
BILL & MELINDA GATES foundation
Every person deserves the chance to live a healthy, productive life.
Bill & Melinda Gates Foundation
VILLAGES
Vince Seaman
Deputy Director - Strategy, Data & Analytics
Bill & Melinda Gates Foundation

Strategy, Data & Analytics (SDA) Team, Global Development

Director: Uyi Stewart

Mission:

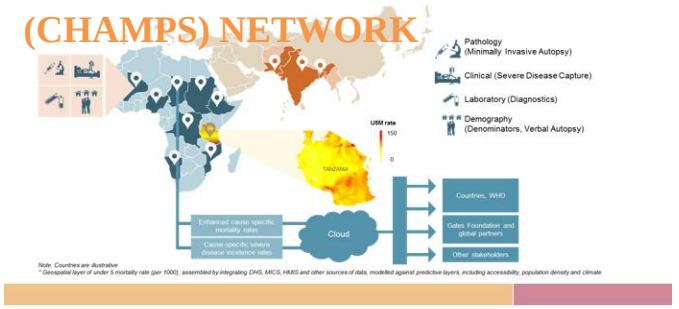
- ***Provide internal support to BMGF program teams in the areas of data collection, use and analysis, geospatial technology, and cost effectiveness***
- ***Oversee cross-cutting investments related to GIS, AI, big data, etc.***
- ***Establish relationships with GIS/data technology vendors & service providers, international organizations, and partners***

Cross-cutting Projects:

1. **BMGF Data Platform** – Polio-initiated effort to build a data platform to store, access, visualize, and share all foundation data assets.
2. **GRID** – Geospatial Reference Layers and Capacity-Building. Co-Funded by DFID. Global stakeholders to guide implementation.
3. **RADIANT (Open Imagery Network)** – Goal is to improve public access to imagery of all types, and provide standard tools to enable viewing, basic analyses and integration with other datasets. Co-funded by Omidyar.

BMGF Programmatic Areas/Teams with GIS-related Projects

CHILD HEALTH AND MORTALITY PREVENTION SURVEILLANCE (CHAMPS) NETWORK



CHAMPS will enable the collection of robust and standardized primary data addressing all causes of death.

Surveillance

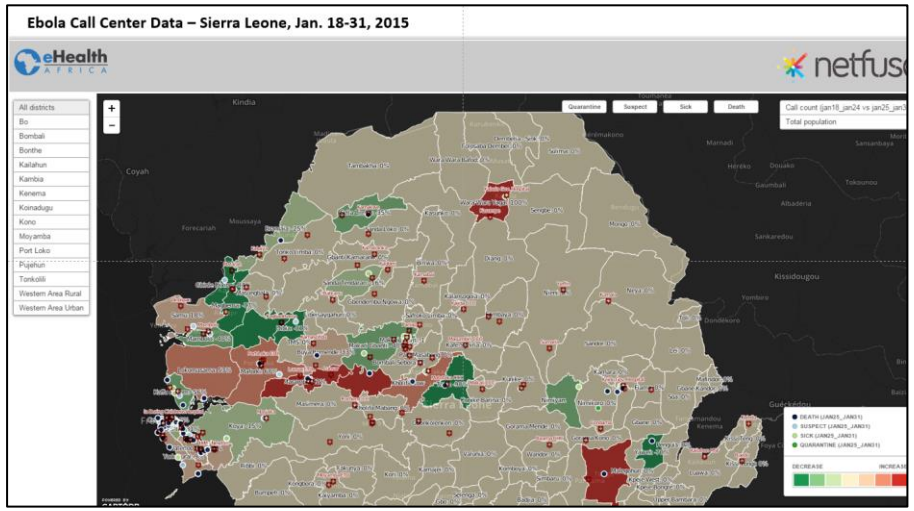
PMA2020 Performance Monitoring and Accountability 2020

Measuring Performance, Informing Policy, Empowering Communities.

ABOUT US | WHAT WE DO | DATA & RESEARCH

Performance Monitoring and Accountability 2020 (PMA2020) uses innovative mobile technology to routinely gather rapid-turnaround, cost-effective population data on family planning and water, sanitation and hygiene.

Family Planning



Emergency Response

Malaria

Integrating Geospatial Analysis into FSP's Strategy and Execution

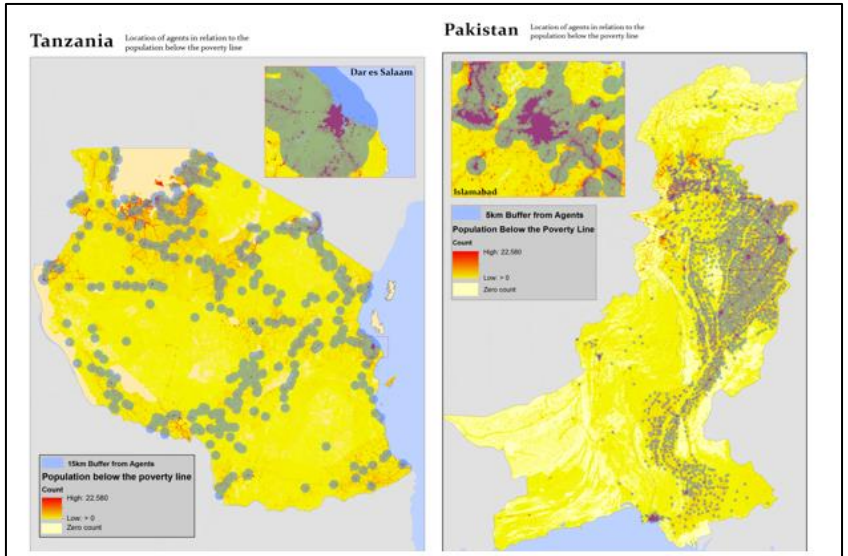


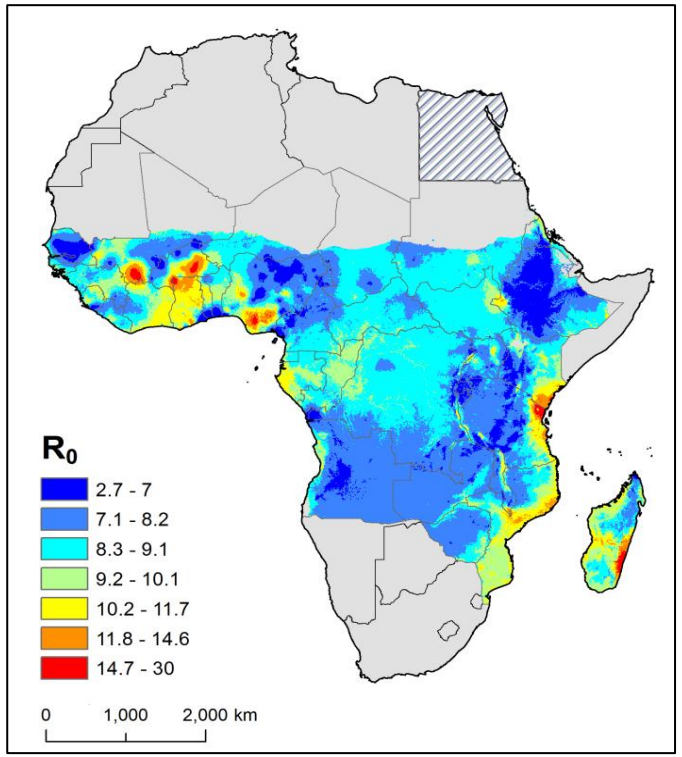
Figure 4: Spatial distribution of poor people relative to mobile money agents in Tazania

Figure 5: Spatial distribution of poor people relative to network of mobile money agents in Pakistan

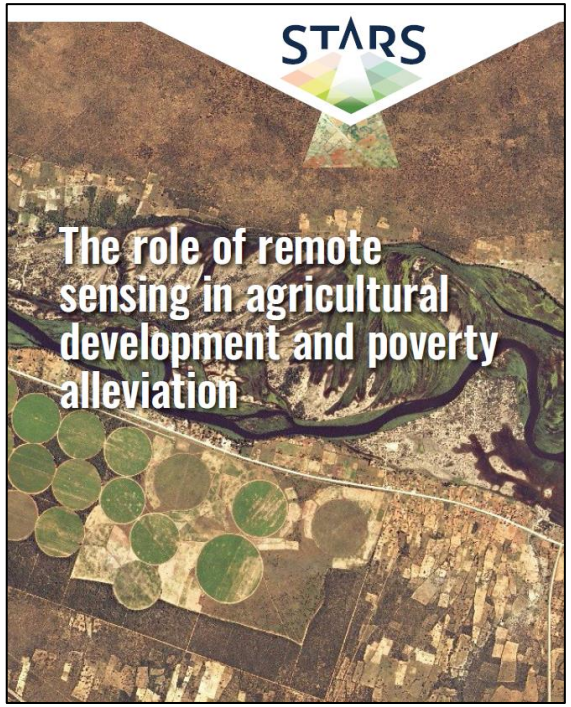
Financial Services for the Poor

BMGF Programmatic Areas/Teams with GIS-related Projects (cont.)

Geographical variation in the intensity of LF transmission

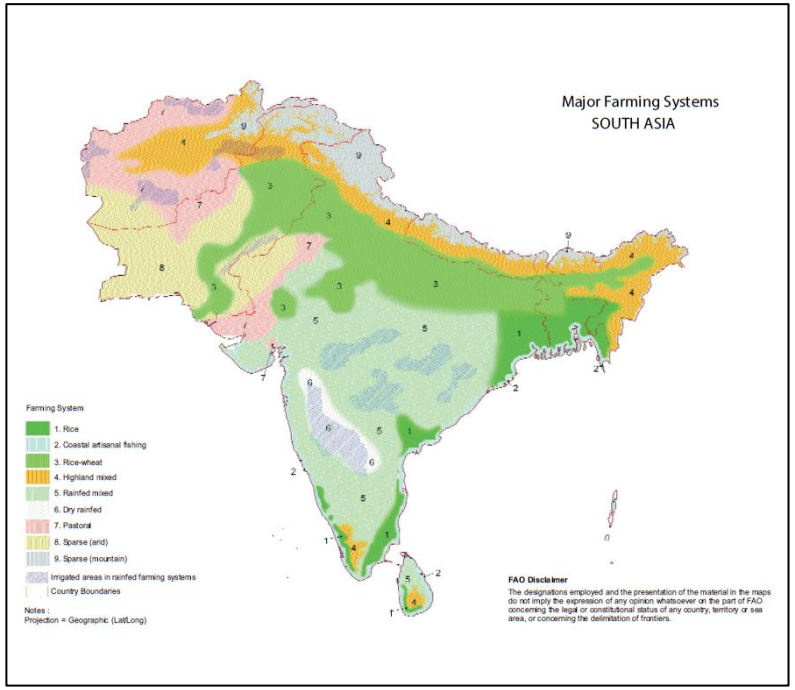


NTDs



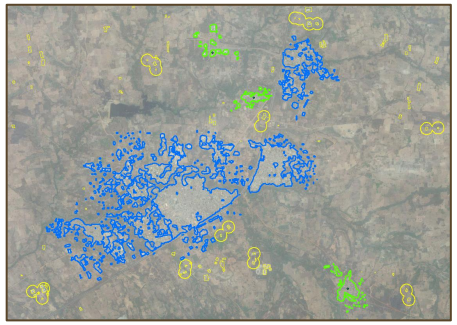
Polio - Locating Missed Settlements

Agriculture

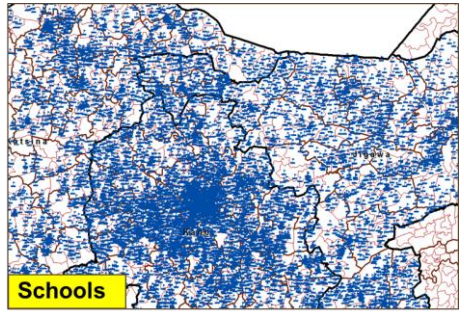


Nigeria: GIS Base Layers Collected for 10 Northern States (2012-13)

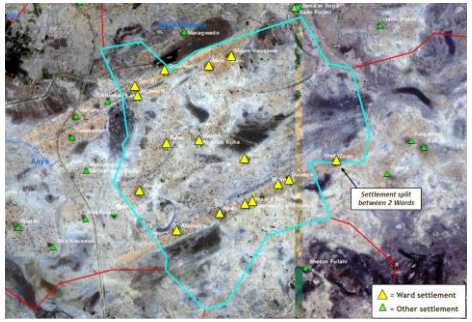
Manual & Automated Feature Extraction of Satellite Imagery



