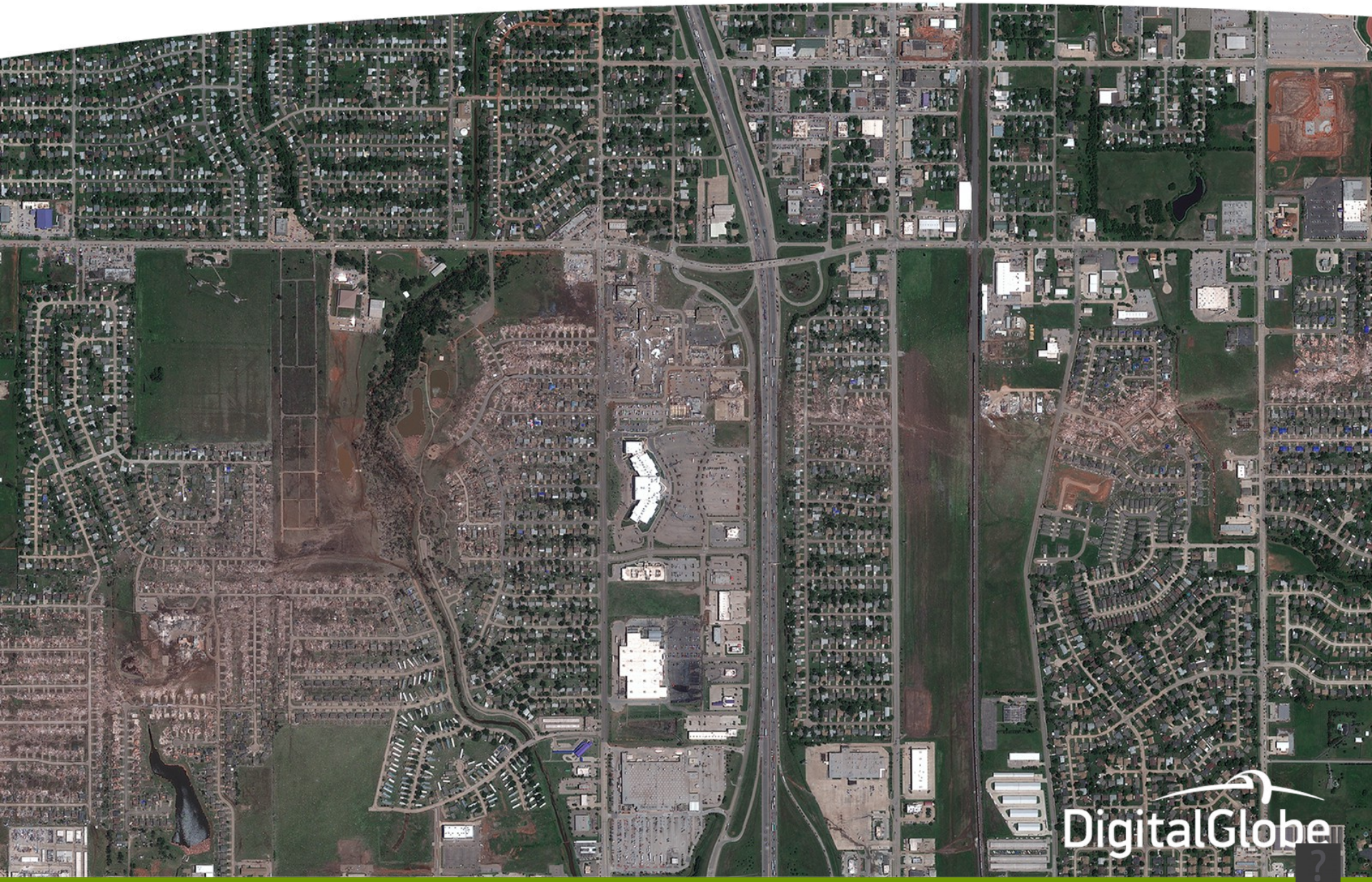
Extract Vector Information

Leverage Advanced Elevation Models

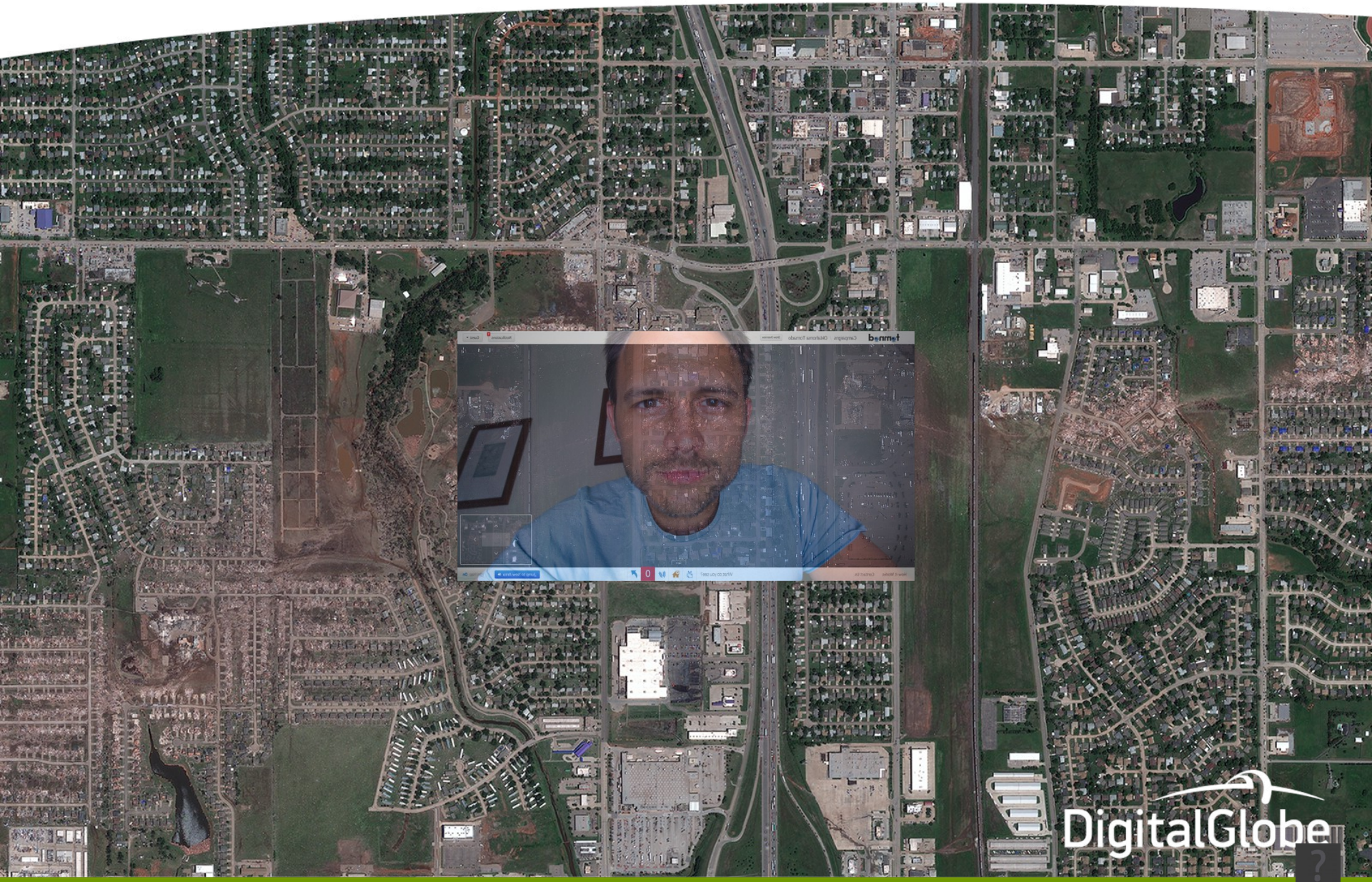
Classify Land Use / Land Cover



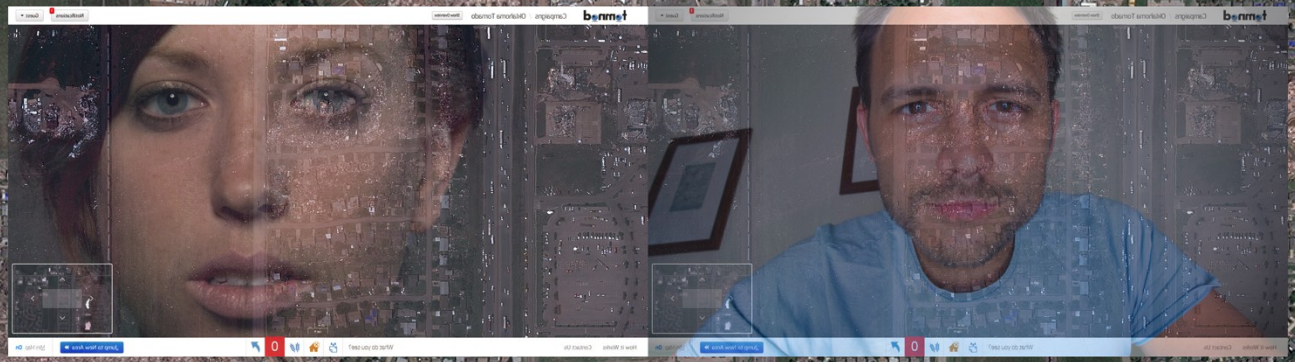
How might we quickly analyze this image?



We could have a human analyst examine it



Two analysts would make the job go faster



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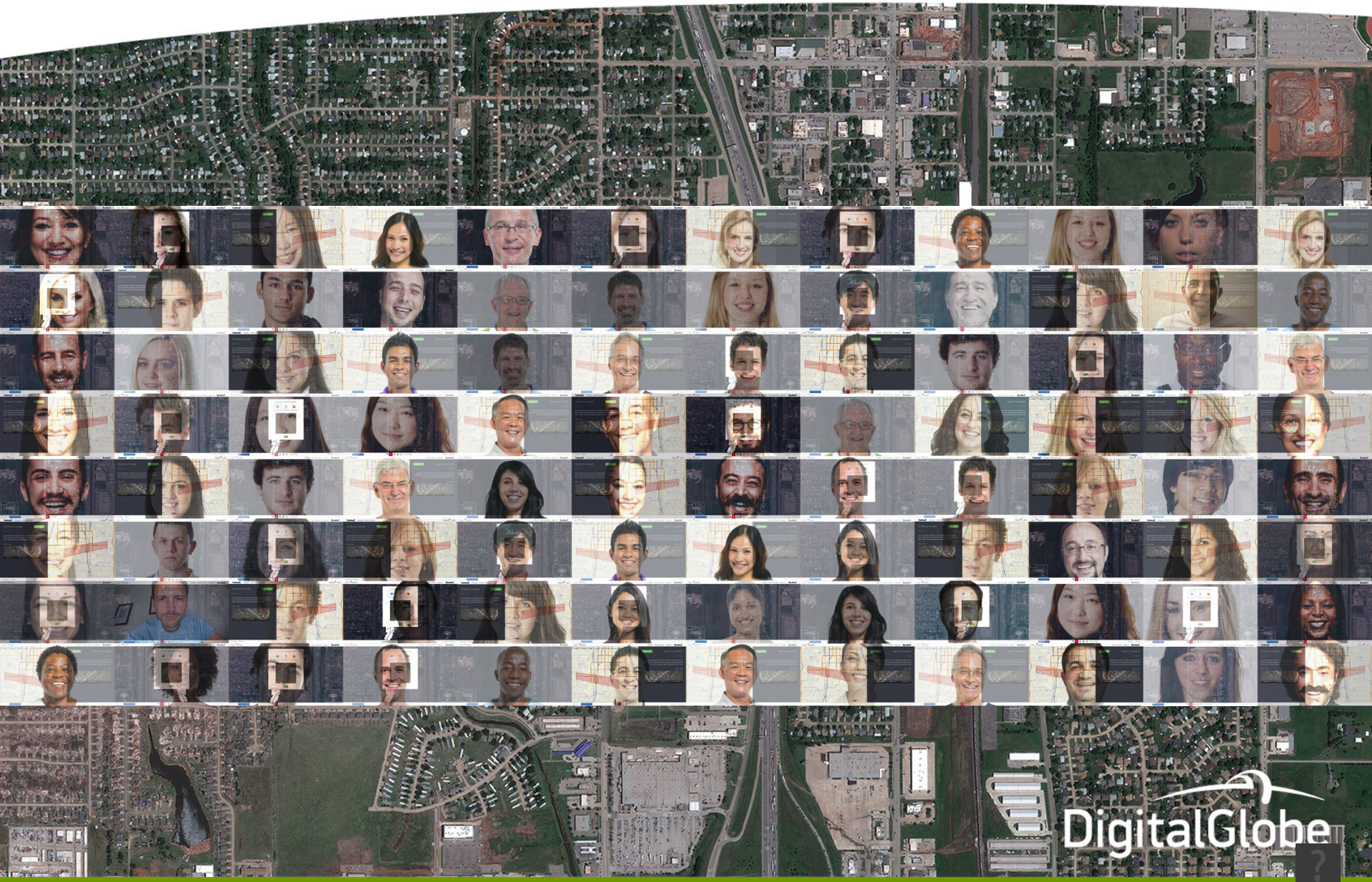
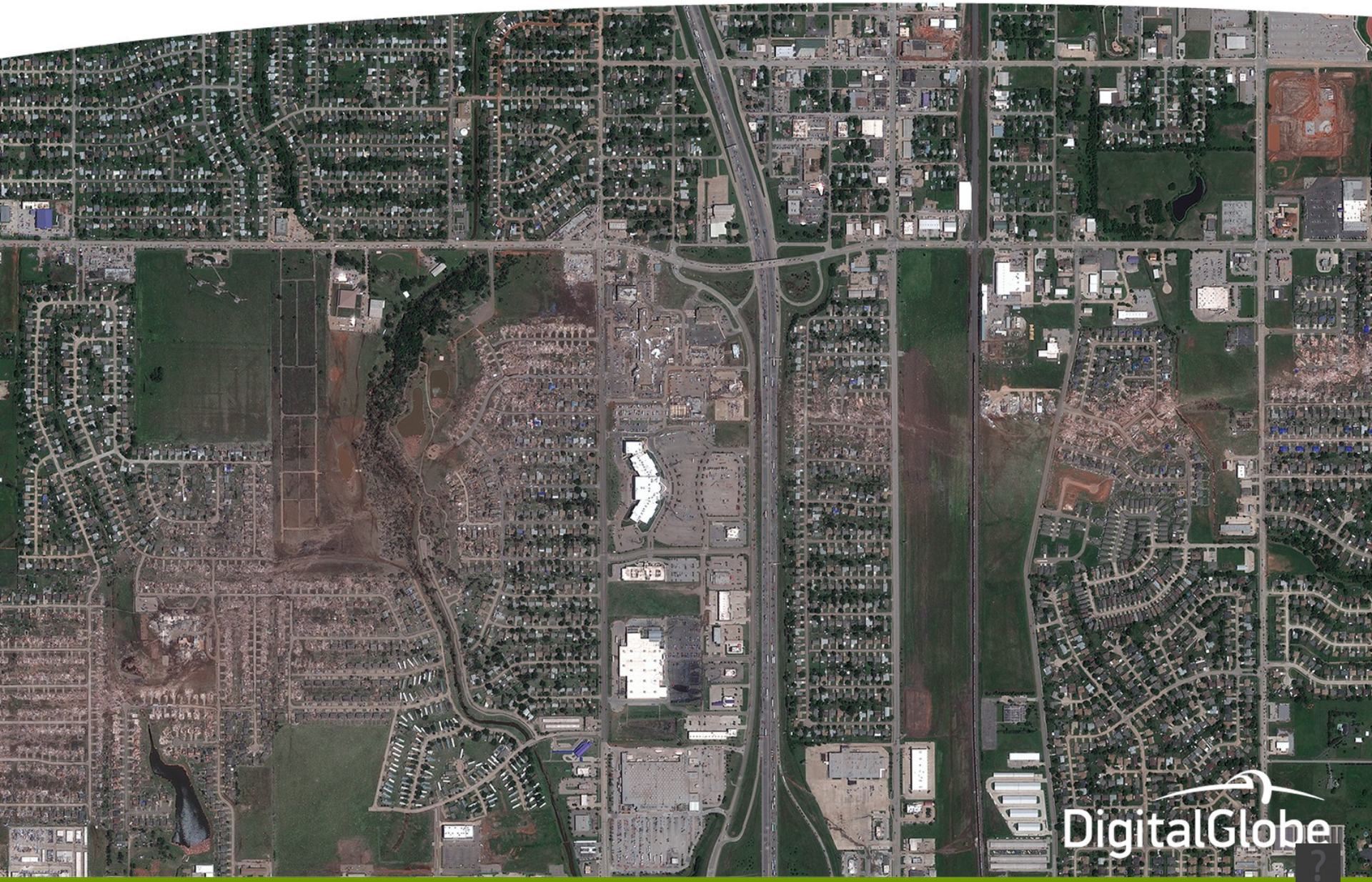
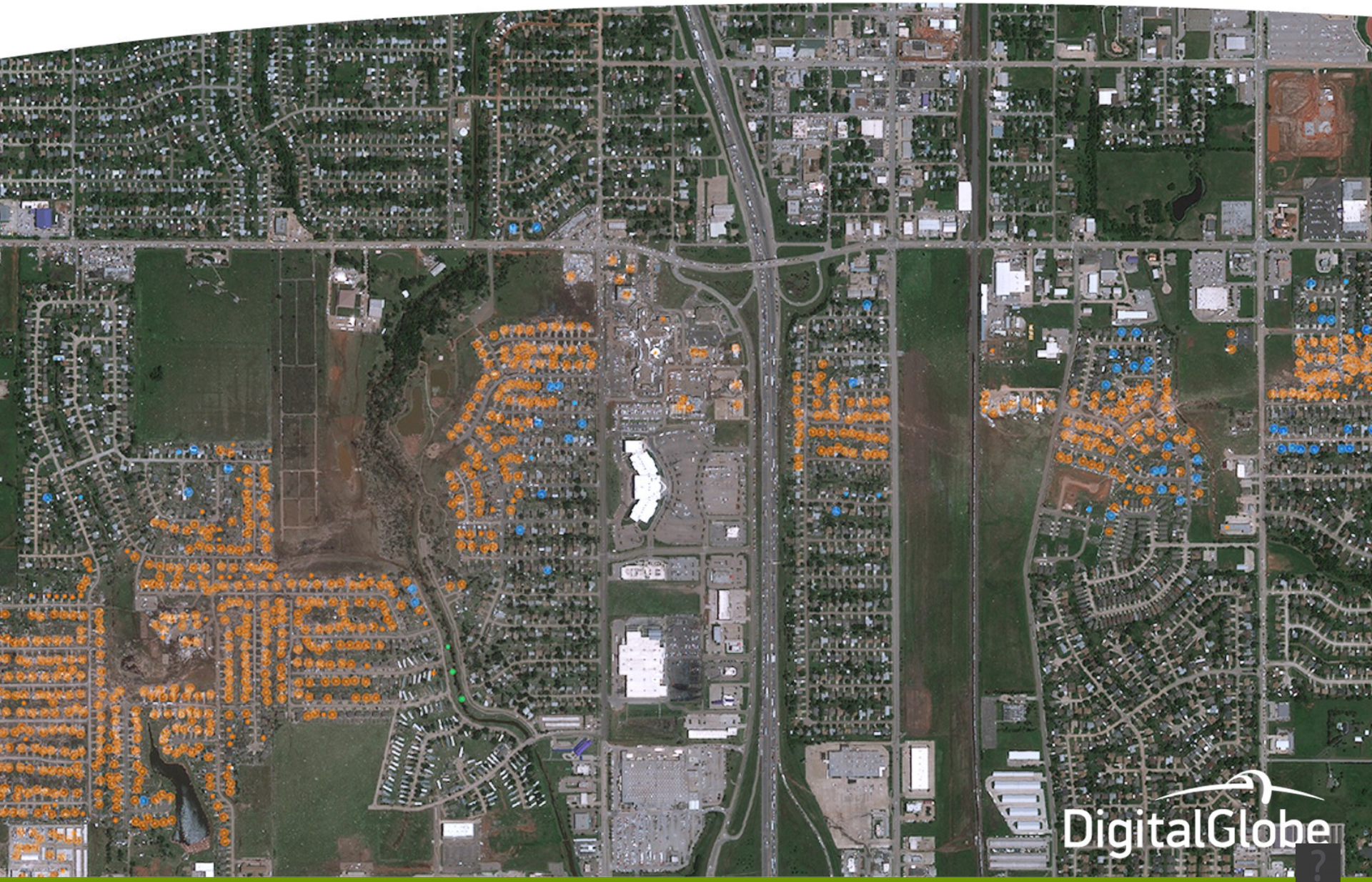
Many analysts would speed it even more