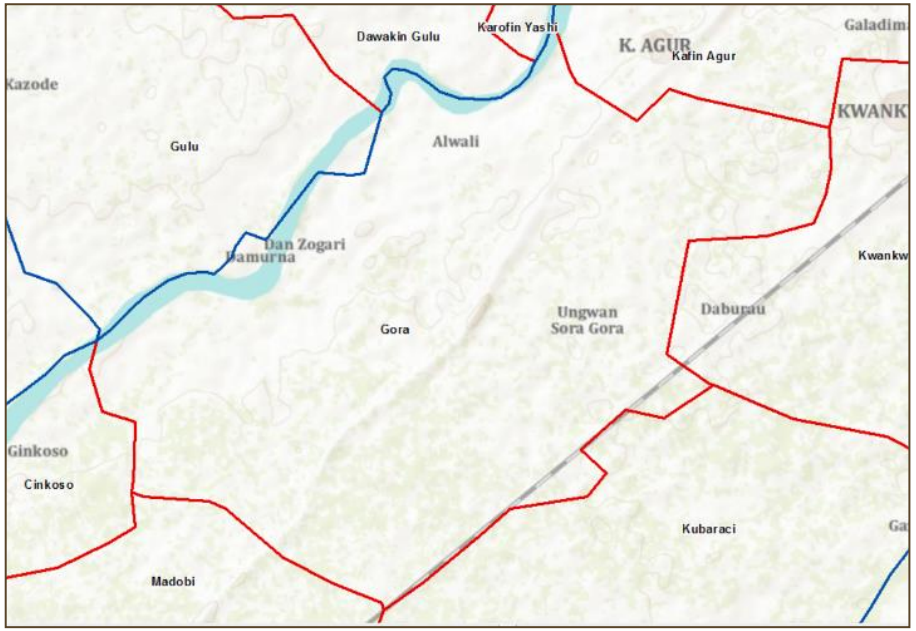
Field Data Collection

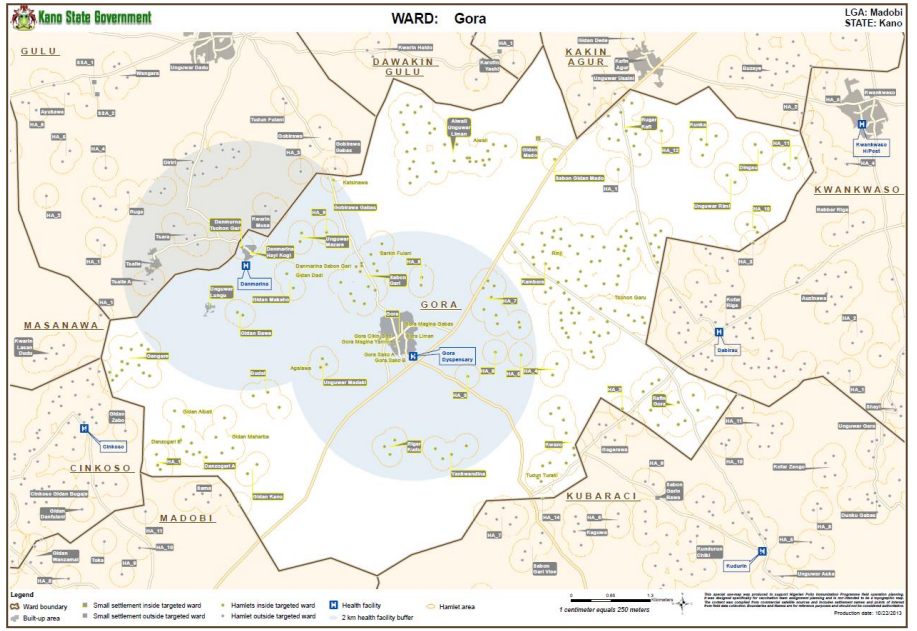


Points of Interest



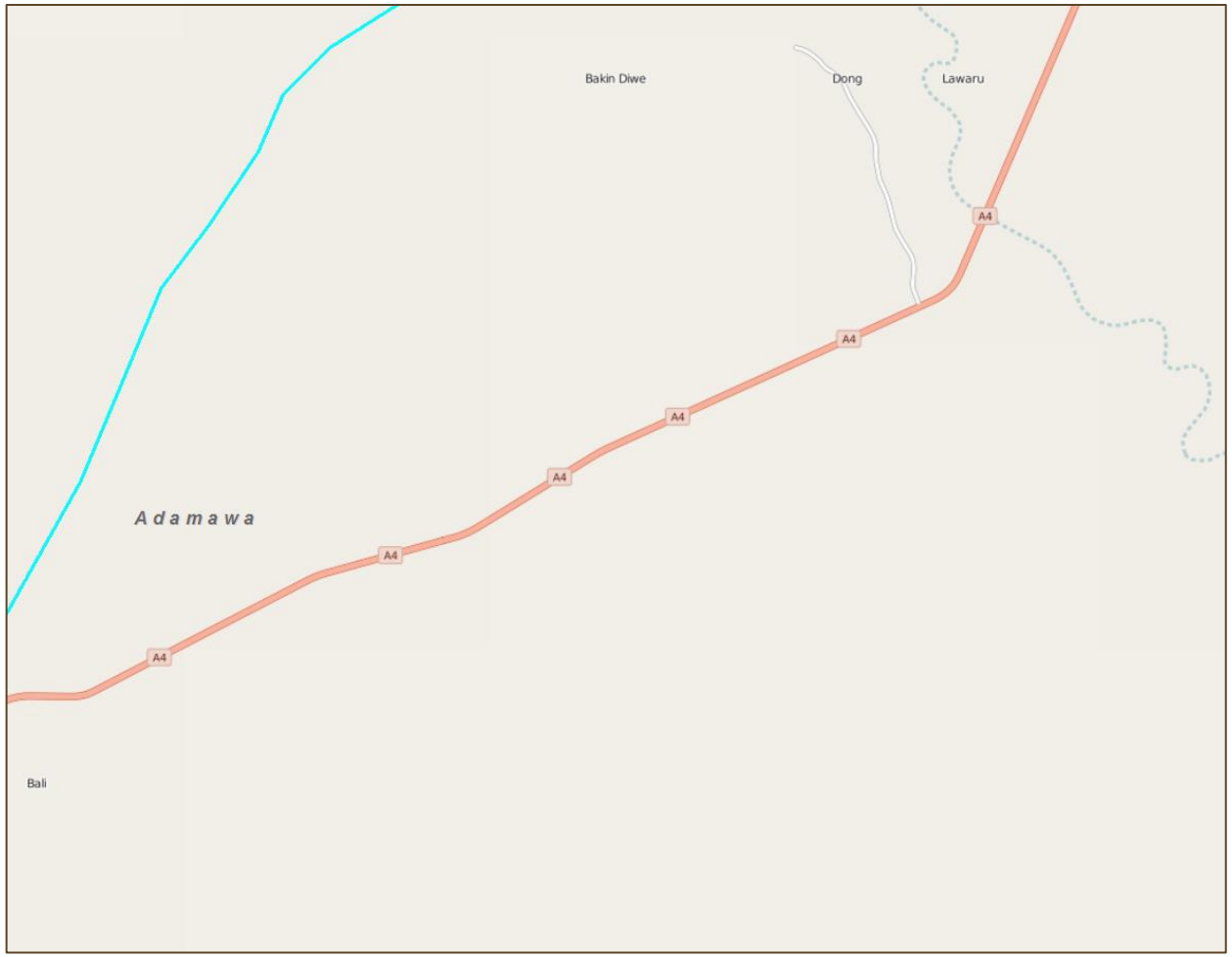
Settlement Attributes used to create Ward Boundaries



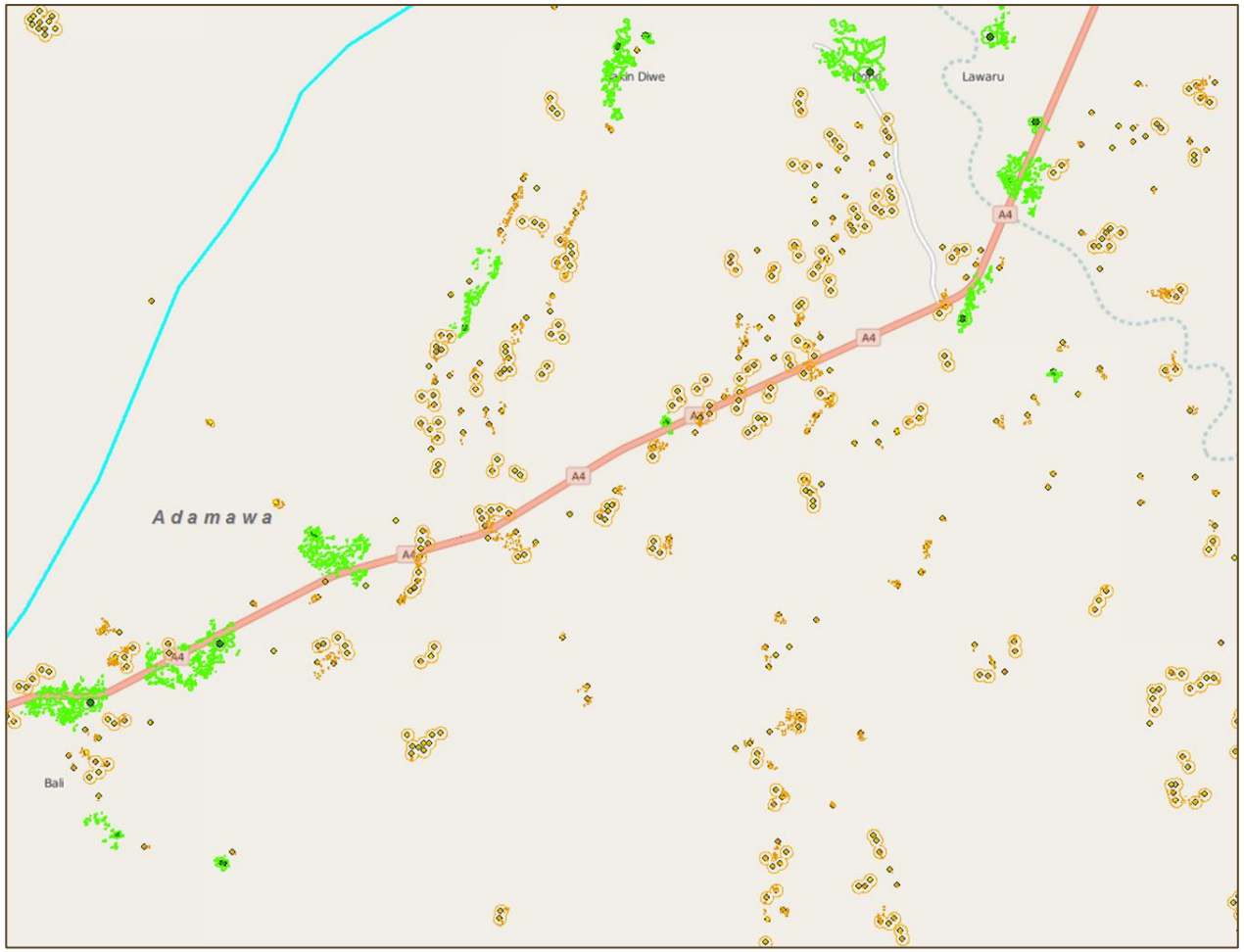


Existing Public Databases are Limited to Urban Centers

Adamawa State, Nigeria (OpenStreet Maps)

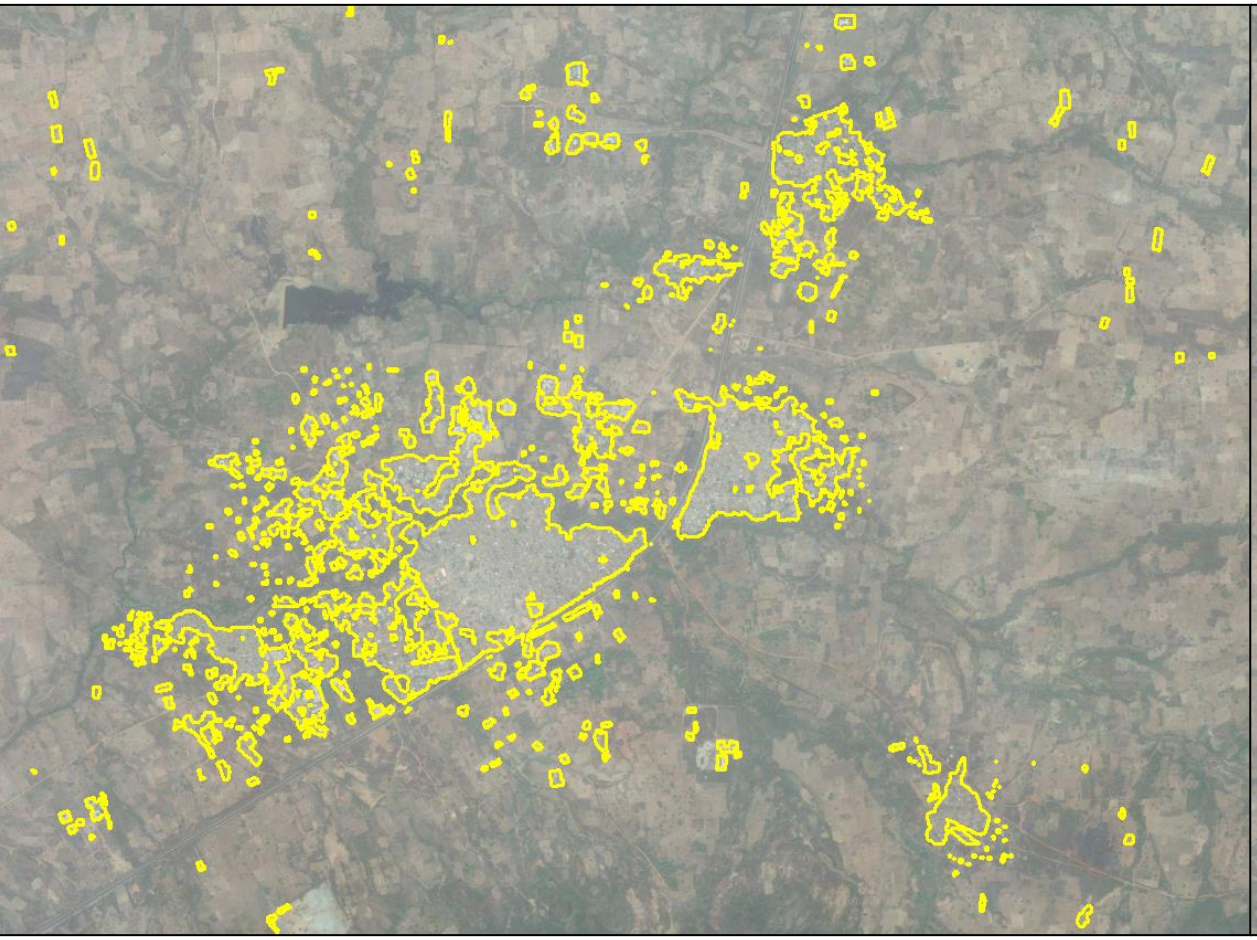


Automated Feature Extraction (FE) Settlements (ORNL)



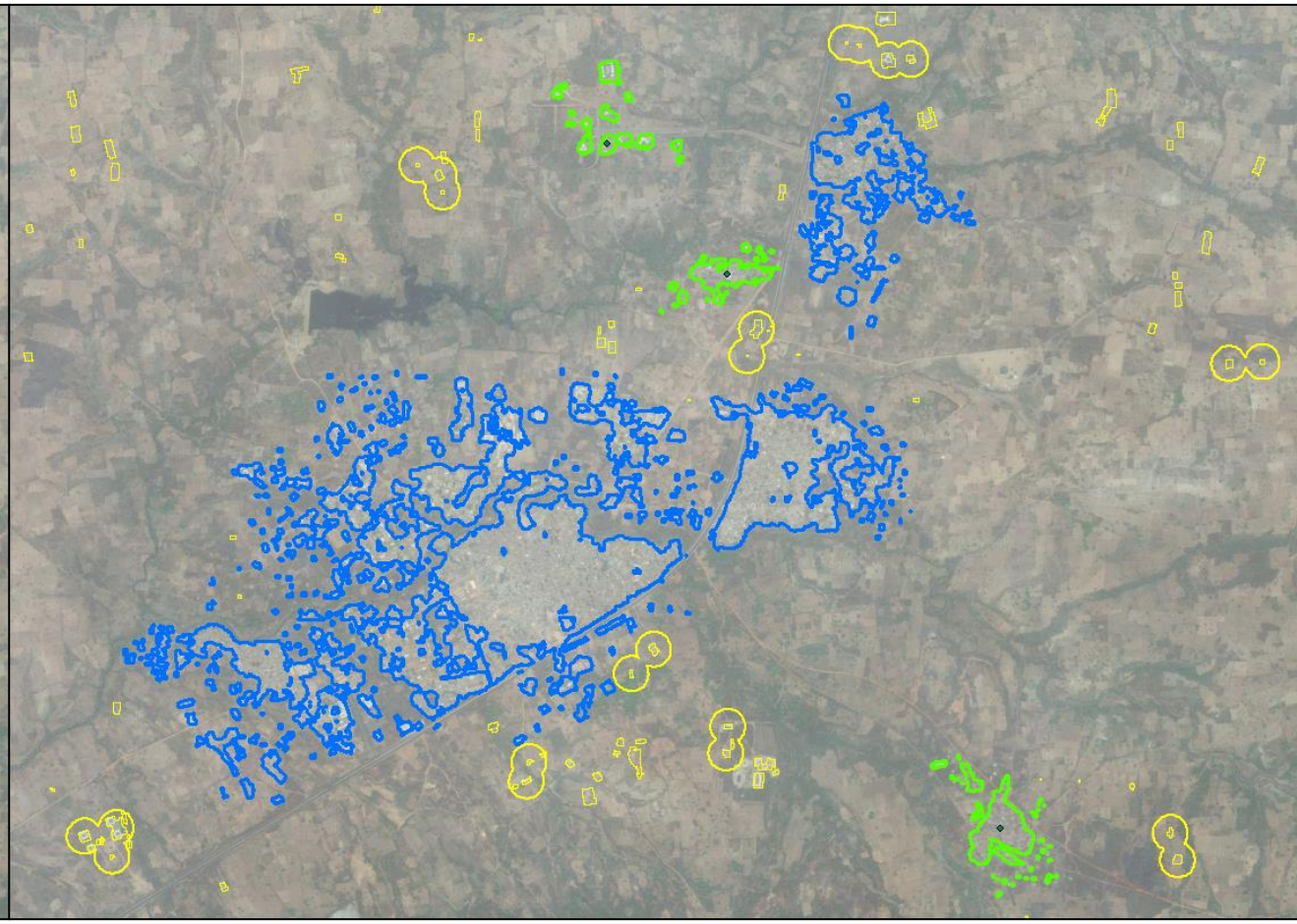
Imagery Extracted Settlement Feature Layer