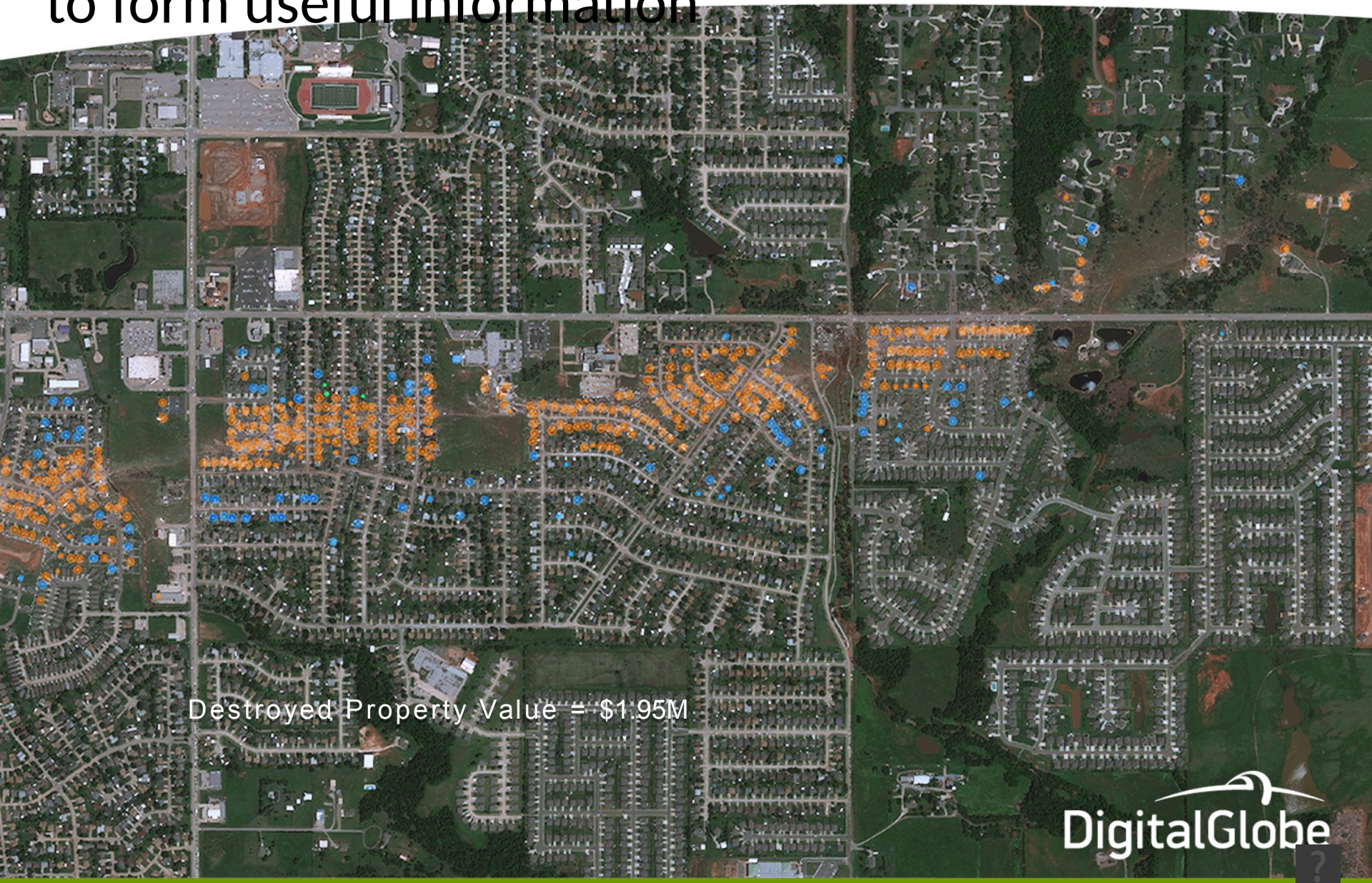
Turning This Image…



…Into This Damage Map, In an Hour

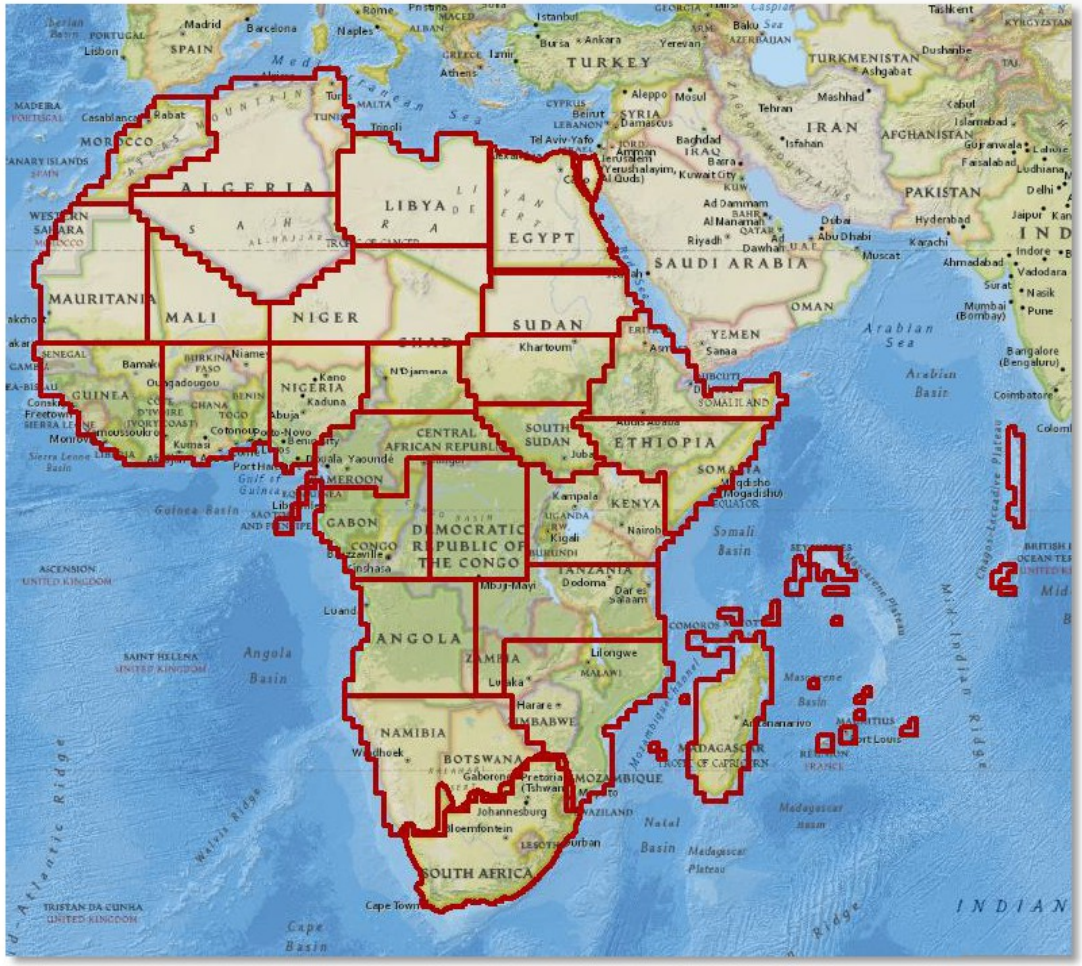


…which can be searched and analyzed to form useful information



Geospatial Big Data Addresses Real World Problems

+Vivid



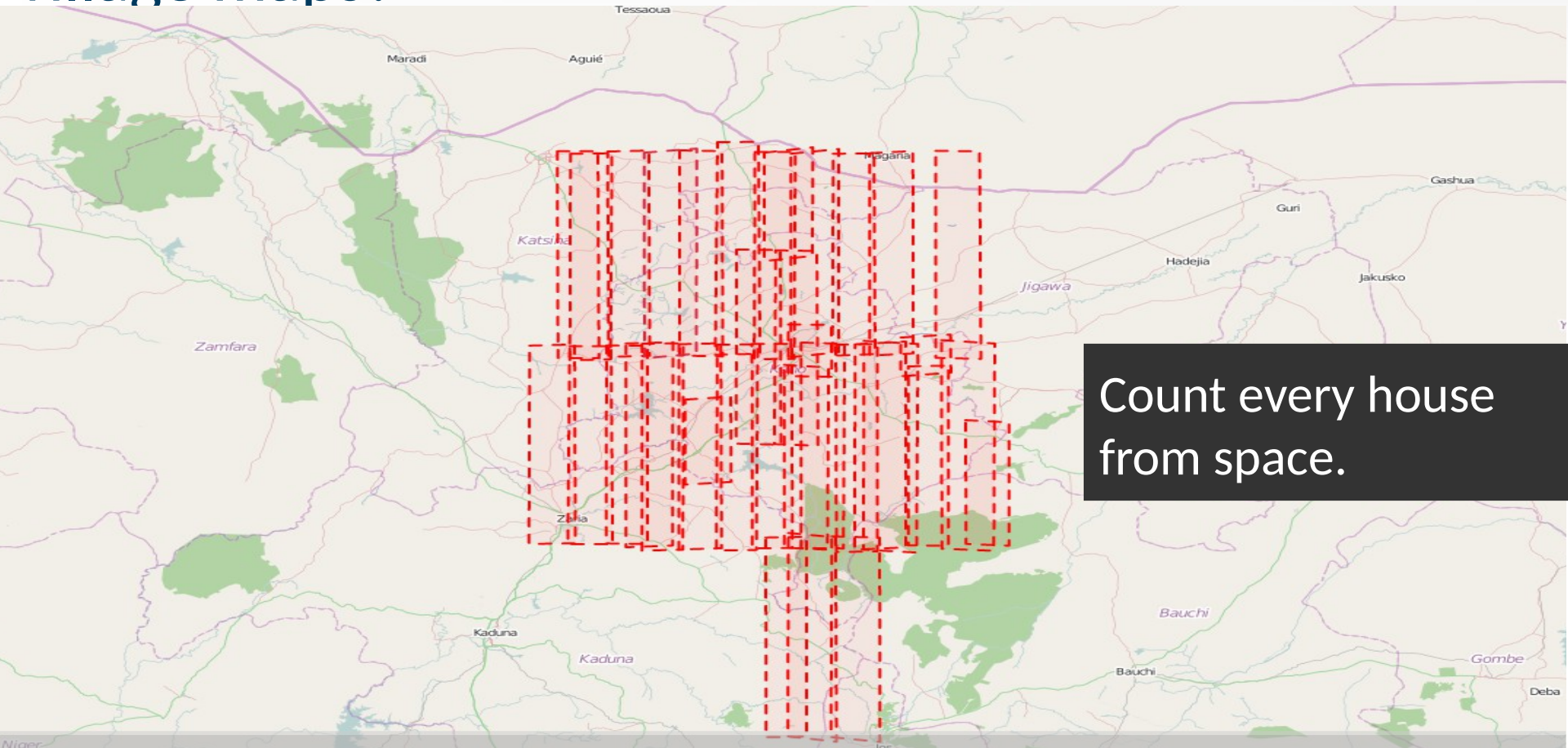
The Continent of Africa was divided into 27 production blocks, as seen on the left. The information below is derived from merging the resultant metadata into one contiguous area.

Information for the entire Continent:

Production Block Codes	AF01 – AF27
Total Area (SQ KM)	29,790,606
Number of HVAs	120
Number of Tiles	330,574
Production Date	12/13 – 3/15
Estimated File Size	357.5 TB

Mapping the unmapped

How do you prioritize your medical supplies in an area with an outdated census and no precise village maps?



Count every house from space.

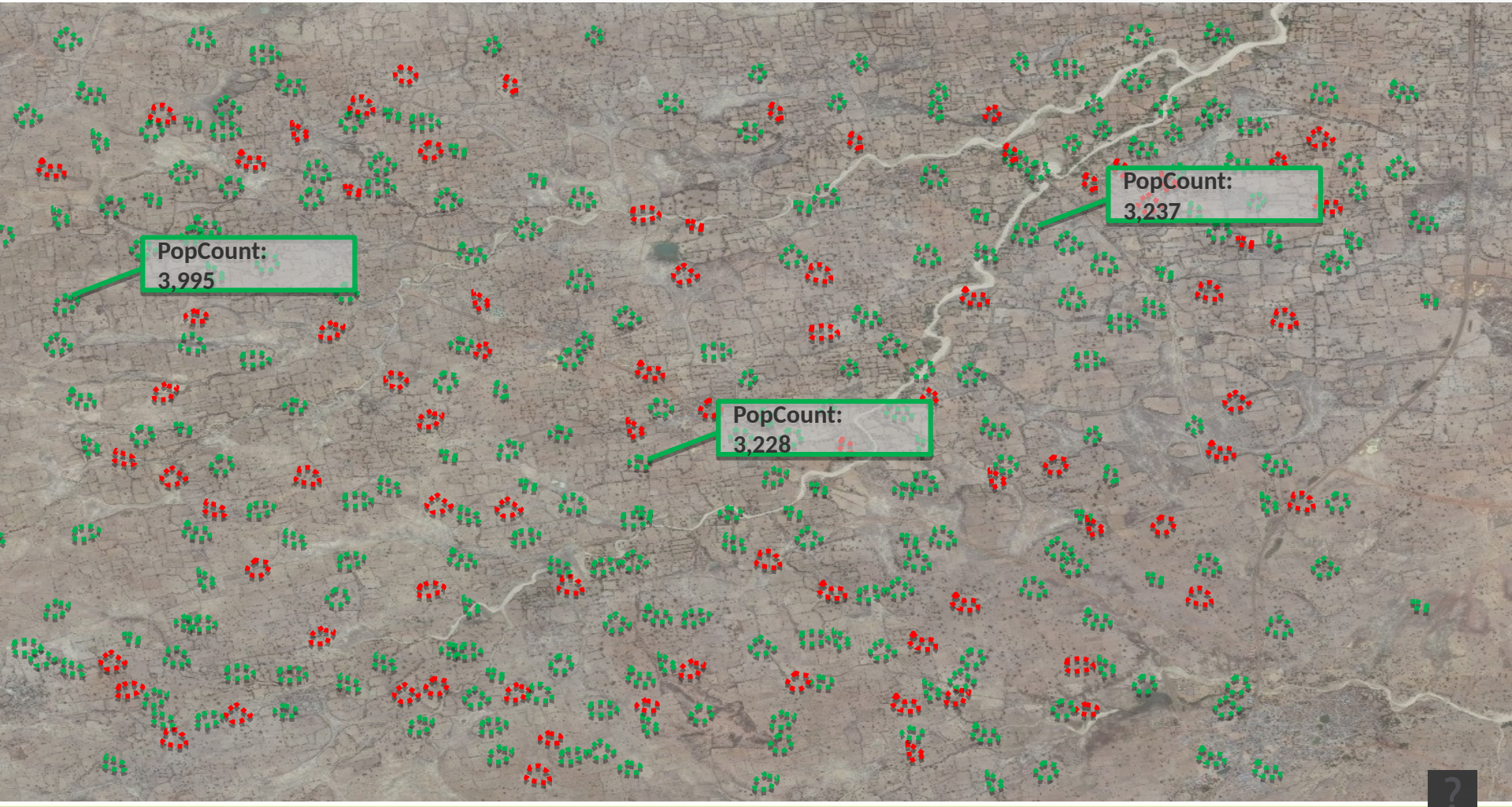
Kano state, Nigeria

?