Raw FE layer



486 features

Aggregated Settlement Layer

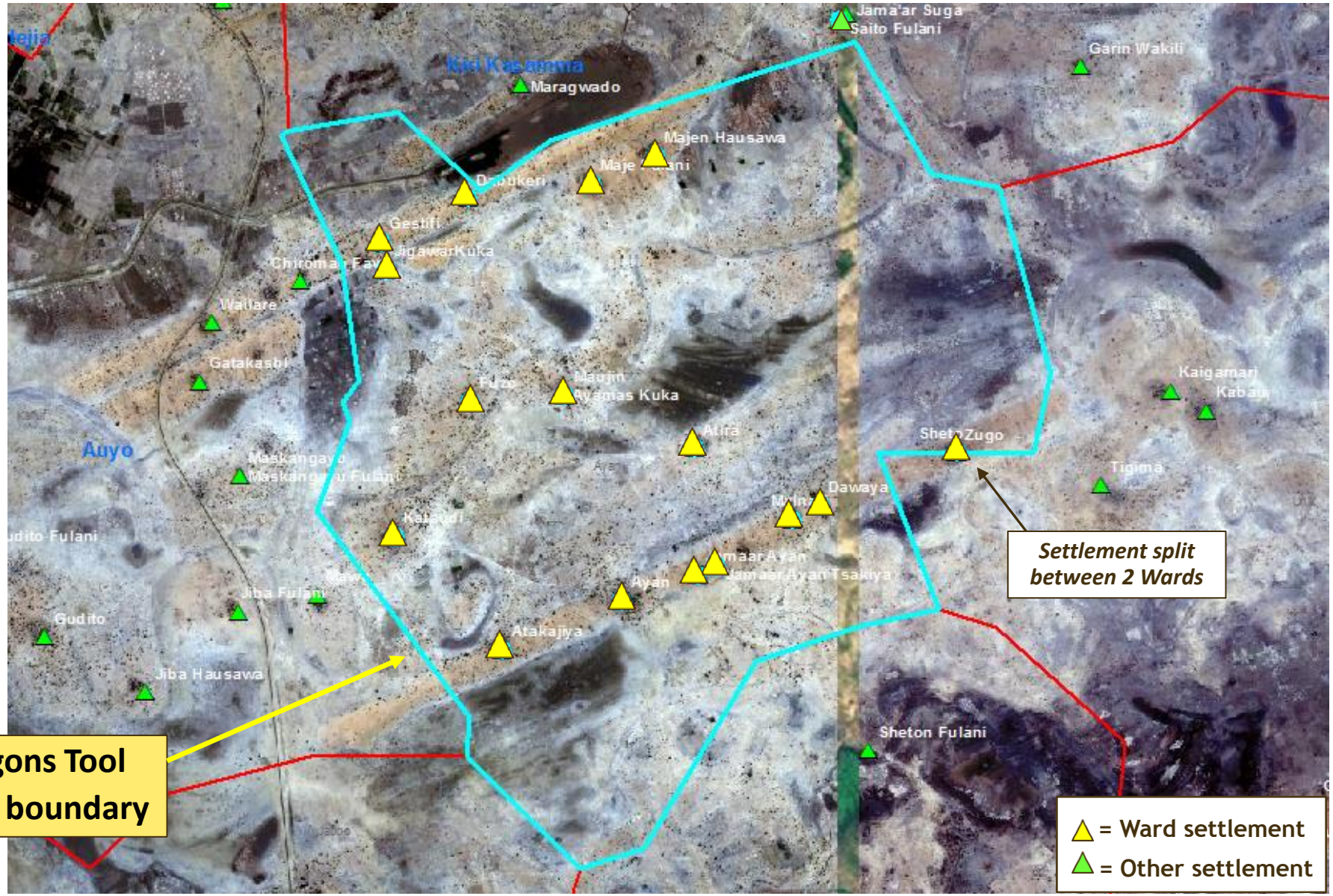


14 settlement features

2 BUAs, 3 SSAs, 9 HA (56 hamlets)

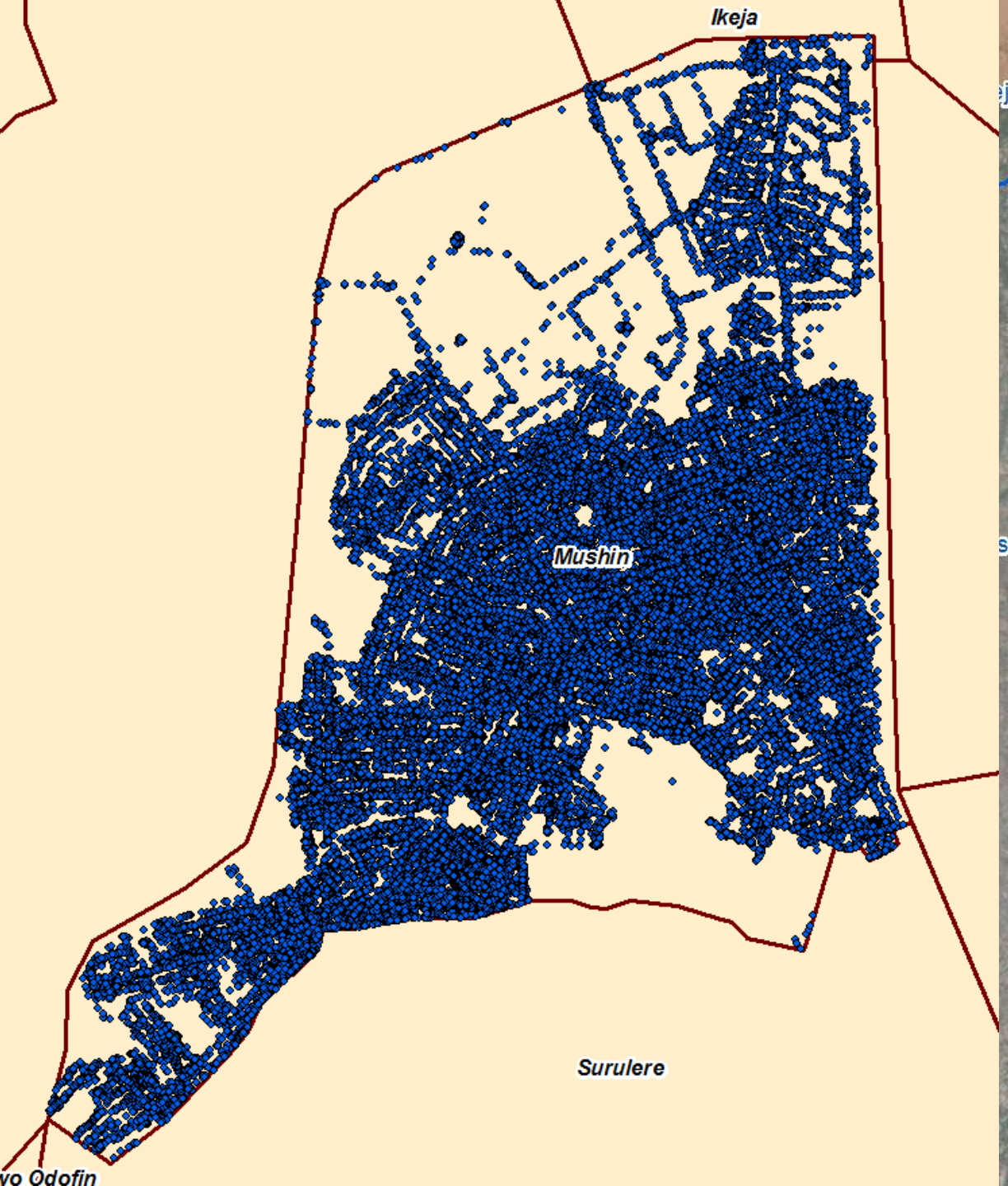
Imagery Courtesy of Digital Globe)

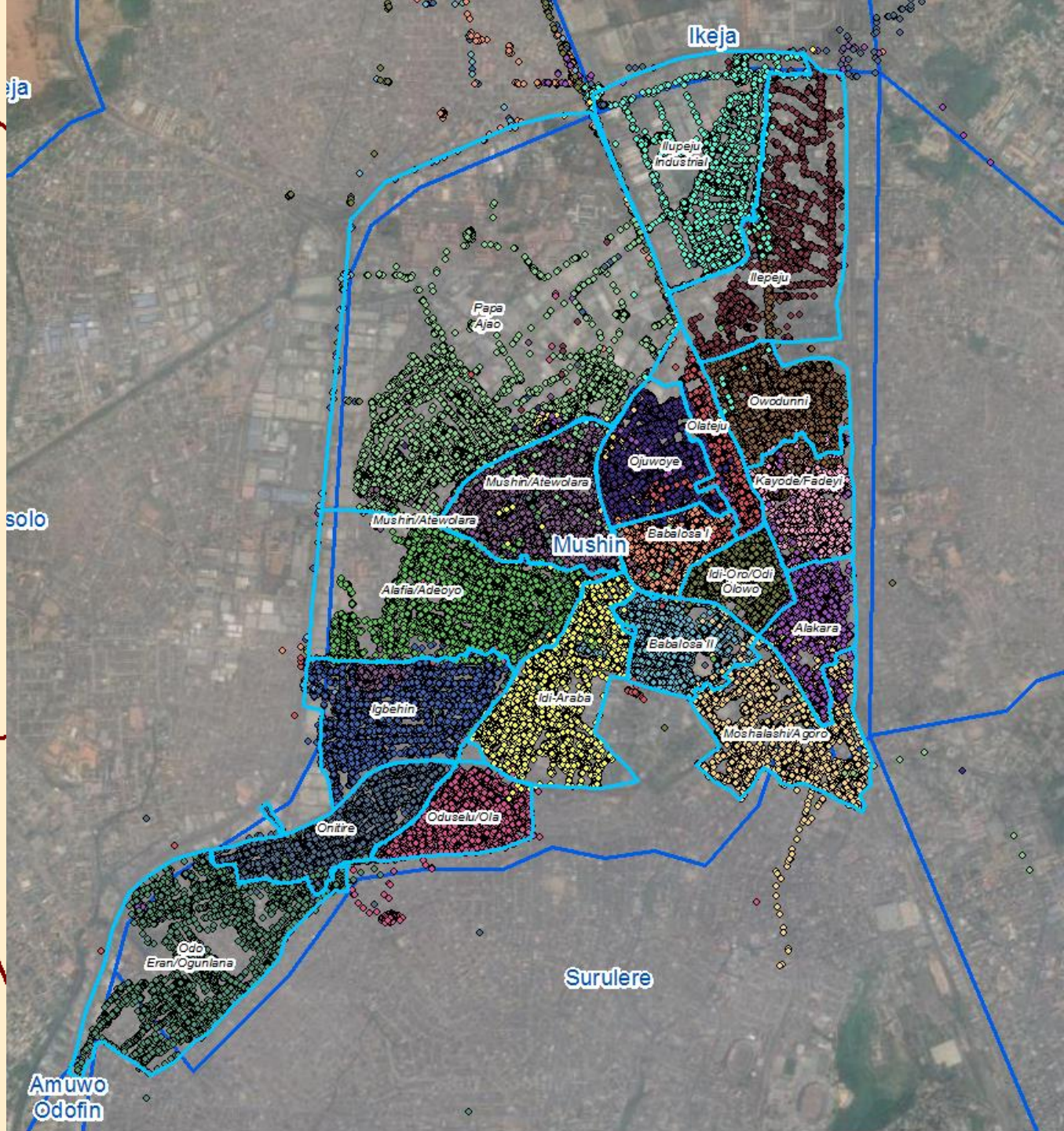
Admin Boundaries Created from Settlement Attributes