Using Automated extraction Software identify every village and nomadic settlements

Crowds validated every village/settlement to ensure accuracy

Estimated population density of various villages to optimize medical supplies and logistics …

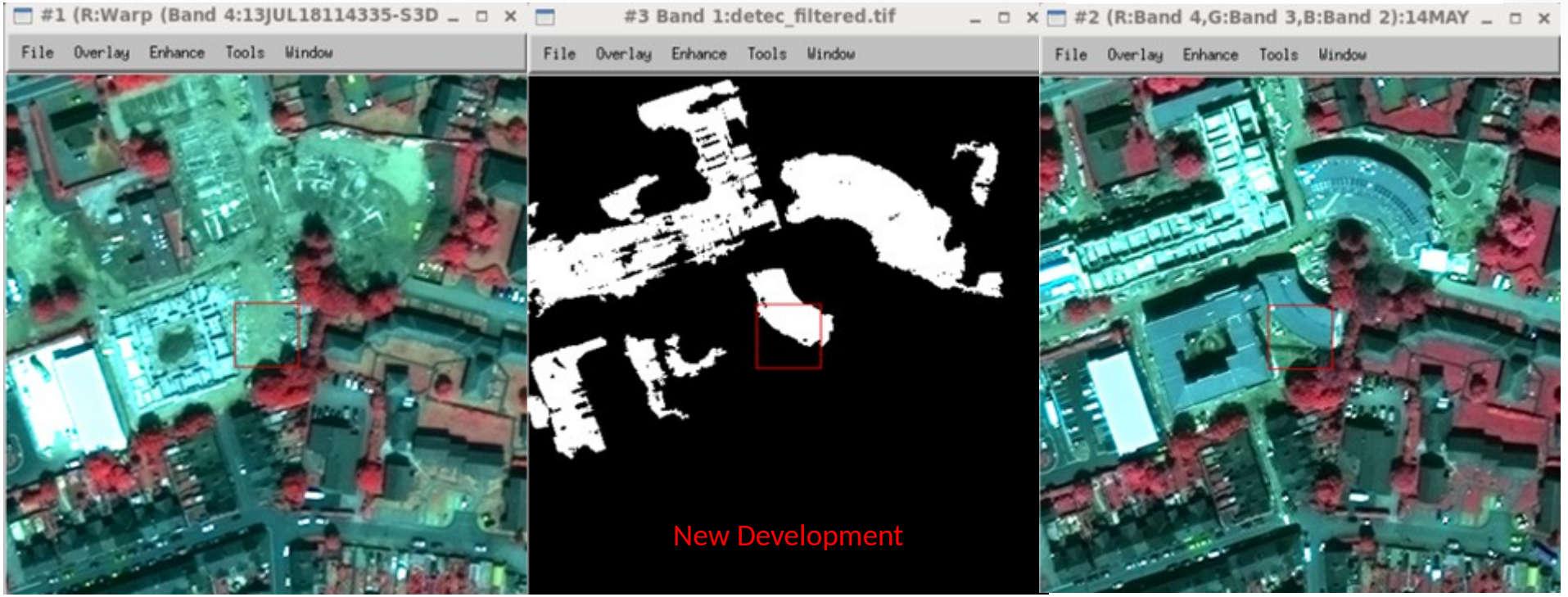


Identifying changes in an urban area

Building change detection: Stafford, UK

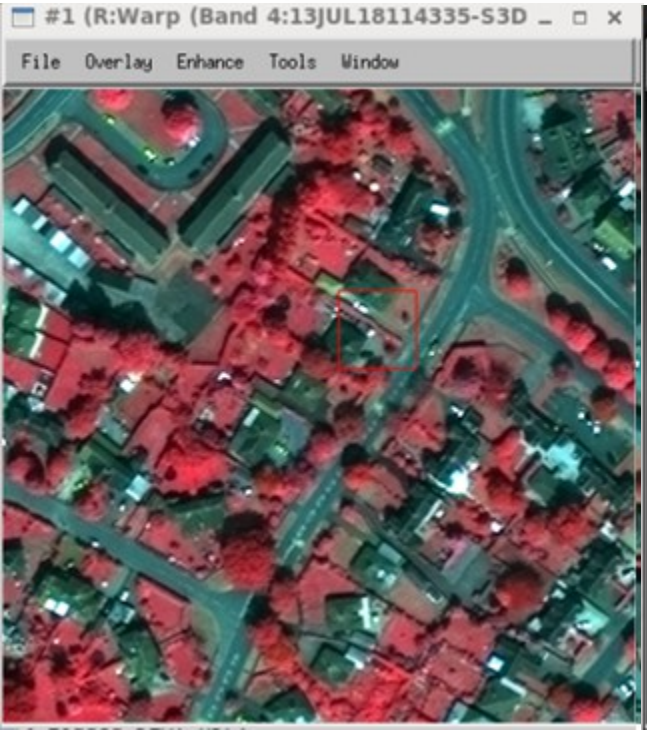
Before

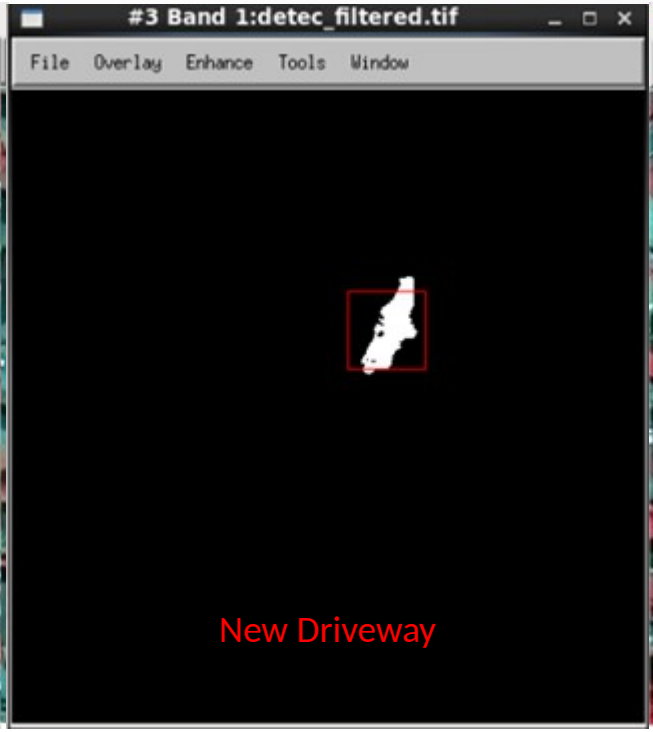
After

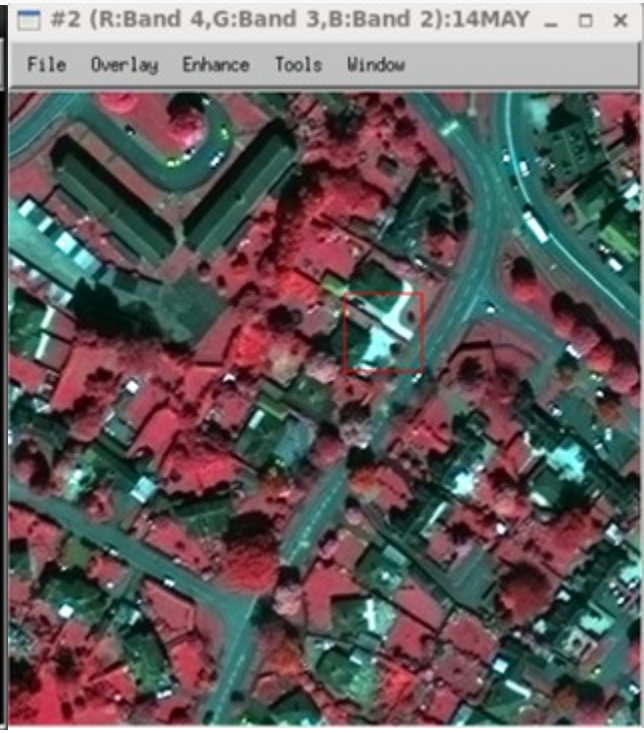


Before

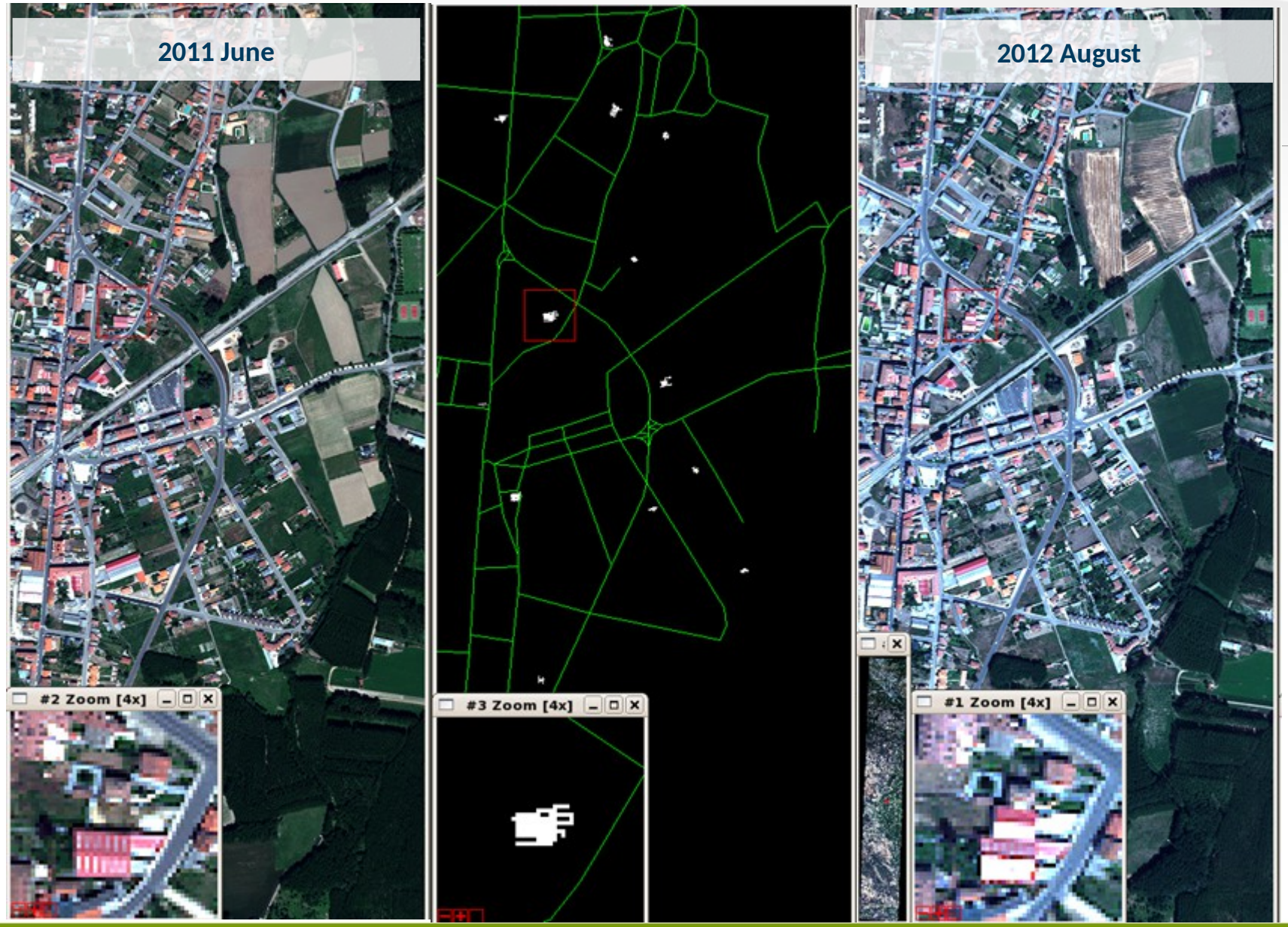
After



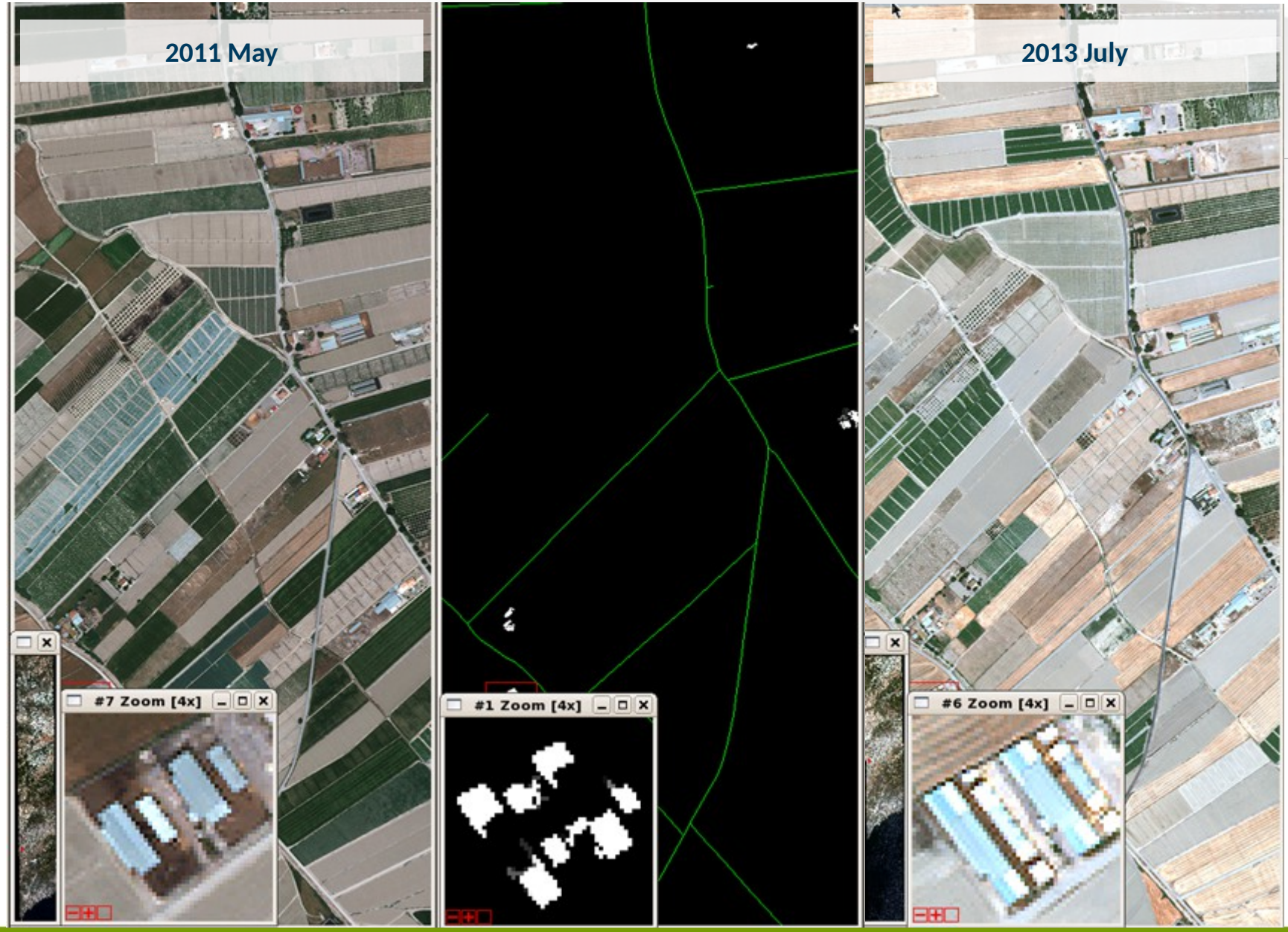




Building Construction (Leon, Spain)

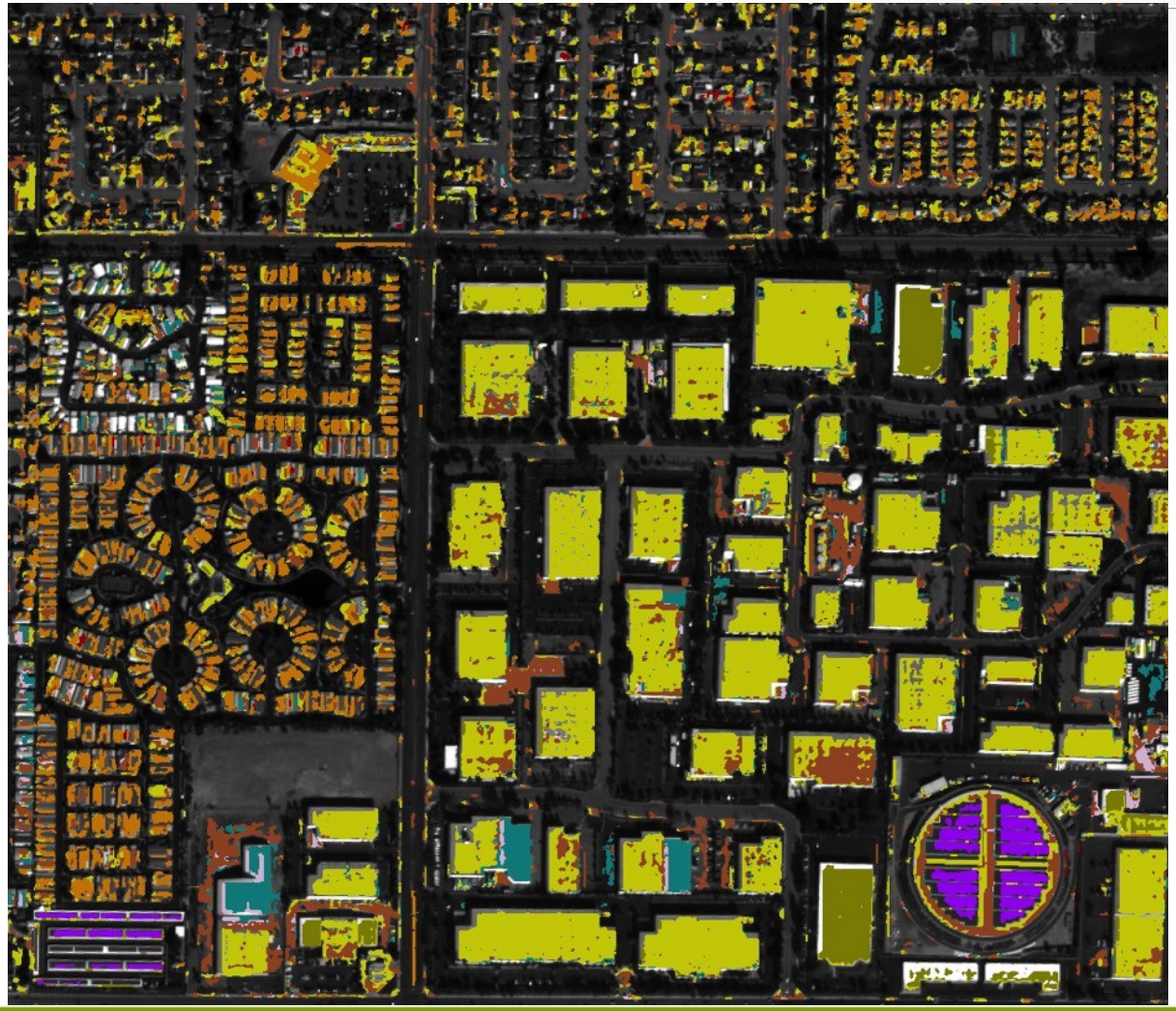


Extension of buildings (Murcia, Spain)



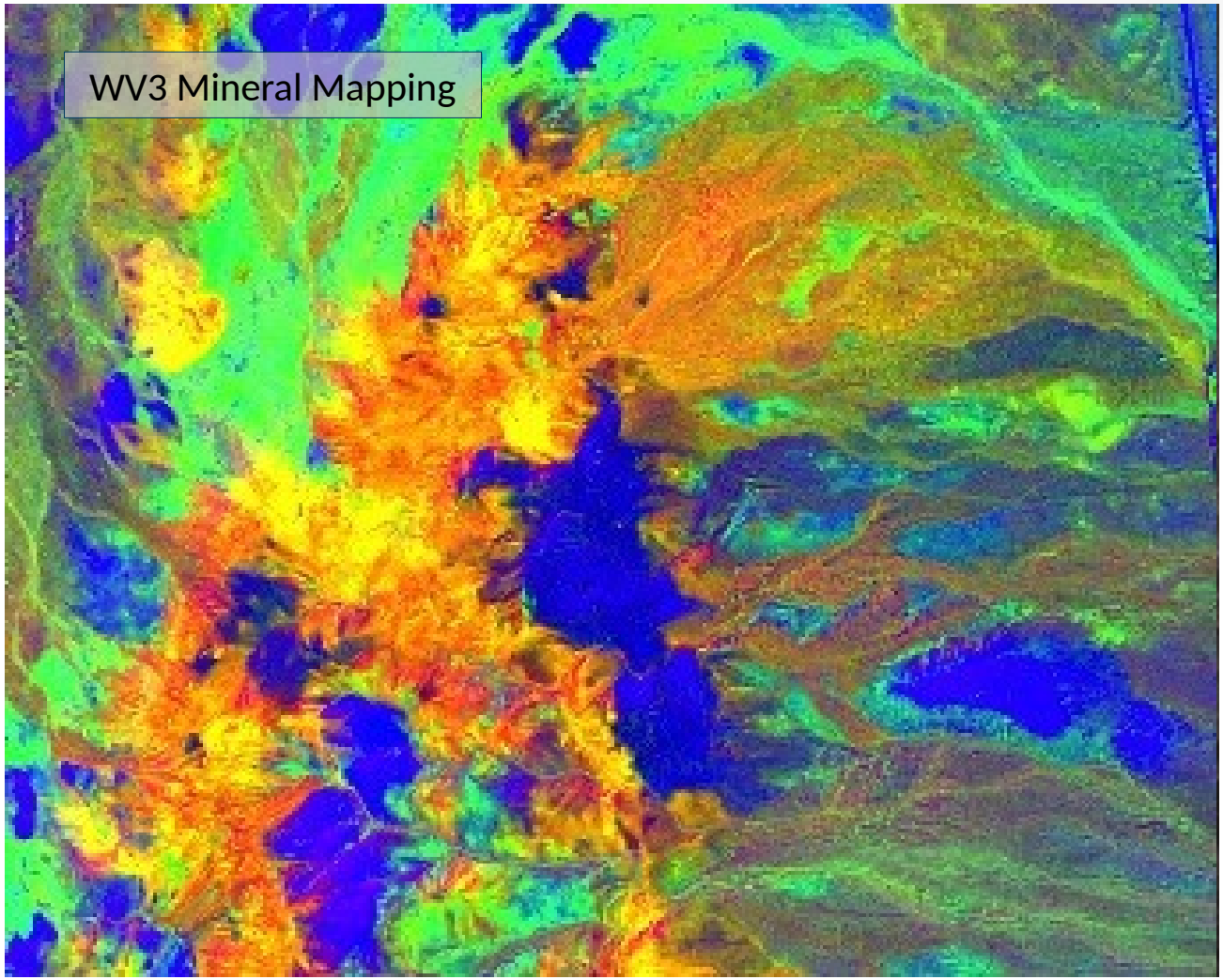
Extracting features in urban landscapes

Mapping urban infrastructure



- Solar Panel
- Steel
- Rubber + Fiberglass, White
- EPDM, White
- Ceramic, Red
- Tile, Red
- Paint on Metal
- Concrete