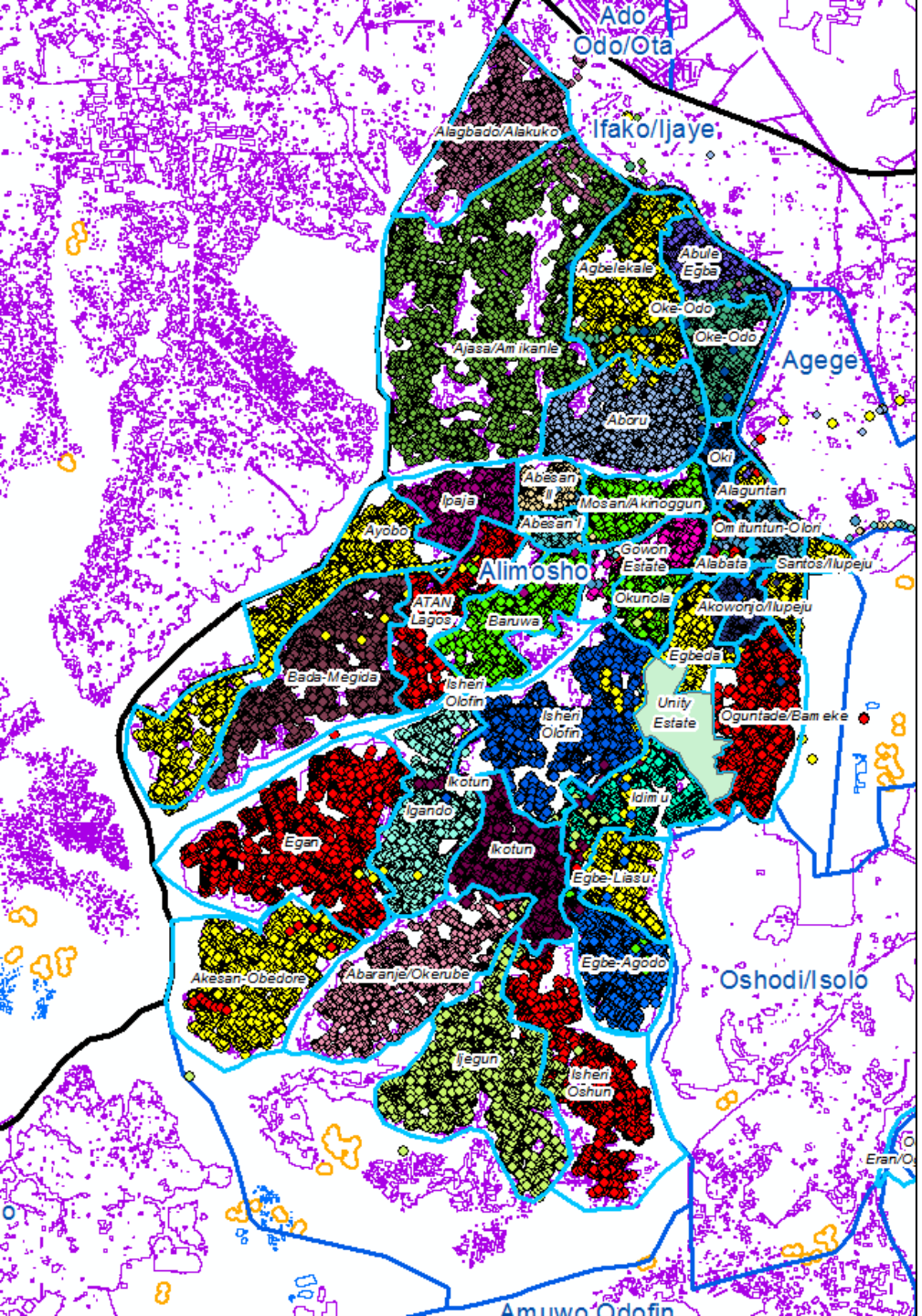


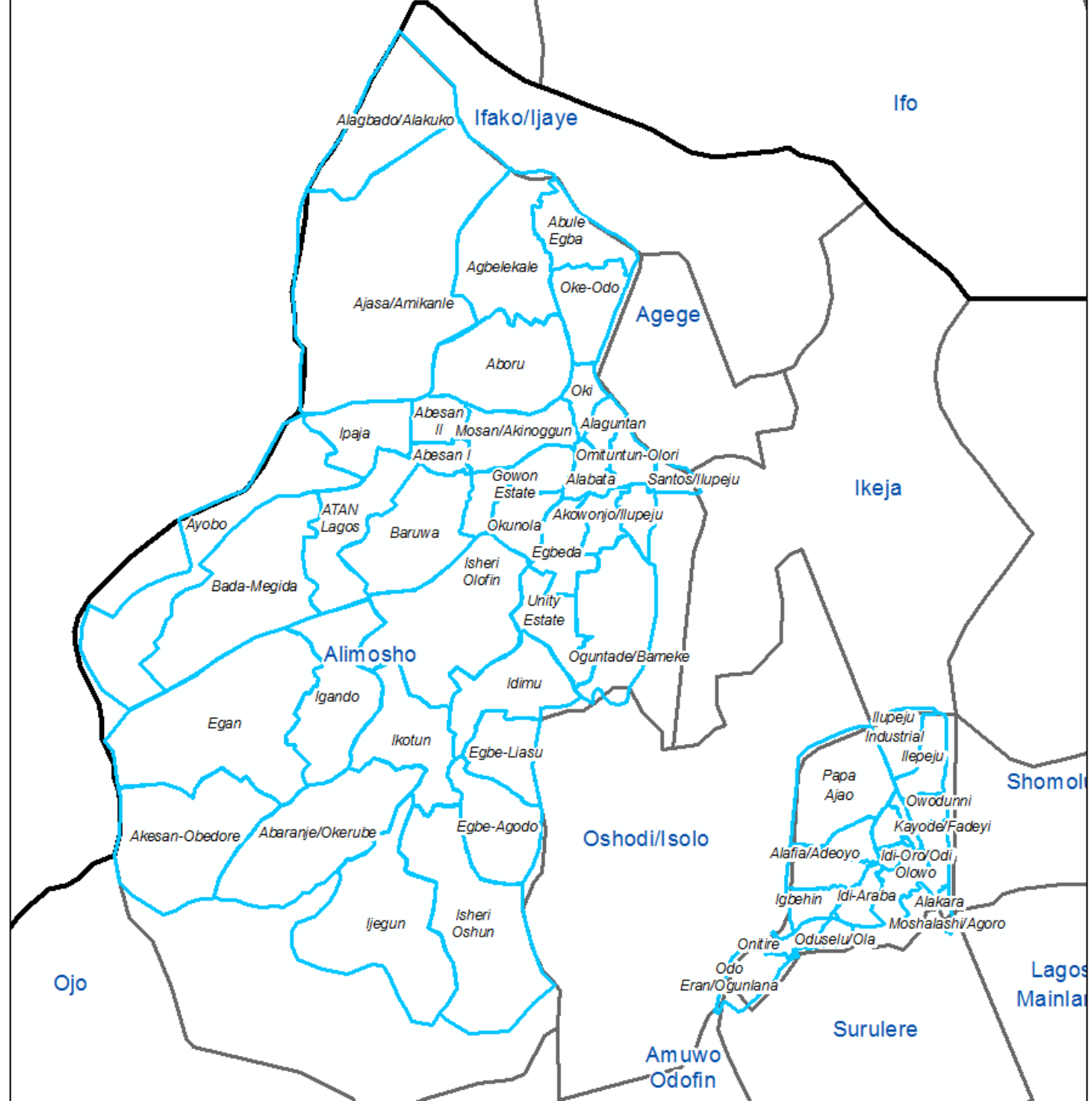
Thiessen Polygons Tool used to create boundary

Polio Vaccination Campaign eTally: Local Supervisors had no trouble understanding and using the eTally application and preferred it over the paper tally


Ikeja
Mushin
Surulere
wo Odofin


Ikeja
Ilupeju Industrial
Ilepeju
Papa Ajao
Owodunni
Olateju
Ojuwoye
Mushin/Atewolara
Kayode/Fadeyi
Mushin/Atewolara
Mushin
Babalosa I
Idi-Oro/Odi Olowo
Alafia/Adeoyo
Alakara
Babalosa II
Igbehin
Idi-Araba
Moshalashi/Agoro
Onitire
Oduselu/Ola
Odo Eran/Ogunlana
Surulere
Amuwo Odofin


Ado
Odo/Ota
Ifako/Ijaye
Alagbado/Alakuko
Agbelekale
Abule Egba
Oke-Odo
Ajasa/Amikanle
Agege
Aboru
Oki
Abesan II
Mosan/Akinoggun
Alaguntan
Ipaja
Abesan I
Omituntun-Olori
Ayobo
Gowon Estate
Alabata
Santos/Ilupeju
Alimosho
Okunola
Akowonjo/Ilupeju
ATAN Lagos
Baruwa
Egbeda
Bada-Megida
Isheri Olofin
Unity Estate
Oguntade/Bameke
Idimu
Igando
Egan
Ikotun
Egbe-Liasu
Egbe-Agodo
Akesan-Obedore
Abaranje/Okerube
Oshodi/Isolo
Ijegun
Isheri Oshun
Eran/O
Amuwo Odofin


Ifo
Alagbado/Alakuko
Ifako/Ijaye
Abule Egba
Agbelekale
Oke-Odo
Ajasa/Amikanle
Agege
Aboru
Oki
Abesan II
Mosan/Akinoggun
Alaguntan
Ipaja
Abesan I
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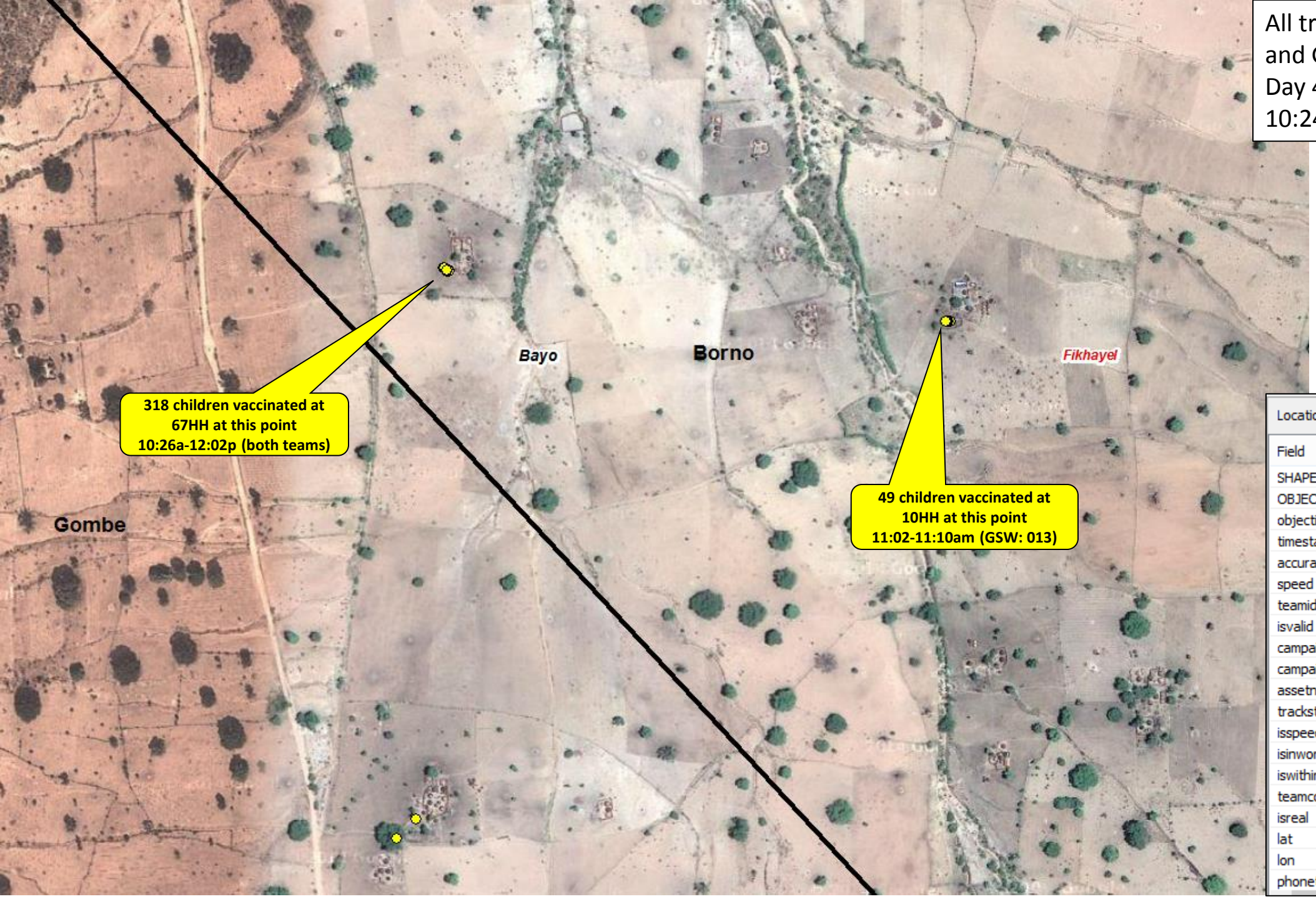
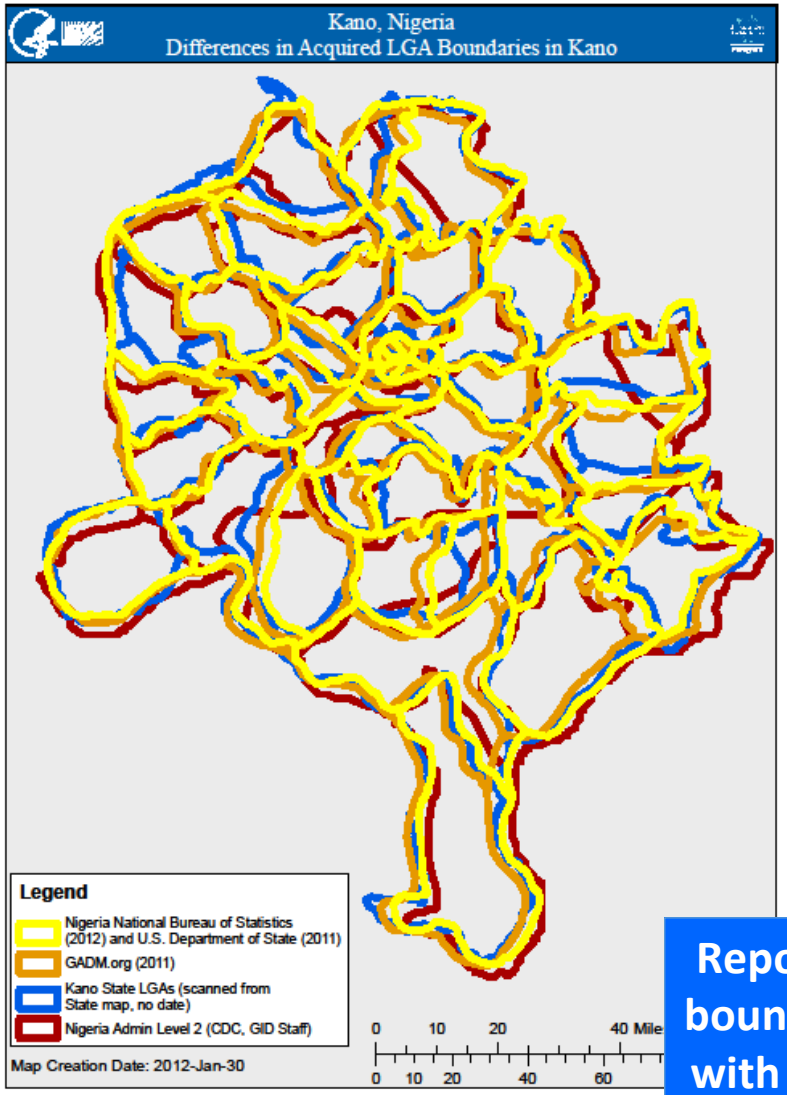
Gowon Estate
Alabata
Santos/Ilupeju
Ikeja
Ayobo
ATAN Lagos
Baruwa
Okunola
Akowonjo/Ilupeju
Egbeda
Bada-Megida
Isheri Olofin
Unity Estate
Alimosho
Oguntade/Bameke
Idimu
Igando
Egan
Ikotun
Egbe-Liasu
Ilupeju Industrial
Ilepeju
Papa Ajao
Shomolu
Owodunni
Kayode/Fadeyi
Akesan-Obedore
Abaranje/Okerube
Egbe-Agodo
Oshodi/Isolo
Alafia/Adeoyo
Idi-Oro/Odi Olowo
Igbehin
Idi-Araba
Alakara
Moshalashi/Agoro
Ijegun
Isheri Oshun
Onitire
Oduselu/Ola
Odo Eran/Ogunlana
Ojo
Lagos Mainla
Surulere
Amuwo Odofin


All tracks for Teams GWS: 013 and GSW:ST 013 are from Day 4 (1-March) between 10:24a – 12:16p
Bayo
Borno
Fikhayel
Gombe
318 children vaccinated at 67HH at this point 10:26a-12:02p (both teams)
49 children vaccinated at 10HH at this point 11:02-11:10am (GSW: 013)
Location: 11.627618 10.506237 Decimal Degree
Field | Value
SHAPE | Point
OBJECTID | 311191
objectid | <null>
timestamp | 3/1/2016 11:18:31 AM
accuracy | 5
speed | 0
teamid | 868096013449755
isvalid | 1
campaignday | 4
campaignid | 75
assetname | Unknown Asset
trackstamp | 3/2/2016 9:13:19 AM
isspeedvalid | 1
isinworkingperiod | 1
iswithindates | 1
teamcode | GSW:013
isreal | 1
lat | 10.506197
lon | 11.62761
phonetime | 2/29/2016 11:18:33 PM