Identifying minerals



Clay

Mica

Carbonate

Finding individual objects

Vehicles

… or aircraft

Rear Engines,
Medium and Large

Under-wing
Engines, X-Large and Large

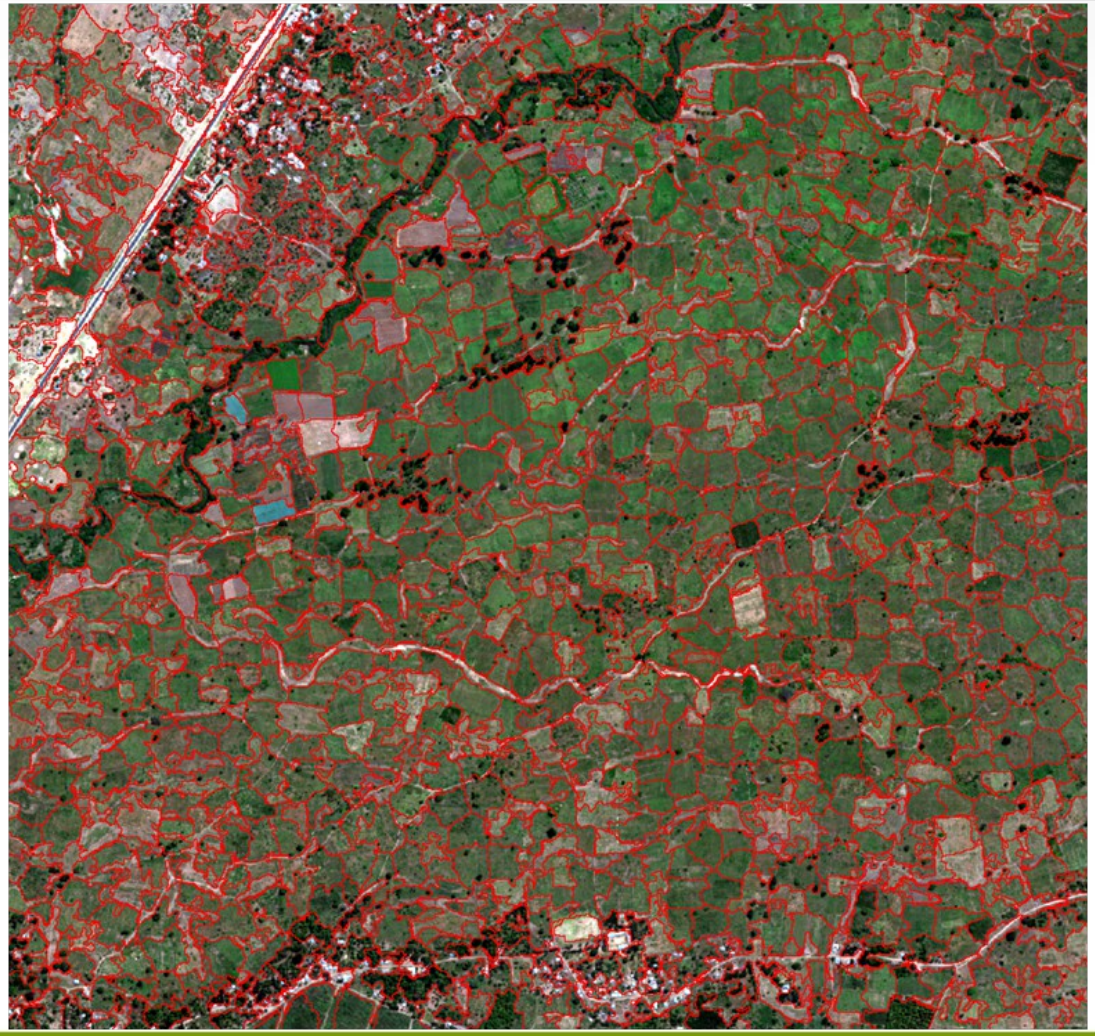
Fighter

Helicopter

Commercial

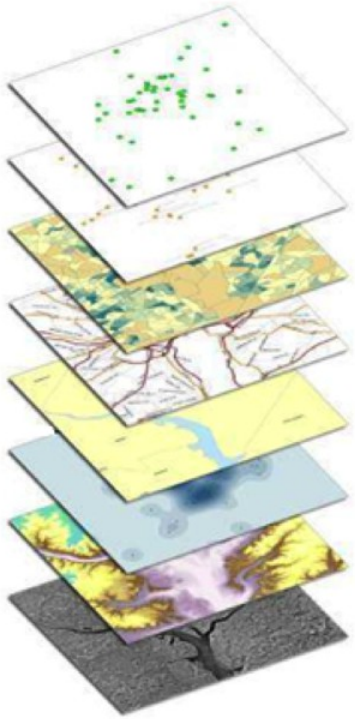
Military

… or agricultural field boundaries

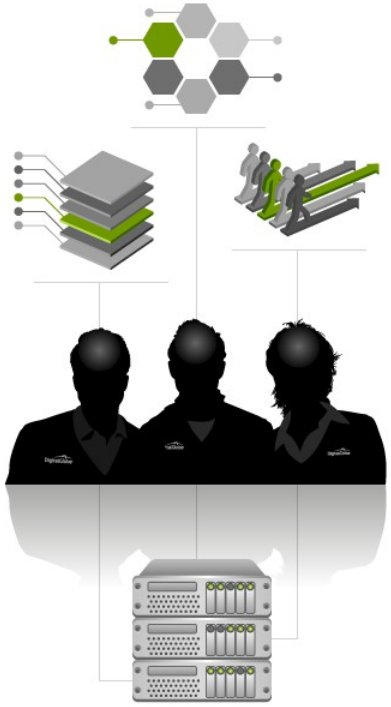


Our Approach Leverages Geospatial Analytics to Predict the Future

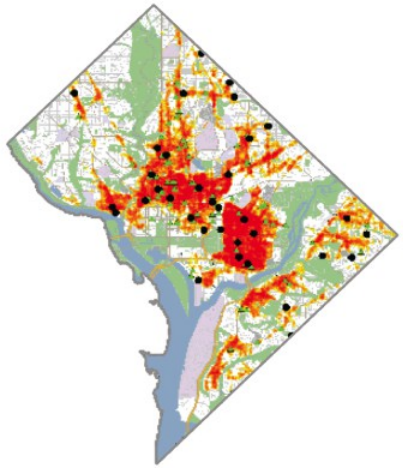
Physical geography, human geography & spatial event data



Expertise, tradecraft & tools



Geospatial insight



Human Landscape Data Themes and Structure

Standards: Data is structured based on NGA's 13 core themes of Human Geography

Communication: TV, radio, telephony, cellular coverage

Demographics: National / regional / local level statistics

Transportation: Roads, railways, airports, bus networks and schedules

Economy: GDP/GNP, labor market

Significant events: HADR

Education: Rates/levels of education and literacy, schools, enrollment

Religion: Faith-based places of worship (churches, mosques, temples)