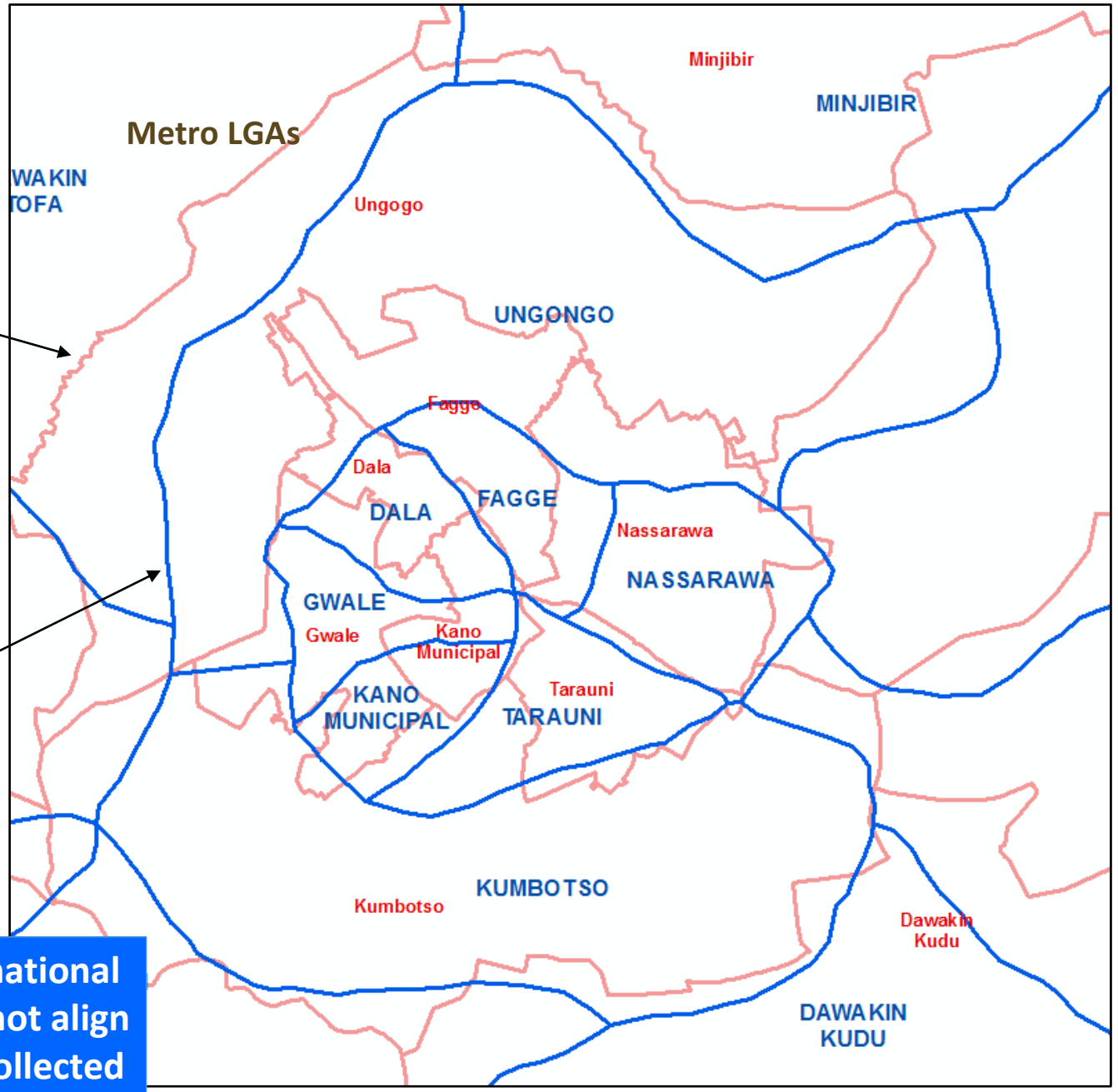
Administrative Boundaries

Nearly all existing data is <u>inaccurate</u> !



VTS Boundary

Published Census Boundary

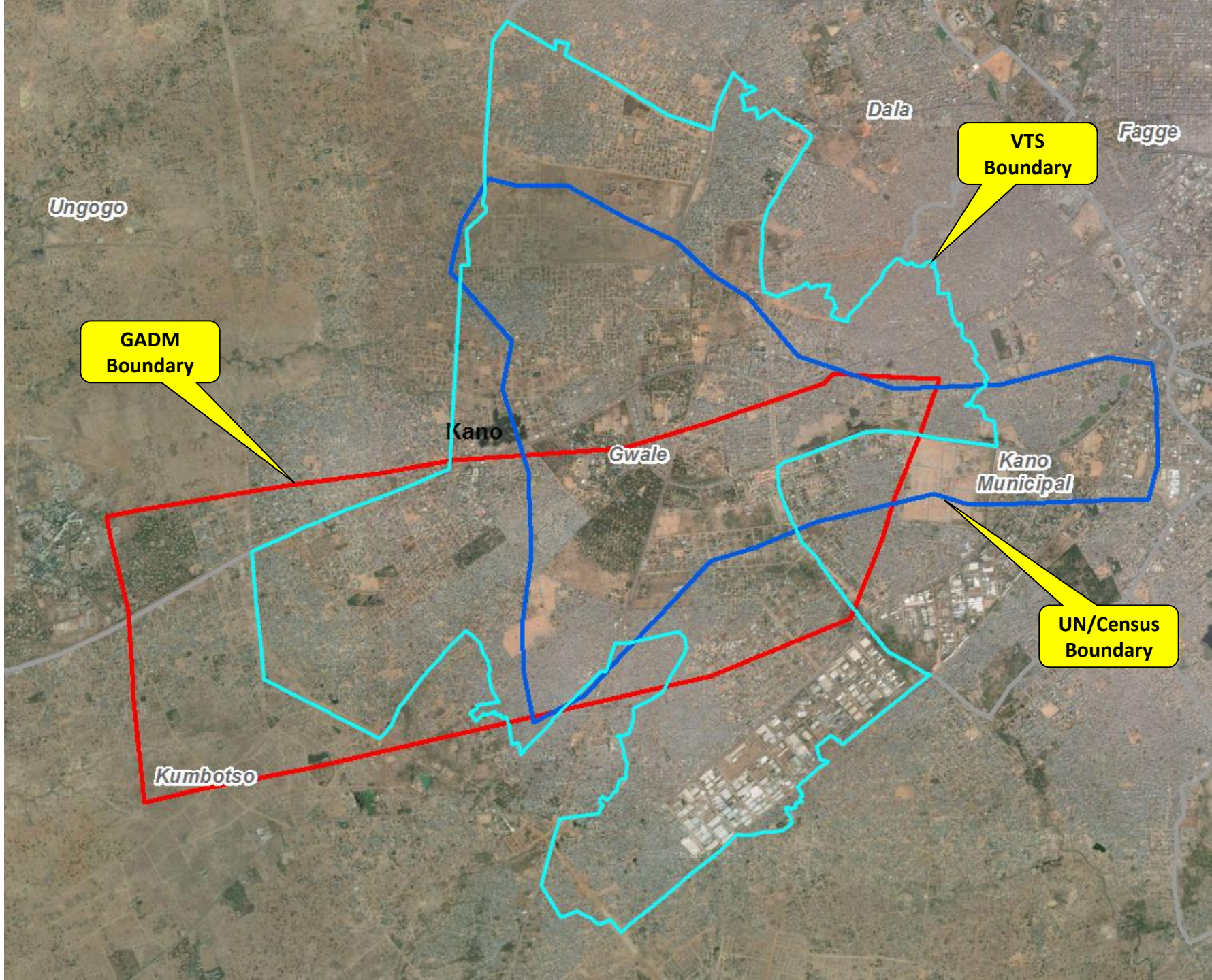


Reported sub-national boundaries do not align with GIS data collected in Nigeria

Nigeria Sub-National Boundaries from VTS[1], GADM[2] and UN-WHO (Census) all Differ

Gwale LGA, Kano State

Jan 2015

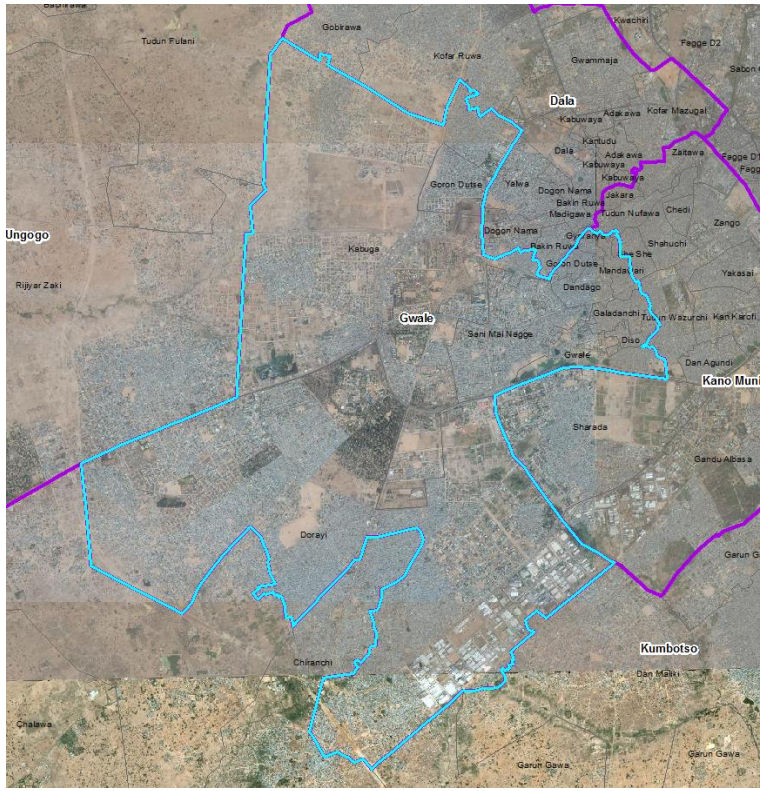


[1]*VTS = Vaccination Tracking System and polio Nigeria geodatabase: http://www.geopode.world*

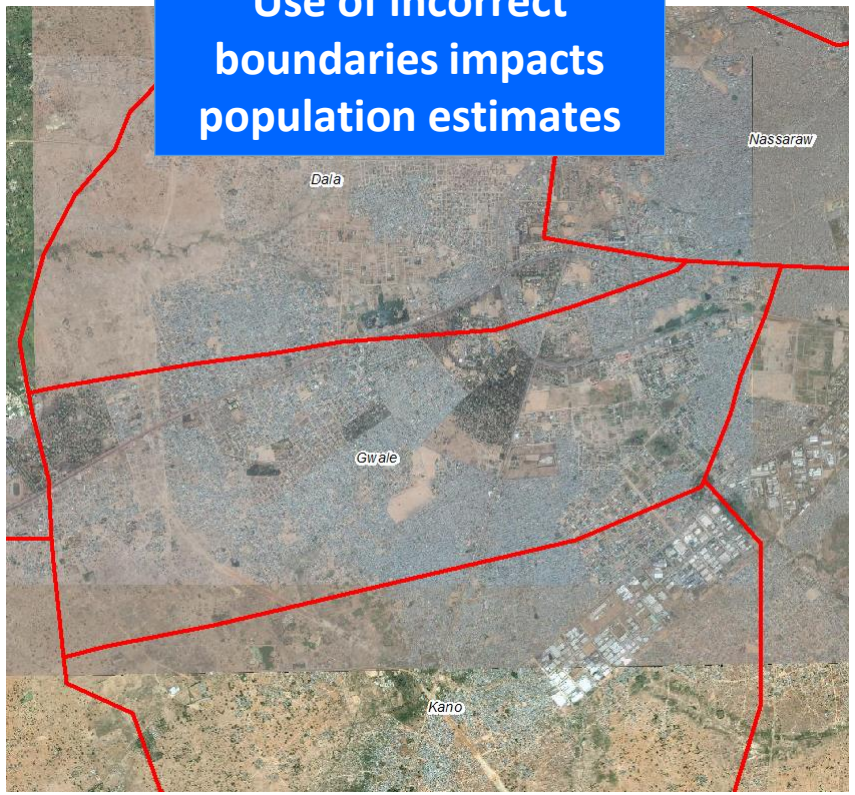
[2]*GADM = internationally-recognized global boundary resource developed by Robert Hijmans & colleagues at the University of California, Berkeley and the University of California, Davis (Alex Mandel): http://www.gadm.org/*

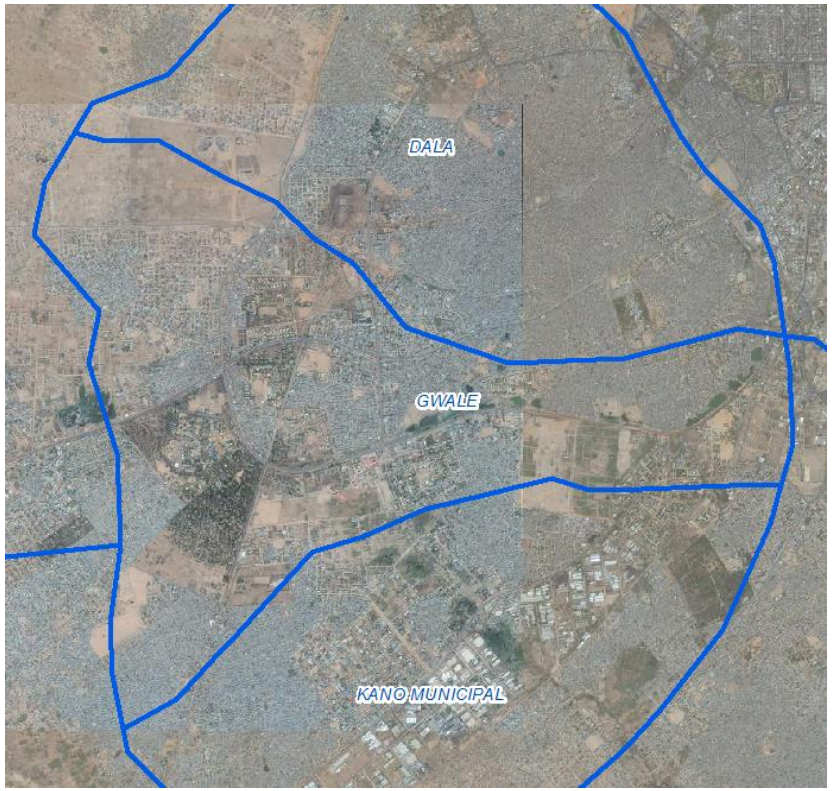
GIS Population Estimates: VTS, GADM[1], UN-WHO Boundaries

Gwale LGA, Kano State, Nigeria



Use of incorrect boundaries impacts population estimates





VTS Boundaries
Pop. Est. = 678,198

GADM Boundaries
Pop. Est. = 372,703

UN-WHO (Census) Boundaries
Pop. Est. = 484,934

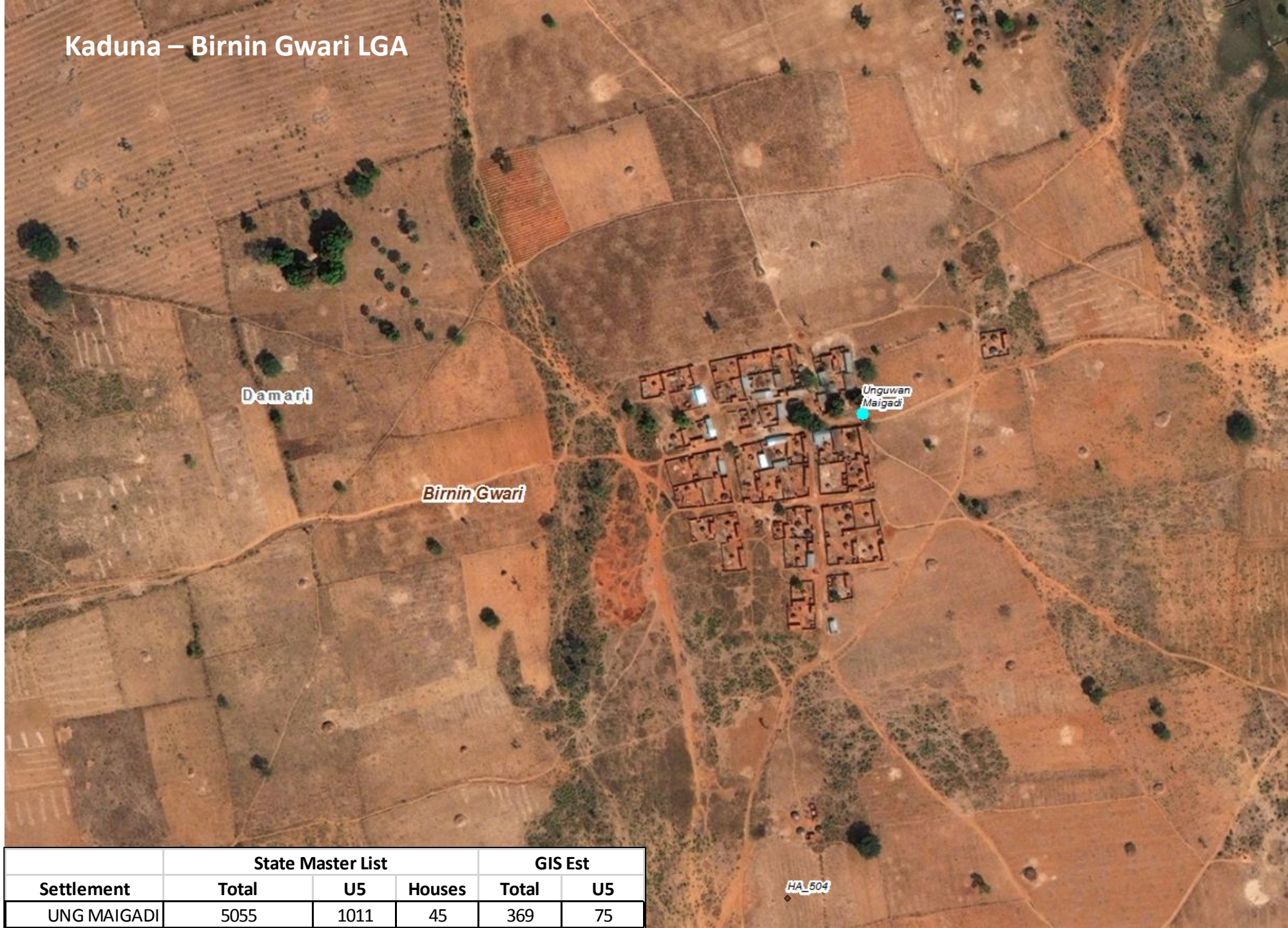
[1]*GADM Version 2.8, March 2016. http://www.gadm.org/*

Second Administrative Level Boundaries initiative

In many areas of Nigeria, administrative population data is not reliable….