Ethnicity: Racial composition, tribal and clan groups, alliances and rivals

Medical /Health: Facilities, conditions, basic needs index, nutrition levels

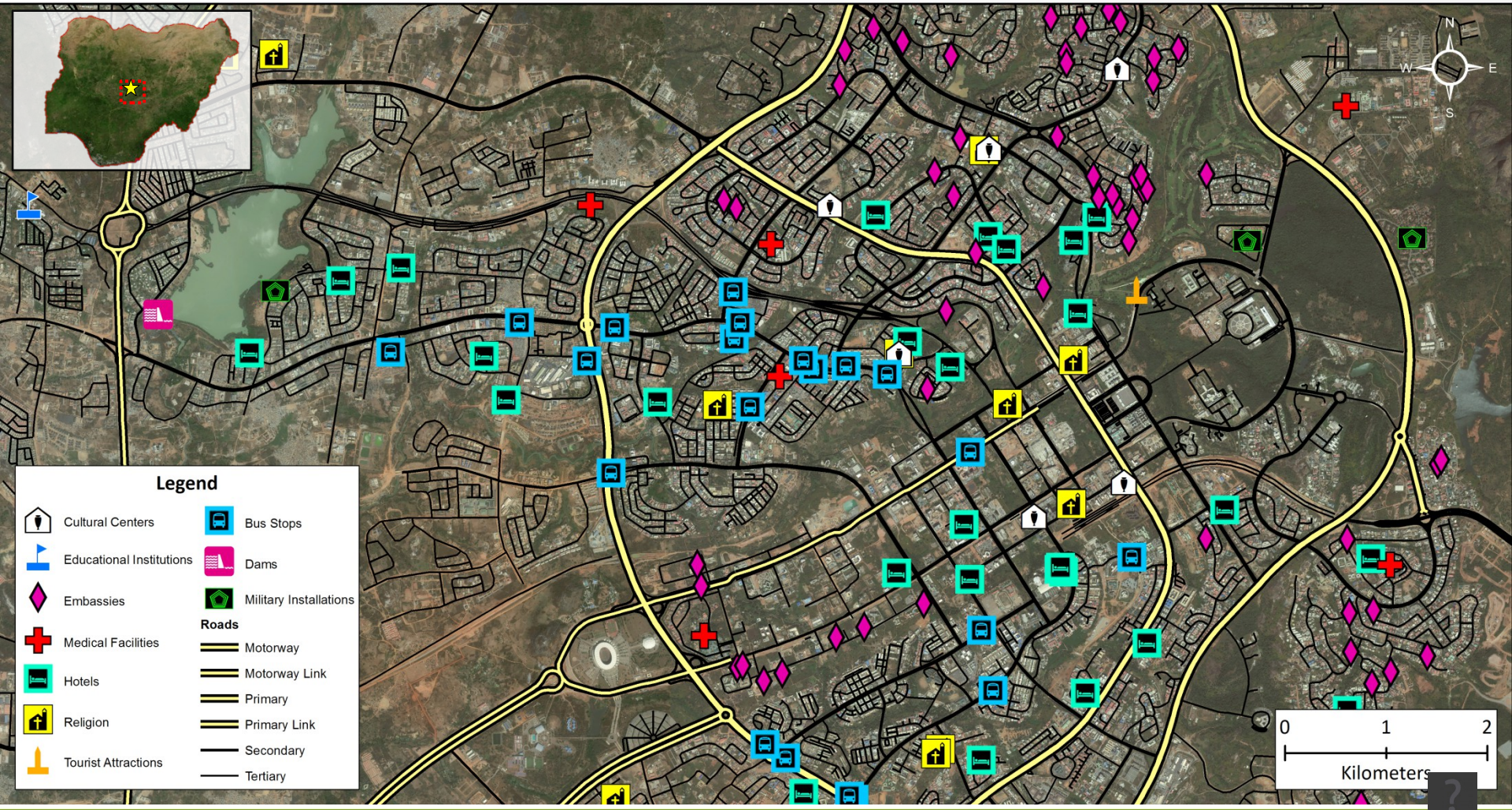
Groups: Civil, political, ideological

Language: Coincides with ethnicity and groups, language

Land: Use, cover, ownership

Water: Hydrology layers, watershed, seasonal fluctuations

Human Landscape Example – Abuja, Nigeria POI Data



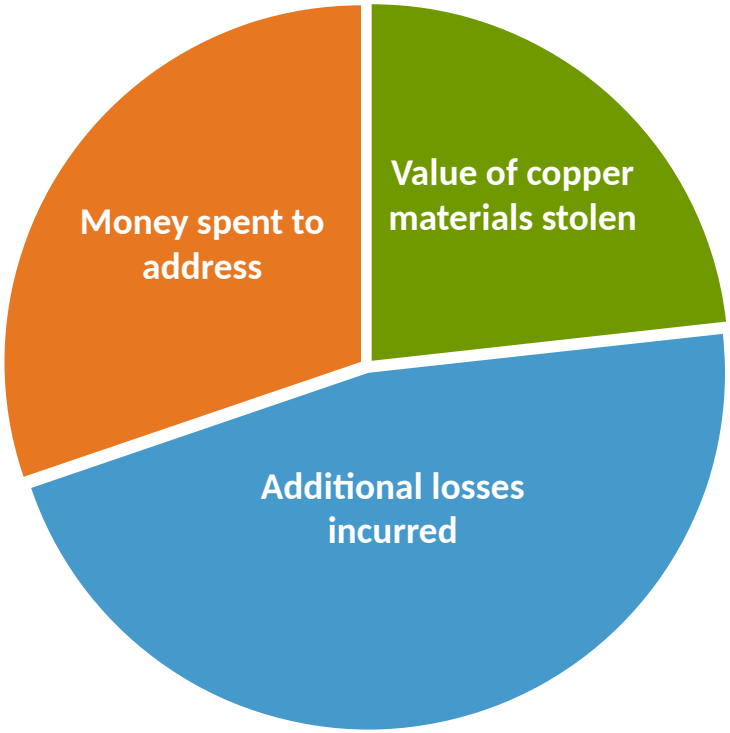
Predicting the Future

Critical Infrastructure Protection

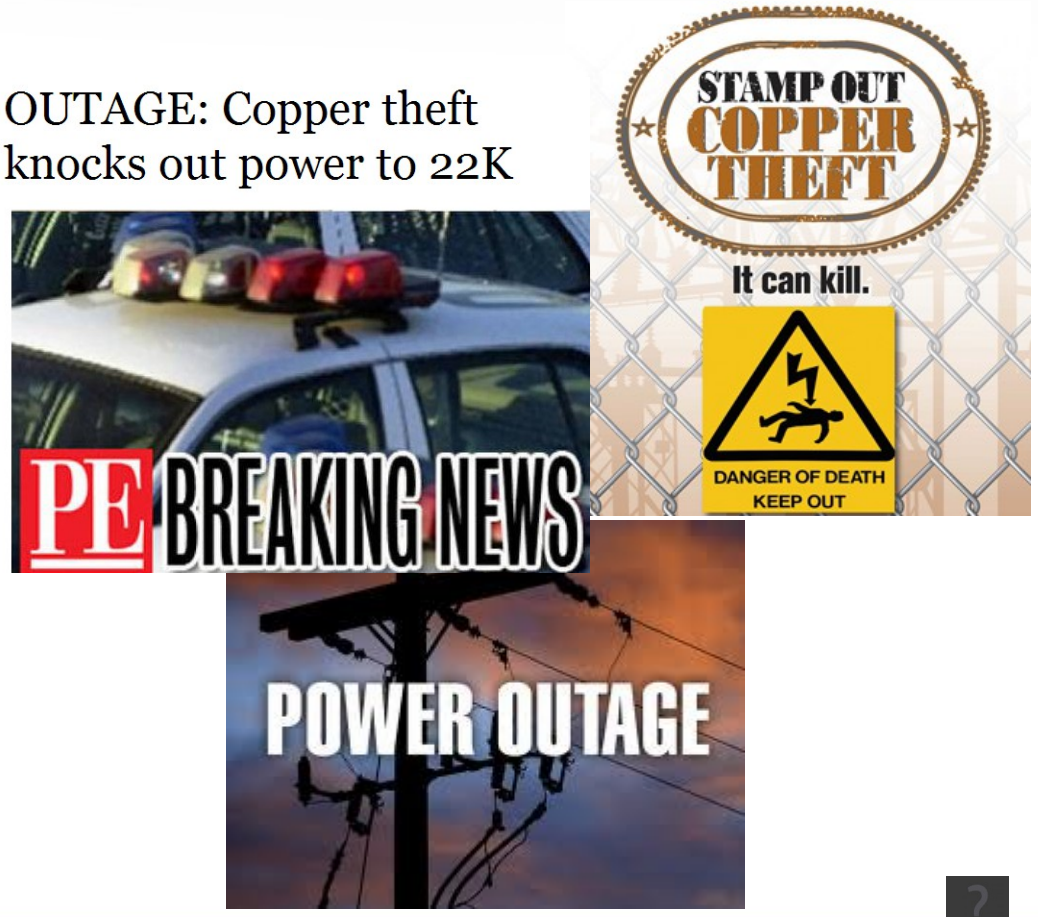
Where is infrastructure most vulnerable to theft or sabotage?

US Utilities Lose Millions to Copper Theft Annually

Economic Impact
$80 – 100M/Yr.



Business Risk



Copper Theft Protection Solution
Get to the Left of Theft

Problem

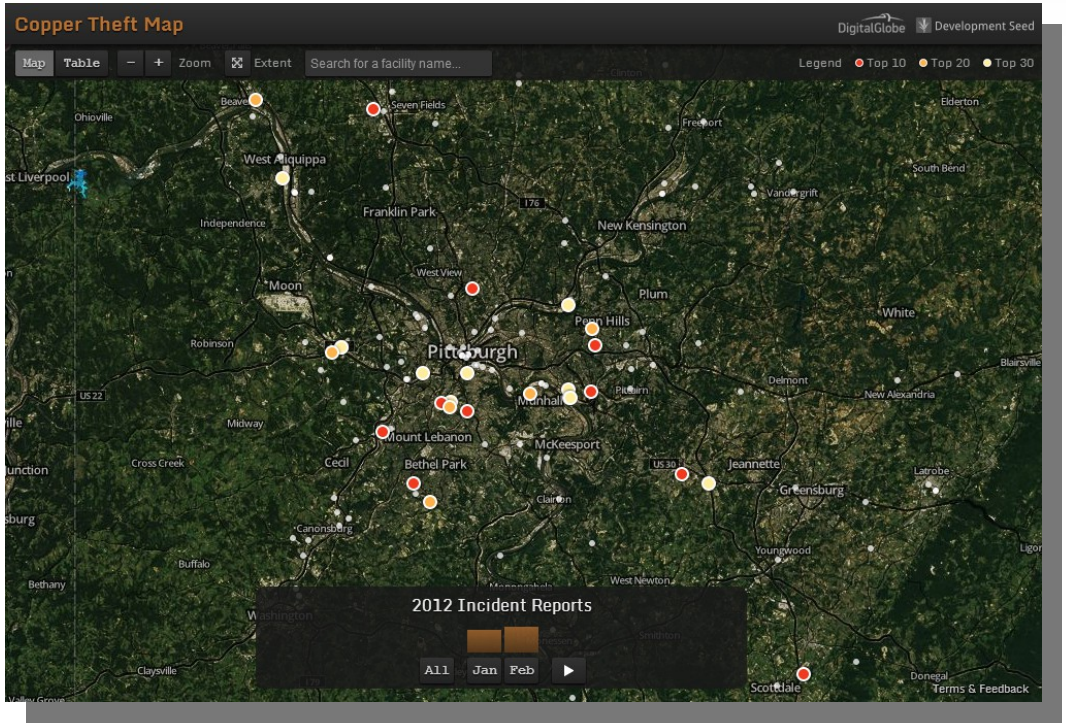
Typical utility security plan assumes little can be done to predict where copper thefts incidents are likely to occur

Solution

Web based substation risk assessment subscription service that uses past crime events and hundreds of spatial factors to identify high risk facilities

Results

Despite 8% increase in attempts 2011, 54% decrease in loss and damages



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Elephant poaching in Garamba National Park

In the past three years alone over 100,000 African elephants have been killed for their tusks. This level of killing represents between a 3-8% overall decline in the species, which will be extinct in less than 20 years if nothing is done to stop this needles slaughter. Learn how geospatial analysis can help park rangers combat the threat of poaching.

enough Satellite Sentinel Project

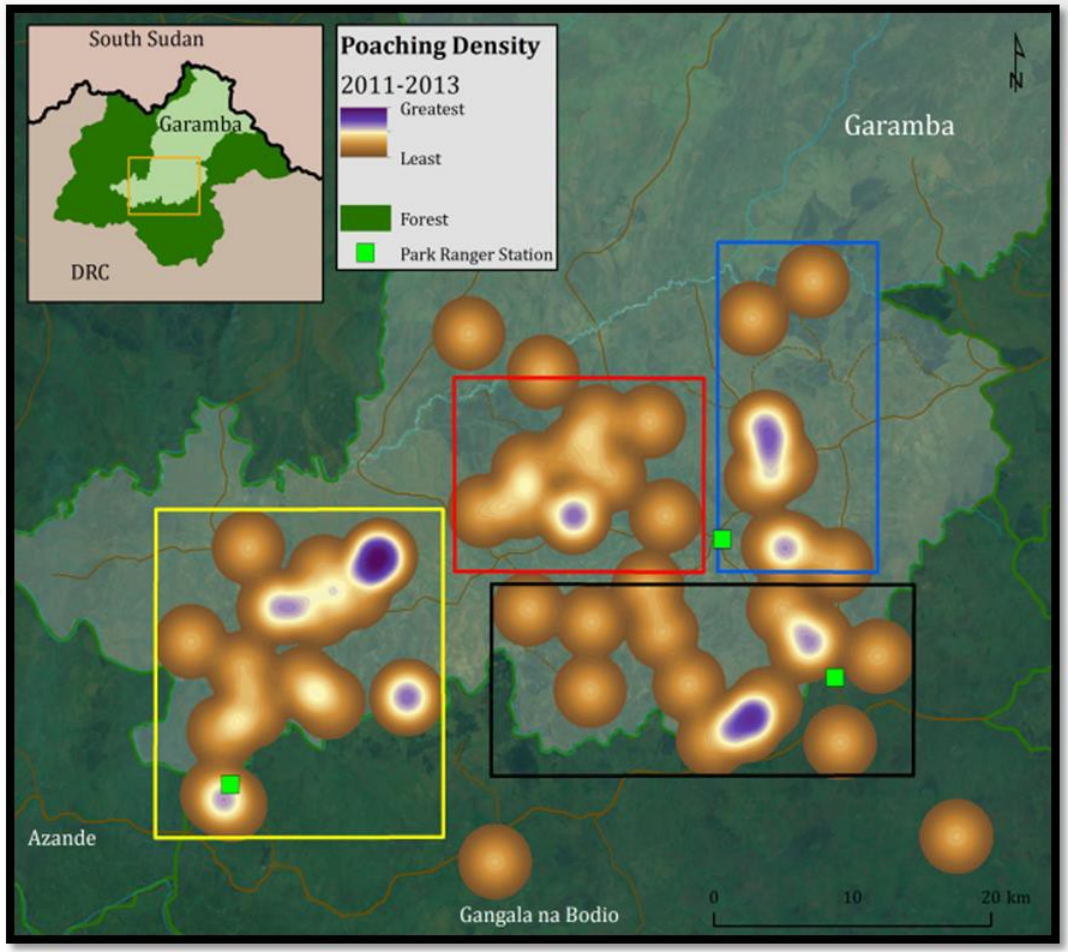
Photo Credit: Rhoda Omega, African Parks

Garamba National Park: Historic Poaching Trends

- Over the past three years (2011-2013) all reported elephant poaching incidents have taken place within the same 1818 km² area of the park which can be further divided into four distinct poaching areas of operation (each less than 480 km²

  - 50% of all the poaching events that took place in 2013 were within 5 kilometers of a 2012 event which indicates that poachers are utilizing the same areas of the park year after year.

  - Between 2012 and 2013 there was a significant (55%) decrease in the number of poaching events within the park. This was particularly apparent in the eastern portion of the poaching area where a 76% decrease in poaching events was observed