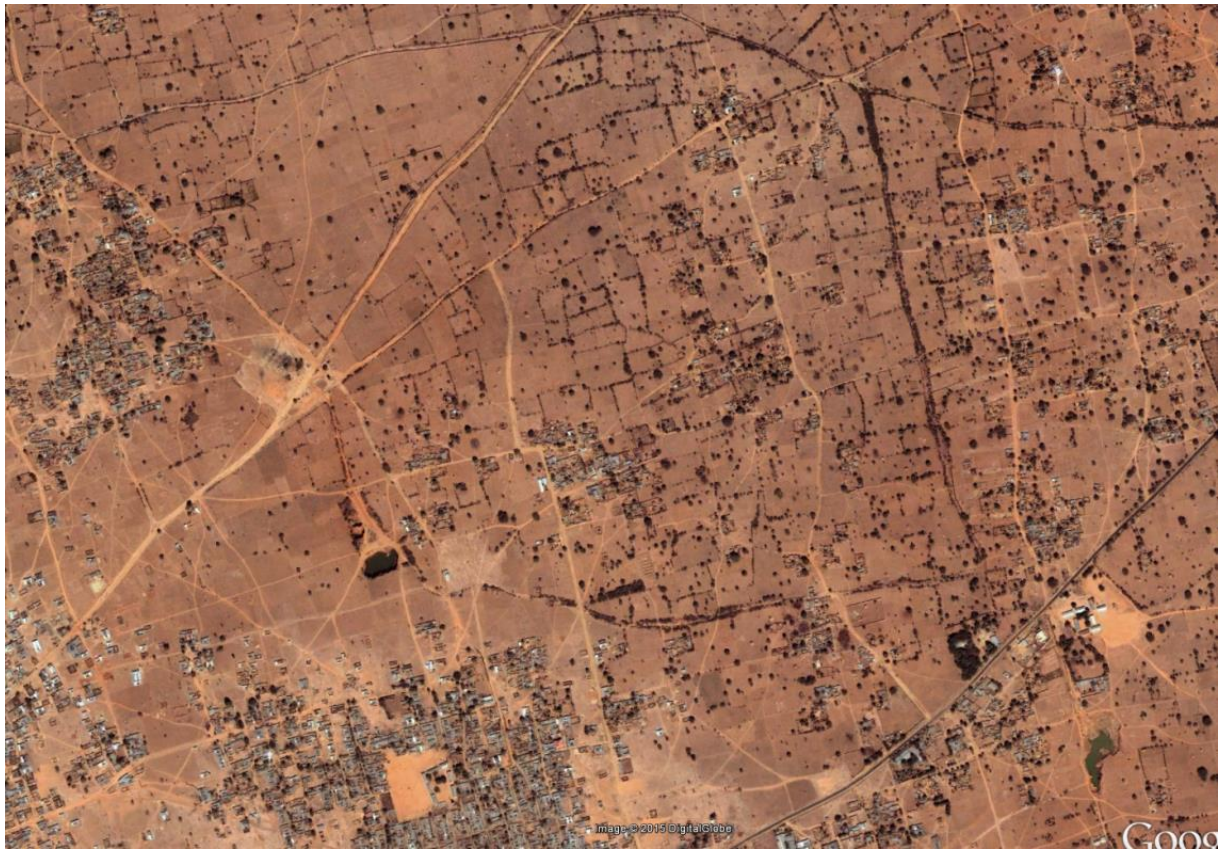
	State Master List			GIS Est	
Settlement	Total	U5	Houses	Total	U5
RAFIN KYAURO	2185	437	21	80	16

…which leads to gross over-estimation of the baseline population at the settlement level.



	State Master List			GIS Est	
Settlement	Total	U5	Houses	Total	U5
UNG MAIGADI	5055	1011	45	369	75

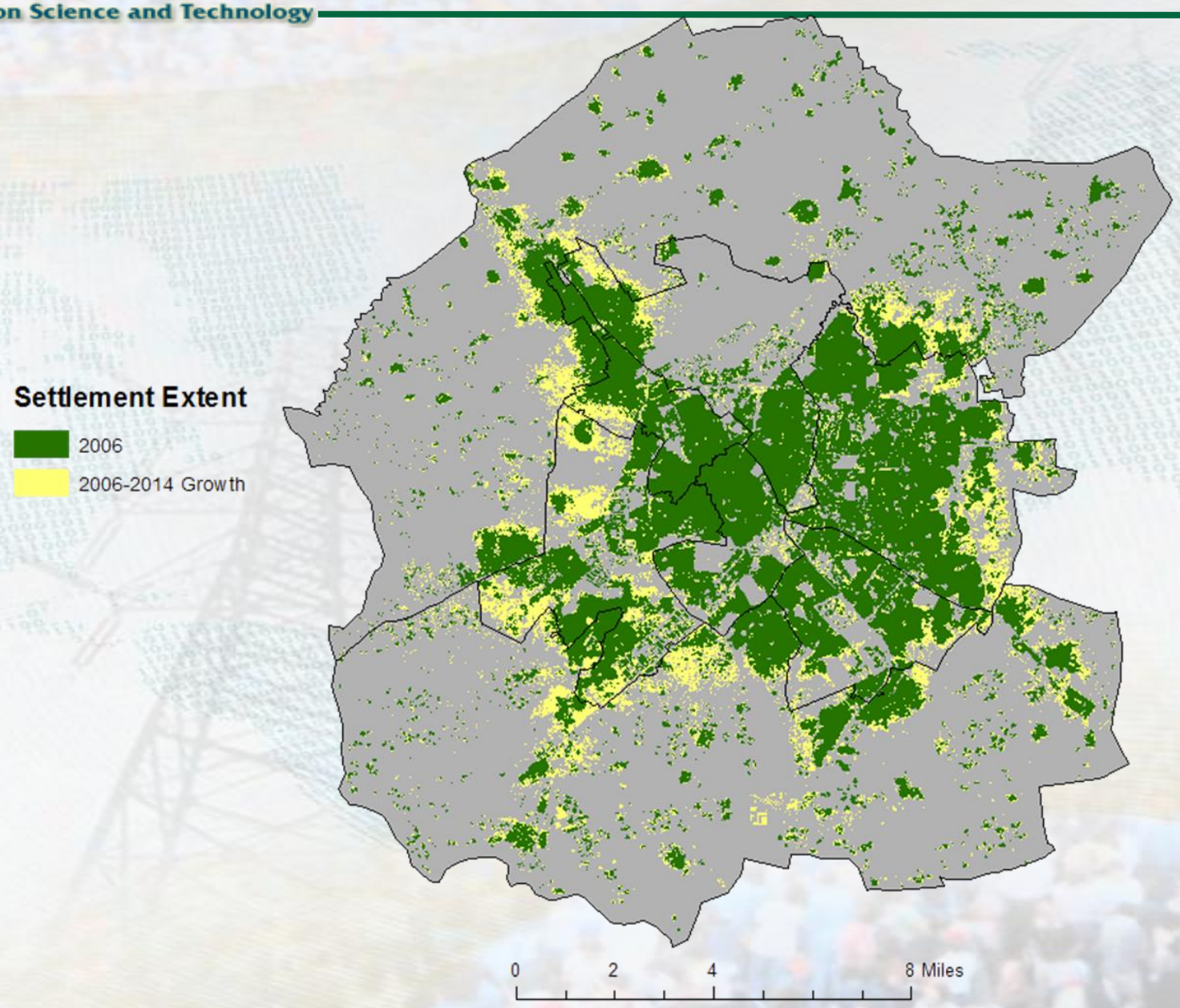
Since 2006, annual population growth of 2.7 – 3.4% applied at the state level – but growth varies widely from rural to urban areas.