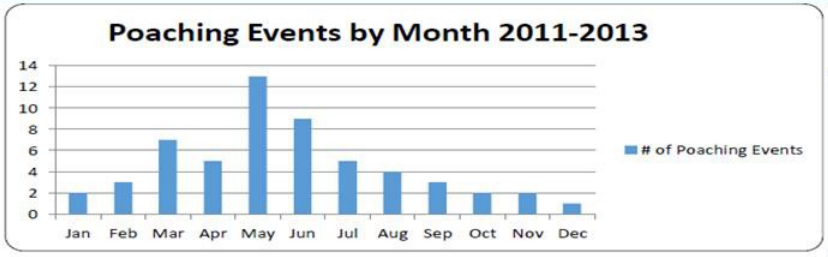


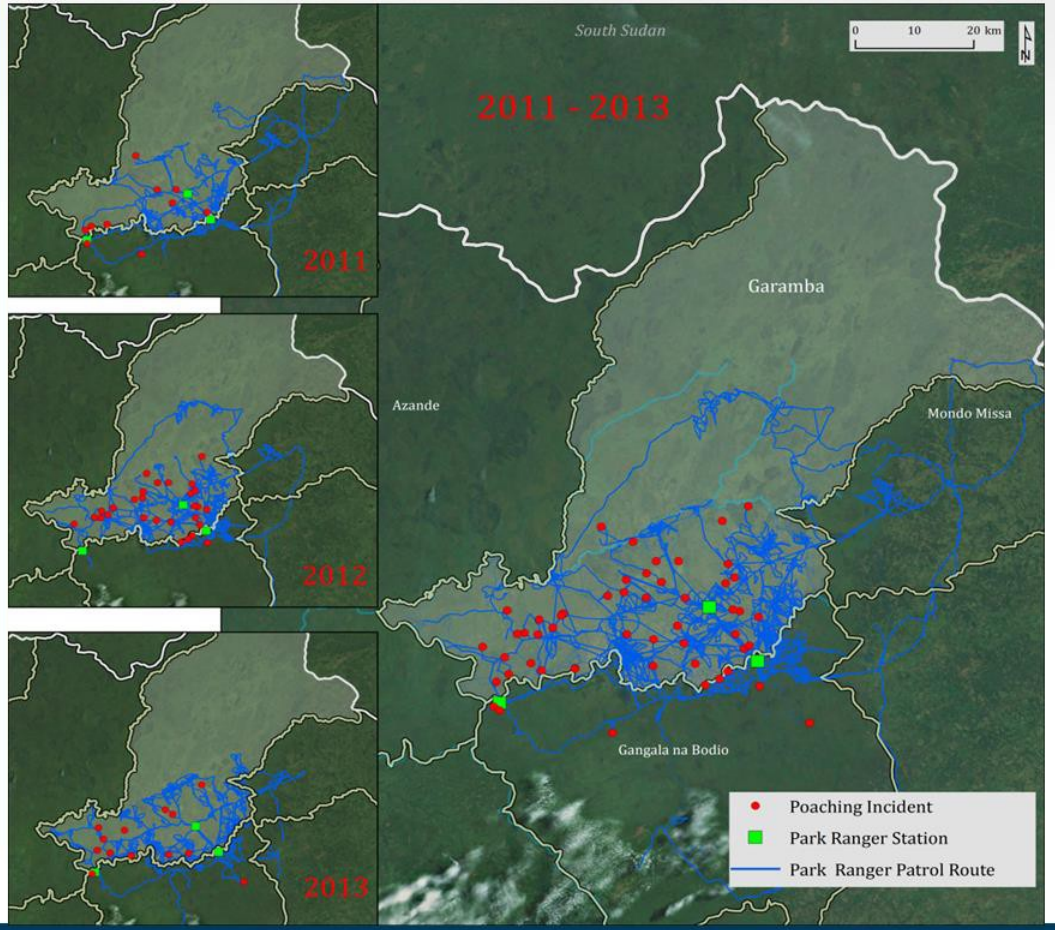
Poaching Events

From 2011-2013 there were 56 elephant kill sites discovered within 56 kilometers of each other in Garamba National Park. Covered by vast grassland and surrounded by the parks gallery forests to the south, east, and west the ~1818 km² area represents the parks primary elephant poaching zone.

Garamba National Park: 2011-2013 Park Ranger Patrols

- In an effort to combat the poaching, rangers have increased both the number of patrols they are conducting and their patrol range (from 7 kilometers in 2012 to 15 kilometers in 2013). Although these efforts appear to have had an effect in the eastern portion of the poaching areas they have had a minimal impact in the western areas where the number of poaching events remains consistent.
  - Ranger patrol data for 2013 and thus far (Jan-Mar) for 2014 indicates that park rangers are primarily sticking to the secondary road network in the western portion of the primary poaching areas of operation. These secondary roads are likely useful to the poachers as a means to reconnect with the primary road network but poaching events generally take place ~3.5 kilometers from a secondary road.
  - Establishing random checkpoints/inspection stations at key chokepoints into and out of the poaching areas particularly during the high poaching months (Mar –Aug) will likely provide the rangers a better means of controlling who travels into these areas.



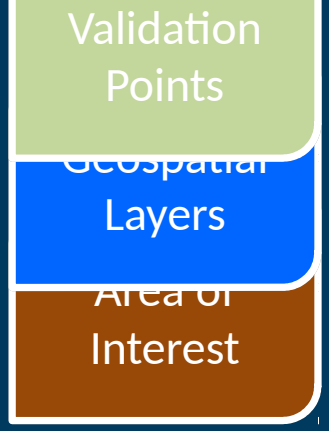


Park Ranger patrol information is most prevalent in the southern portion of the park. Park Rangers rarely travel north of Garamba River. The number of poaching incidents that have occurred in the northern section is unknown. The available data revealed that there were 56 known poaching incidents resulting in 70 elephant deaths.

Analytic Solutions

Signature Analyst™

DigitalGlobe's Signature Analyst™, is a geospatial predictive analysis modeling software that is used to create a signature of virtually any type of geographically-based occurrence.

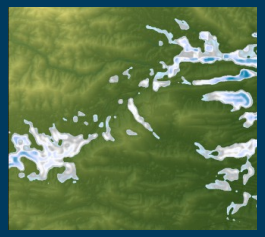


Building the Signature

Creates a statistically relevant geospatial signature by measuring the relationship of each validation point to each geospatial layer within the AOI

Building the Assessment

Projects the geospatial signature throughout the AOI to identify the most geographically similar areas The analytical advantage is the ability forecast "displacement and hidden patterns" to areas without training points



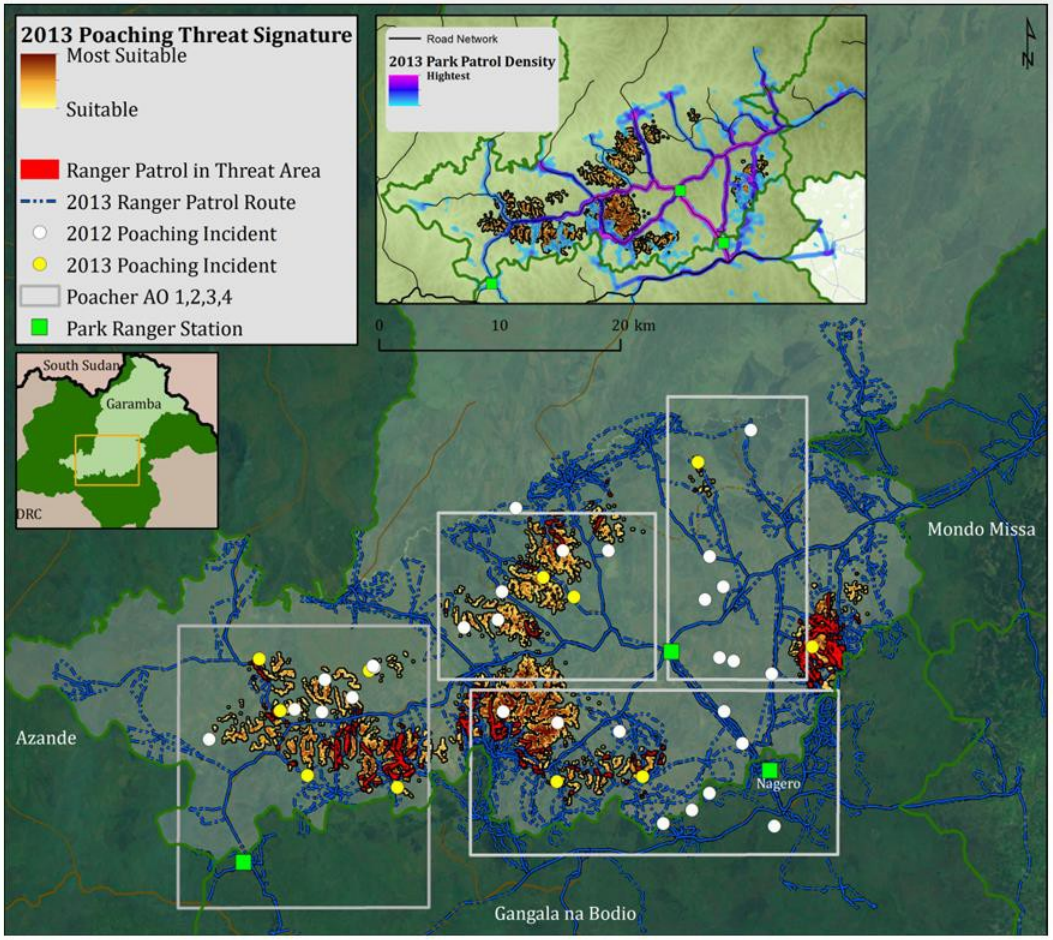
Visualize "Hot Spots"

Feedback to model for continued refinement of the assessment

The Model identifies areas where activities of interest are most likely to be found

Garamba National Park: Key Findings

- Over the past three years (2011-2013) all reported elephant poaching incidents have taken place within the same 1818 km² area of the park which can be further divided into four distinct poaching areas of operation (each less than 480 km²).
  - 50% of all the poaching events that took place in 2013 were within 5 kilometers of a 2012 event which indicates that poachers are utilizing the same areas of the park year after year.
  - Signature AnalystTM further reduced the probable poaching area of operations to four areas of less than 32km²(this represents a 98% reduction in the overall park and a 95% reduction within the historic poaching zone) and one possible new area should poaching in historical areas be disrupted.
- Although efforts to combat the poaching appear to have had an effect in the eastern portion of the poaching areas they have had a minimal impact in the western areas where the number of poaching events remains consistent.
  - Ranger patrol data for 2013 and thus far (Jan-Mar) for 2014 indicates that park rangers are primarily sticking to the secondary road, however poaching events generally take place ~3.5 kilometers from a secondary road.
  - DigitalGlobe has identified key chokepoints into and out of the poaching area, at which checkpoints/inspection stations could be established.



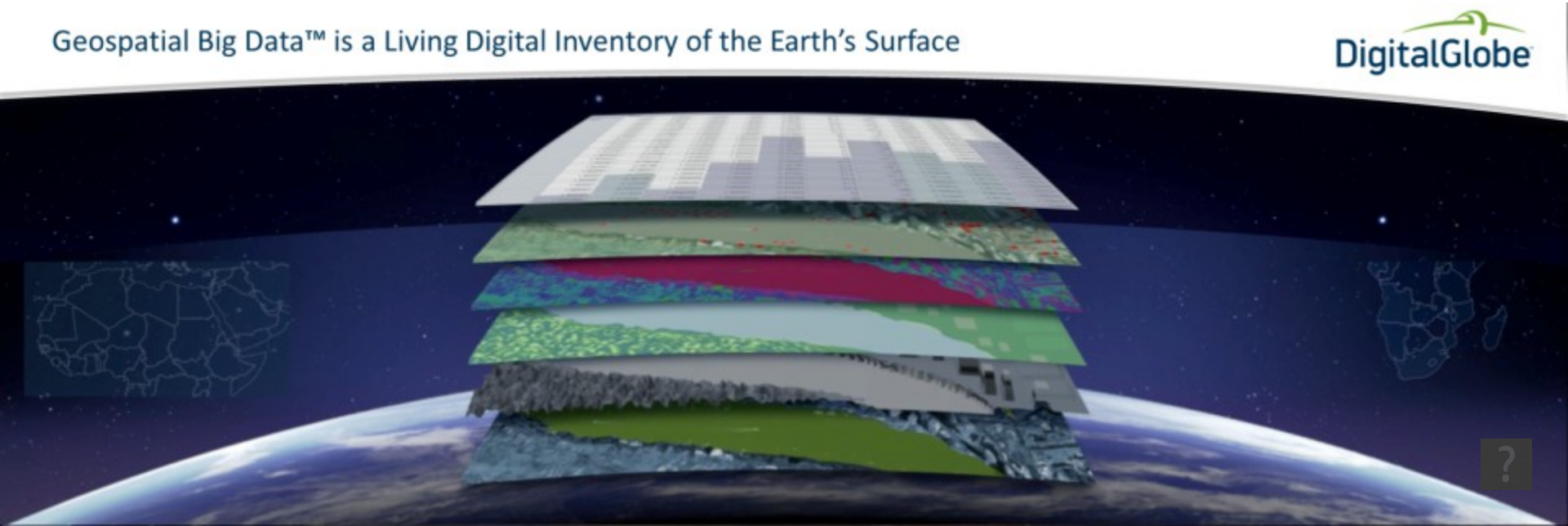
Shifting Focus

Throughout all of 2013, only 45% of all patrols have been within 5 kilometers of a historic poaching event, and only 15% have been in an area identified as highly likely to have a poaching incident by the Signature AnalystTM output.

Summary

- Through a combination of computer vision, machine learning and crowdsourcing, DigitalGlobe has begun turning large volumes of raw very high resolution imagery into actionable knowledge scaling to state and country sized regions.

- These dynamically evolving Geospatial Big Data layers enable the information and insight applications that will make us, by 2020, the indispensable source of information about our changing planet.



www.digitalglobe.com