Detail from
Ungogo, 2006

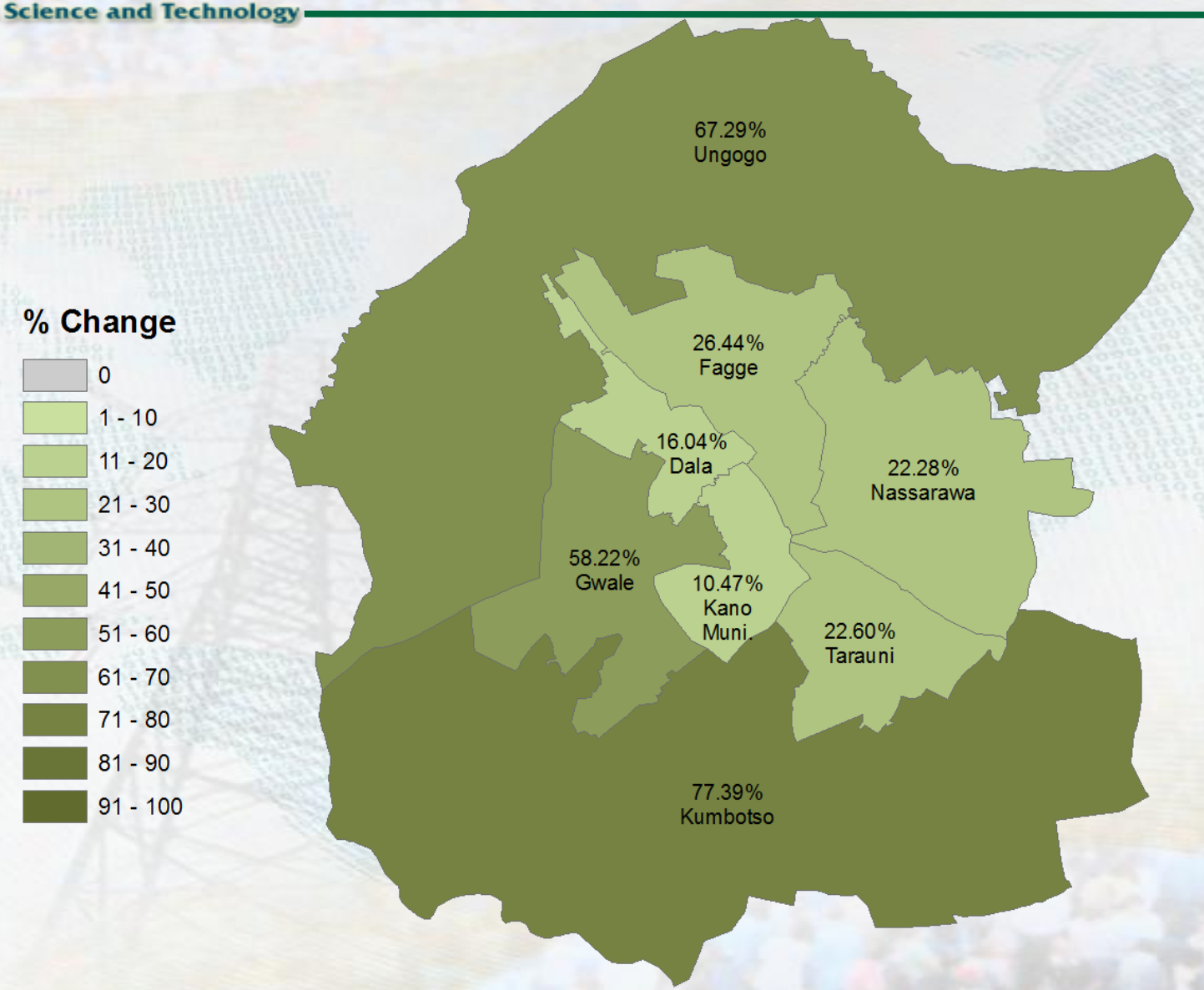
Detail from
Ungogo, 2015

2006 and 2014 Kano Settlement



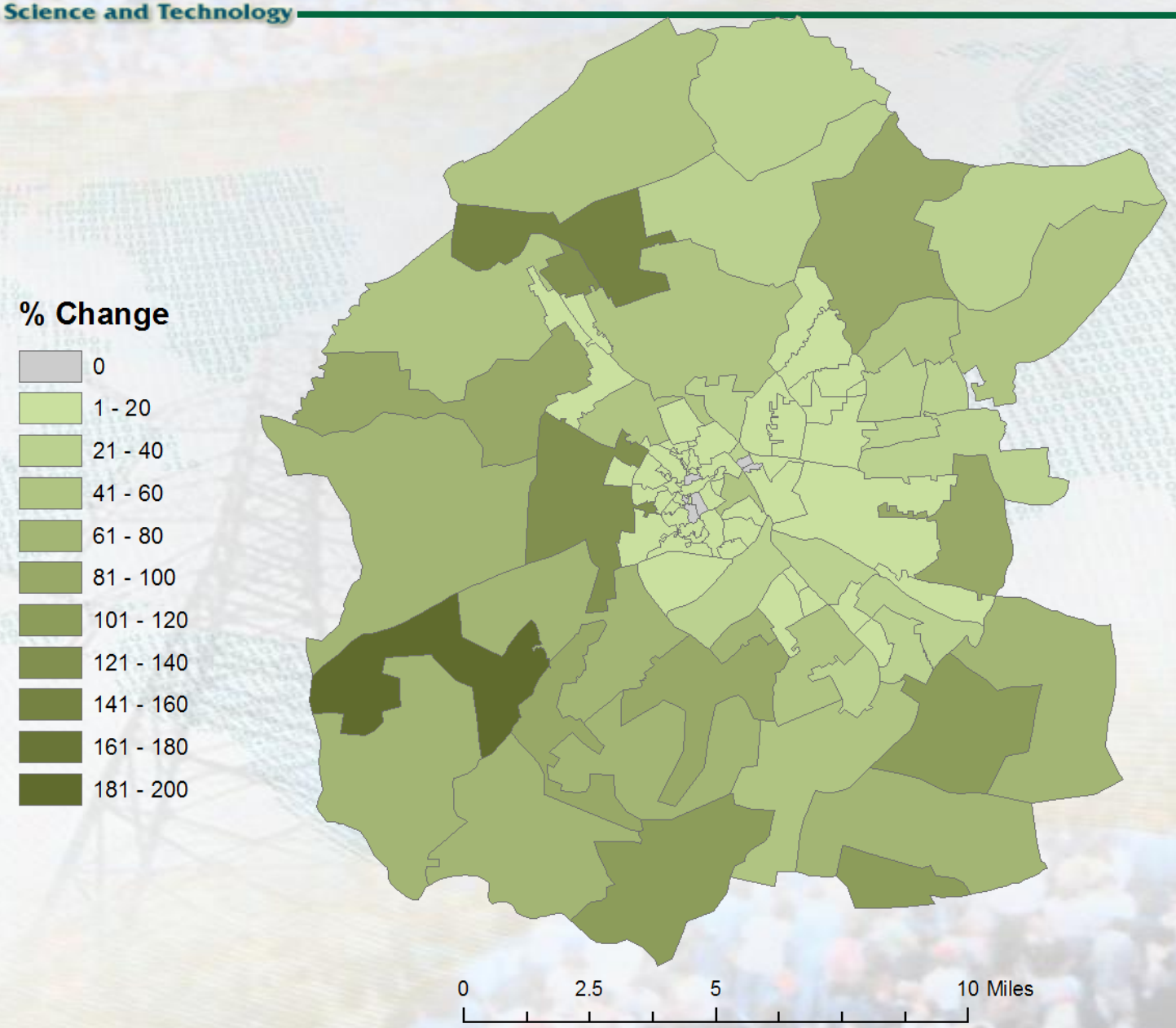
Percent Change in Settled Area by LGA

Geographic Information Science and Technology



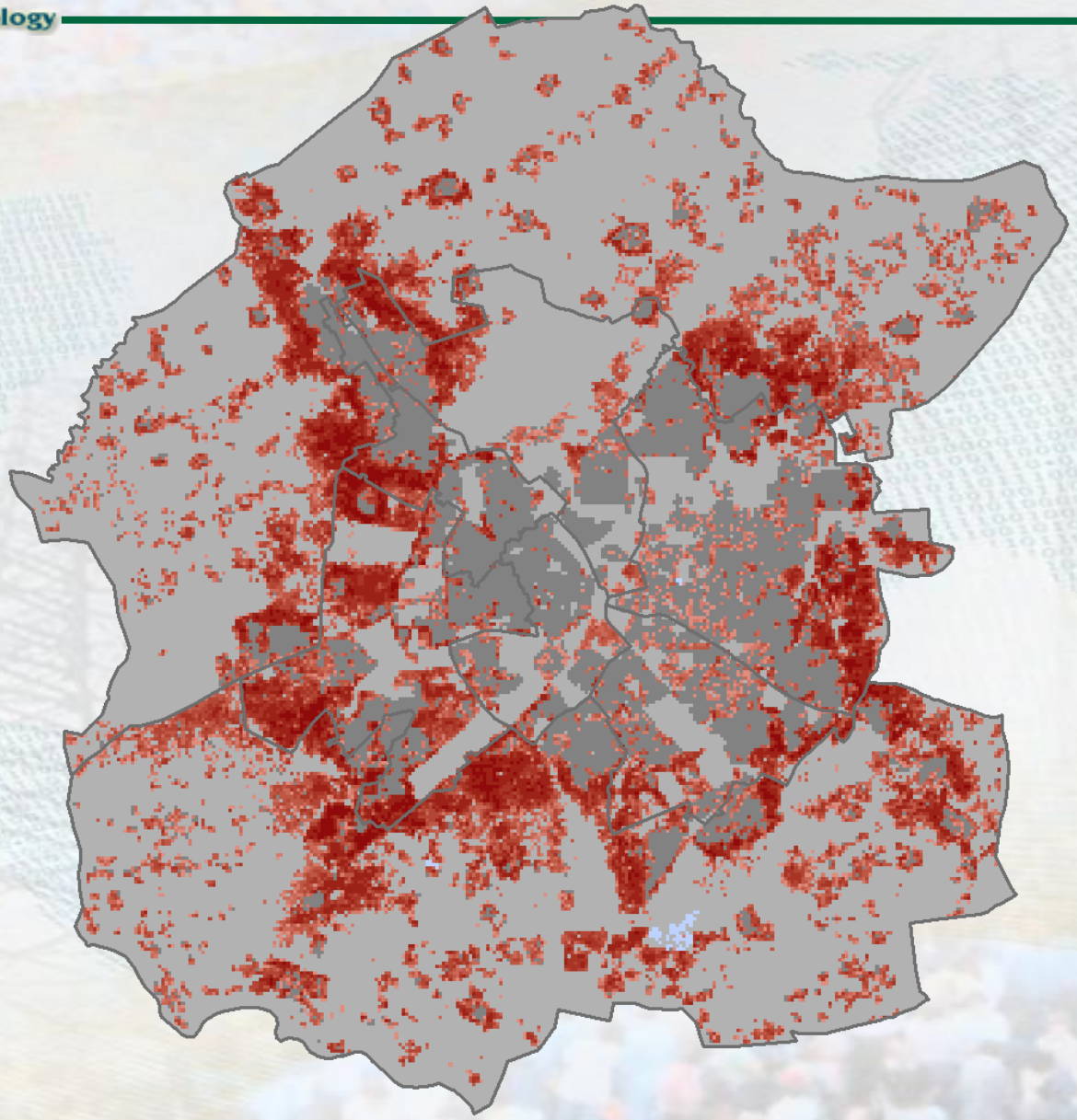
Percent Change in Settled Area by Ward

Geographic Information Science and Technology

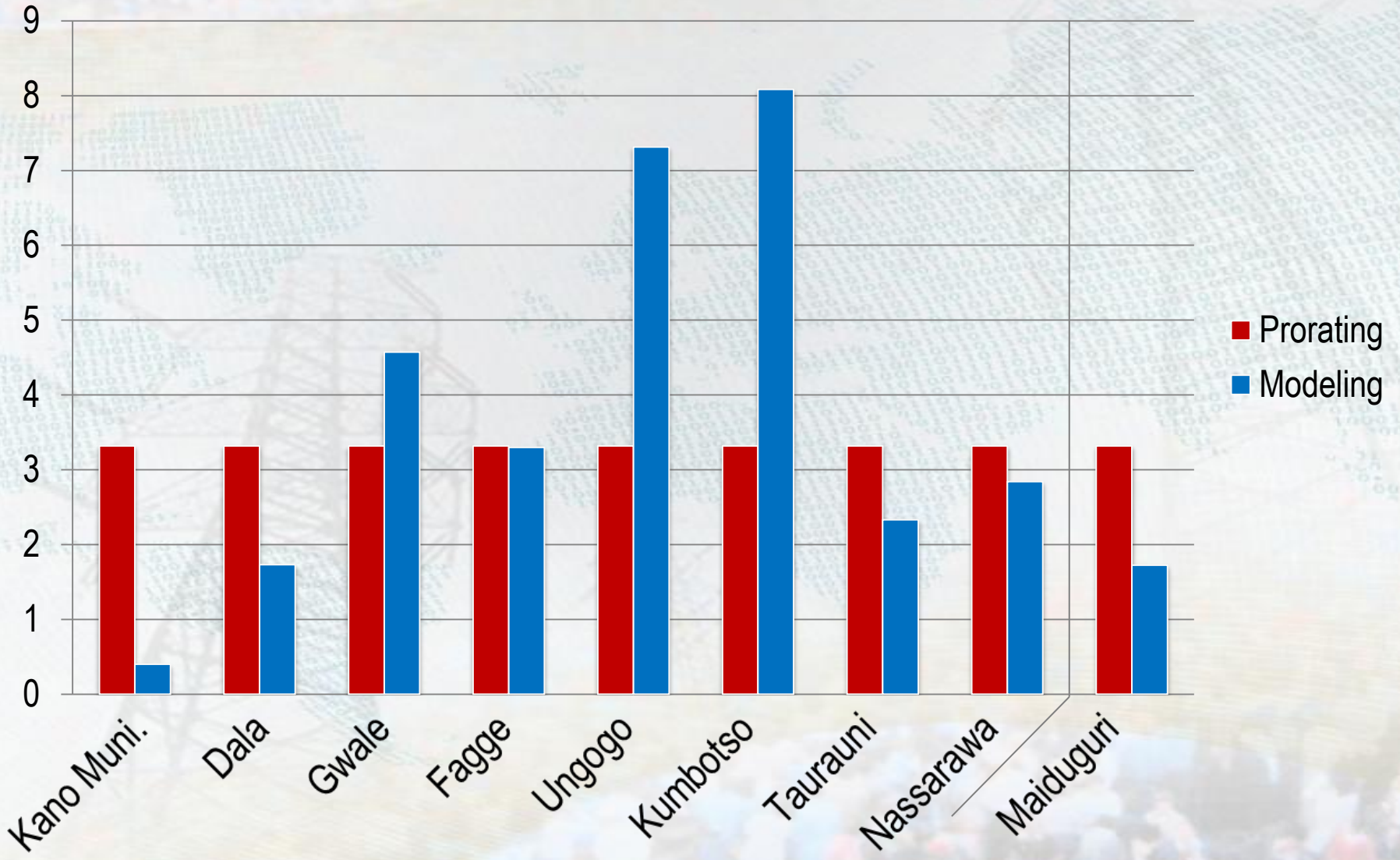


Modeled Population Change

Geographic Information Science and Technology



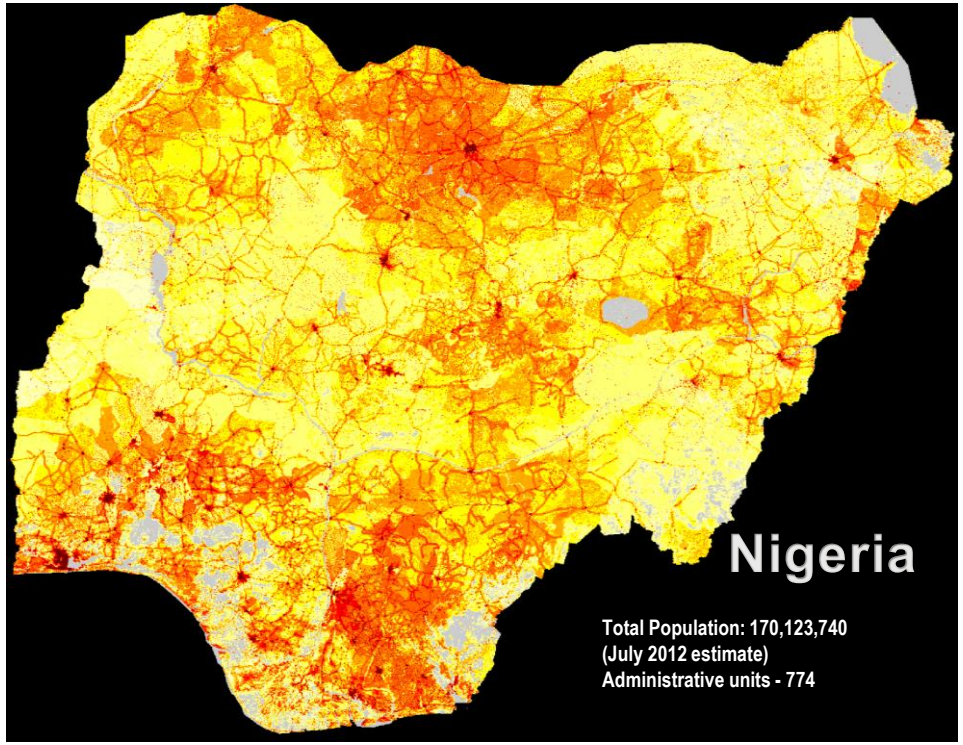
Calculated Rates of Annual Population Change for Both Methods (2006-2014)

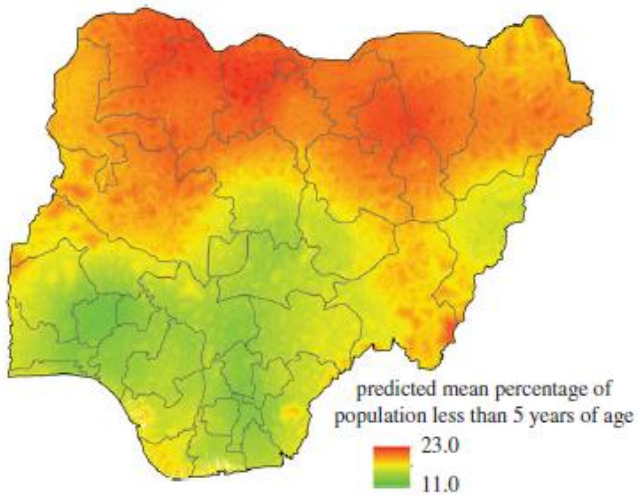


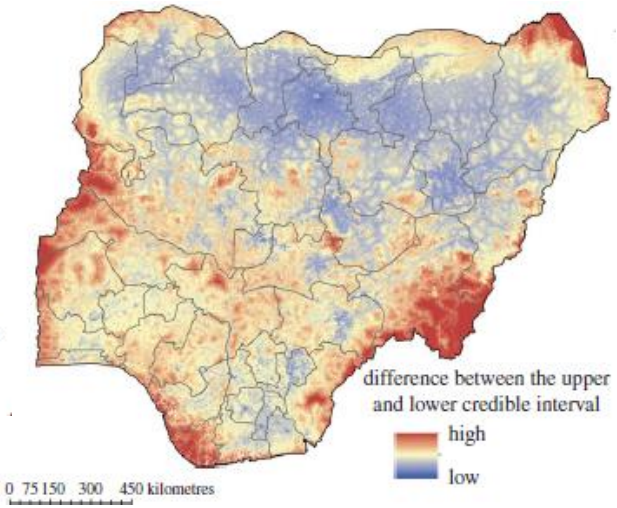
High Resolution Population Distribution In Northern Nigeria

Budhendra Bhaduri

Eddie Bright, Anil Cheriyadat, Amy Rose, Jake McKee, Jeanette Weaver, Mary Urban, Raju Vatsavai







Demographics & Mobility mapping

Andy Tatem, University of Southampton

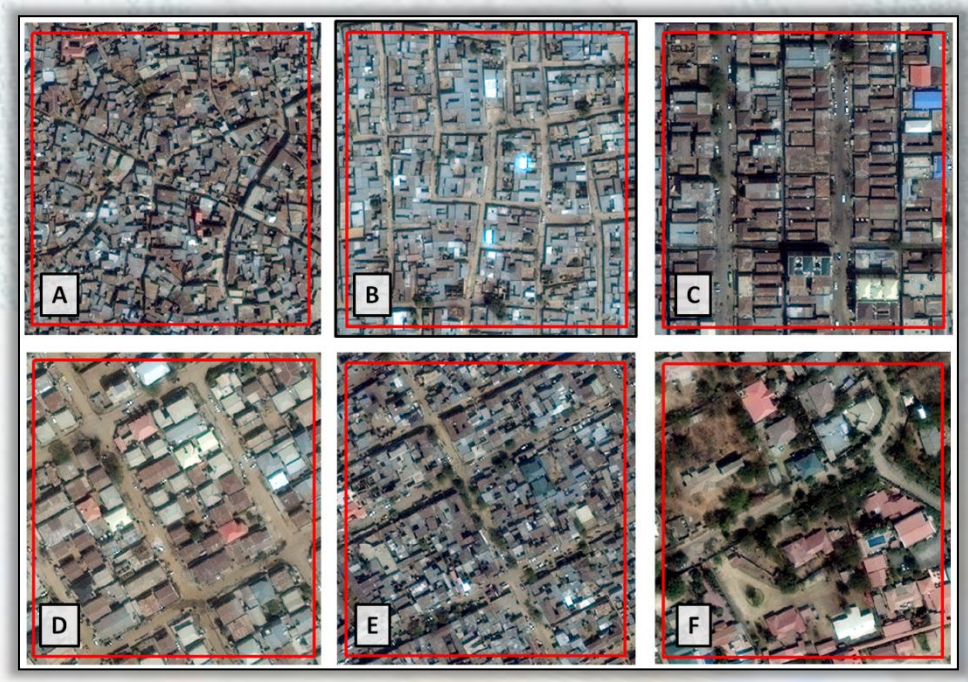
FLOWMINDER.ORG

world pop

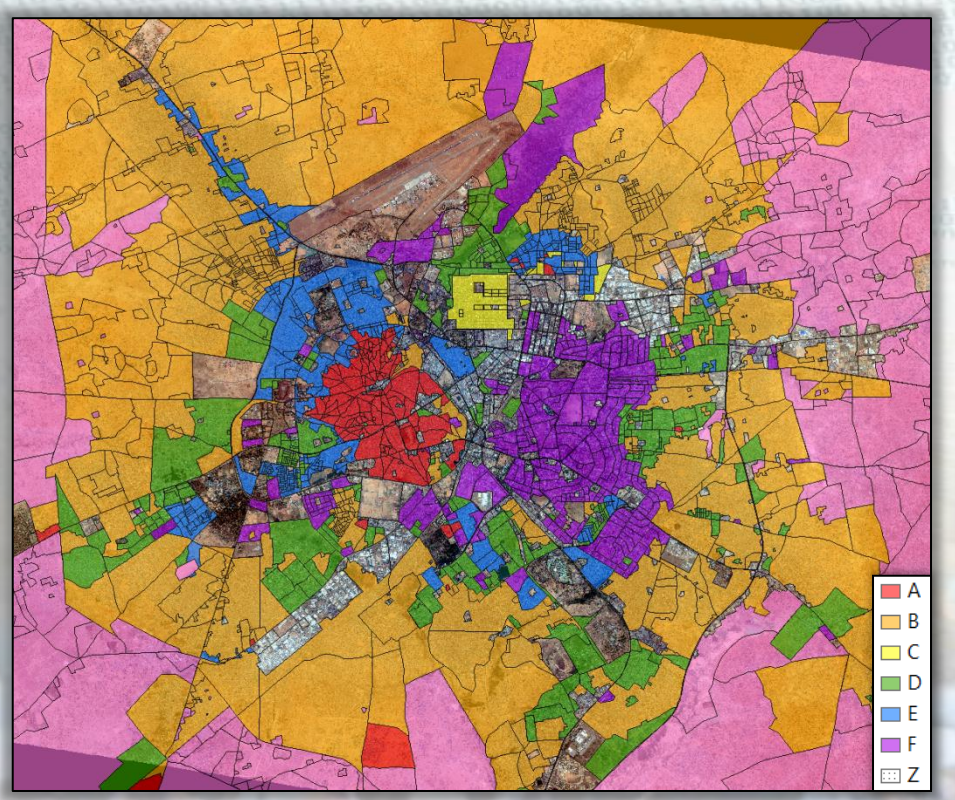
Settlement Neighborhood Classification Layer

Geographic Information Science and Technology

- **Reference Layer for Northern States (based on Kano metro area)**
  - established 7 residential settlement types (6 Urban, 1 rural) + non-residential
- **Population density of each neighborhood type determined from microcensus data (>100 clusters for each type)**



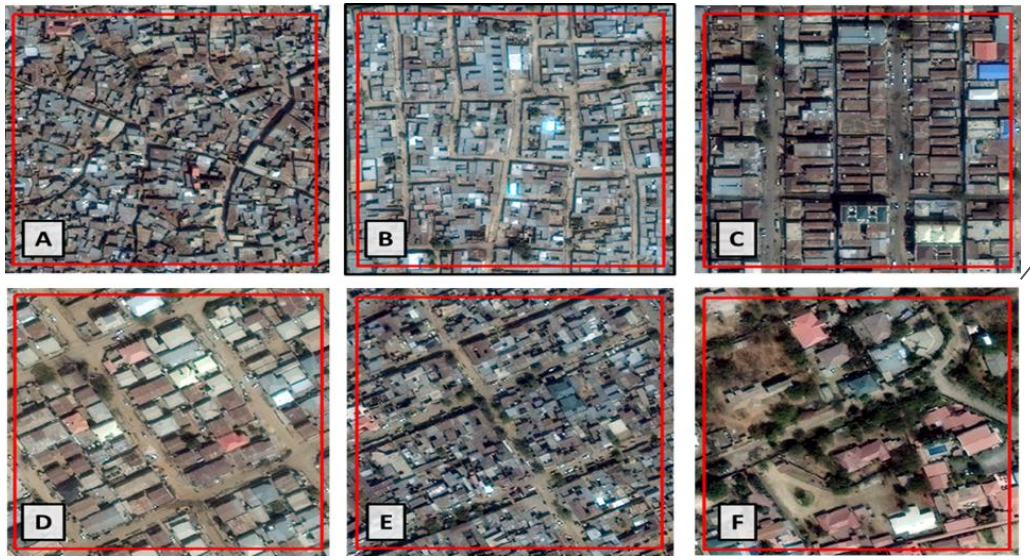
M: rural
Z: non-residential

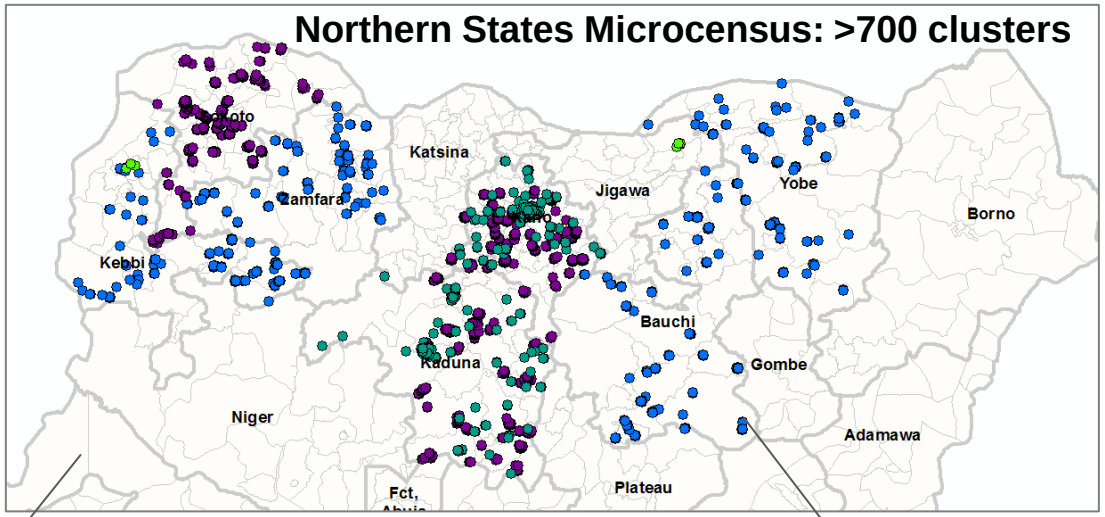


The Microcensus Process

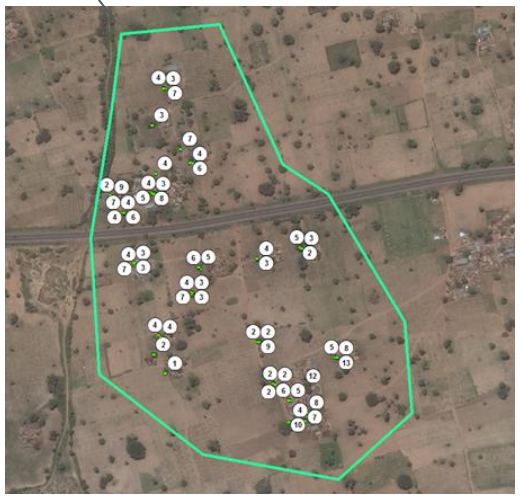
Enumerate population with ground-based ‘microcensus’ surveys in small areas that capture a range of settlement and neighbourhood types to get training data.

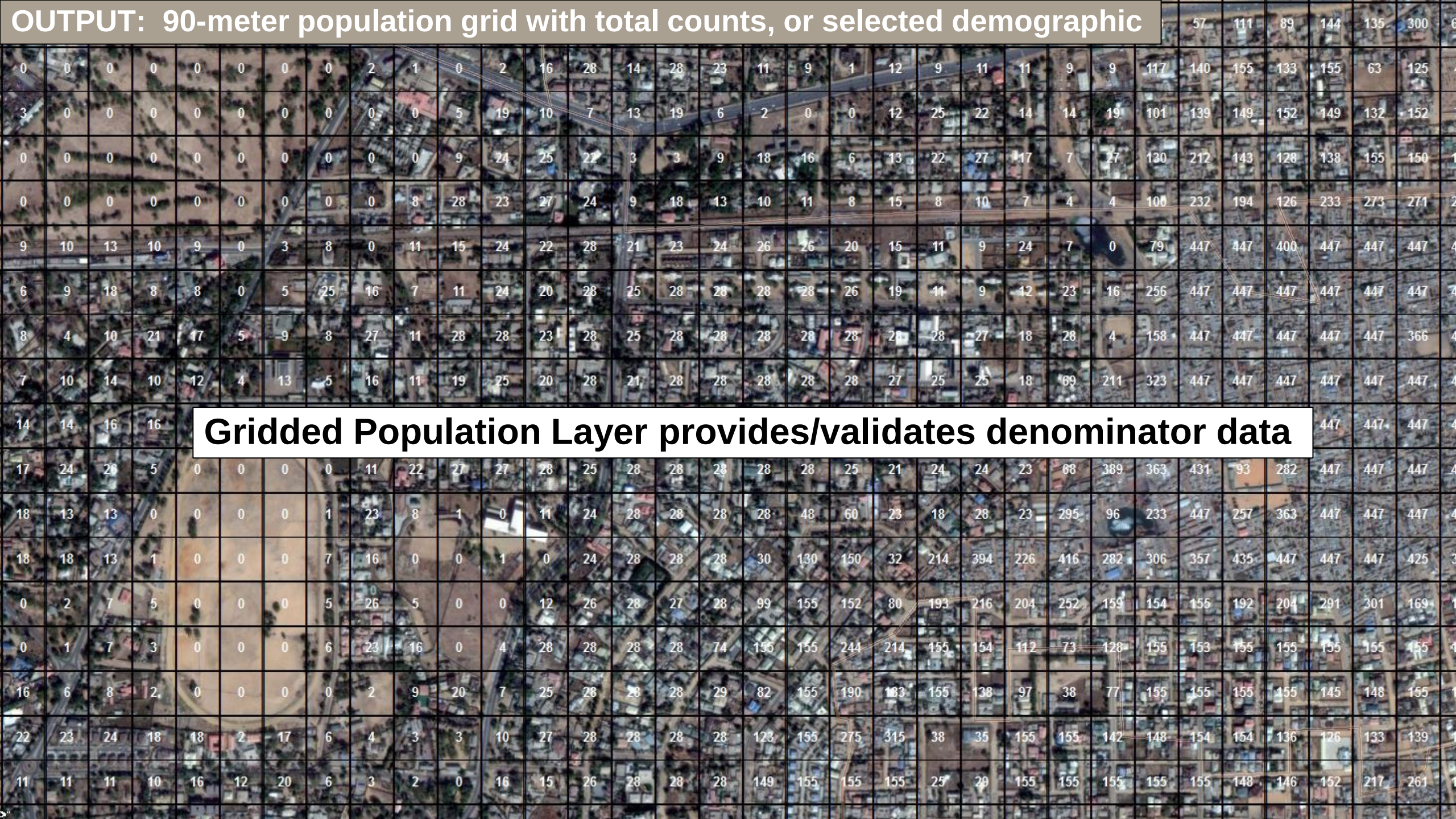
Urban neighbourhood types mapped using satellite imagery and microcensus surveys conducted in each type



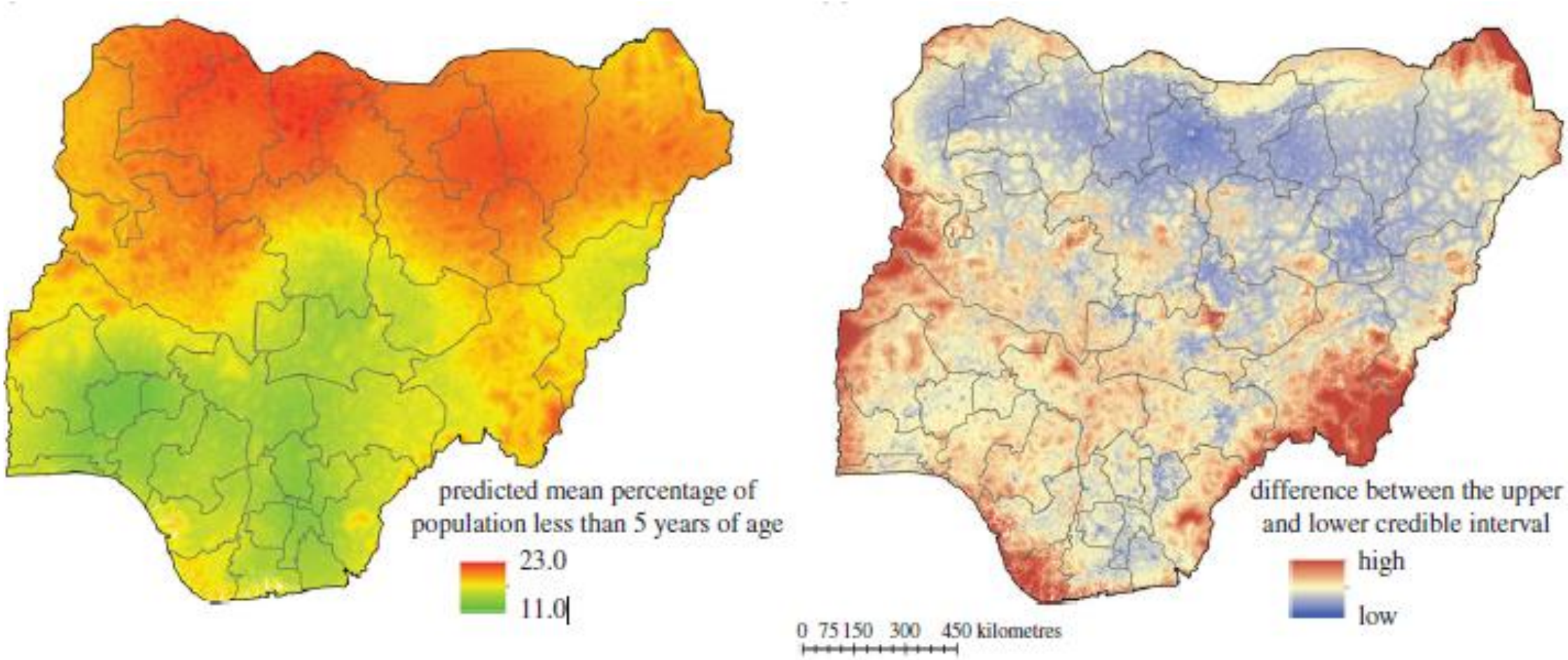


Example microcensus survey of a rural settlement




OUTPUT: 90-meter population grid with total counts, or selected demographic
Gridded Population Layer provides/validates denominator data

DEMOGRAPHICS BASED ON MODELLING DATA FROM SURVEYS SHOWS HIGH VARIABILITY FROM NORTH TO SOUTH



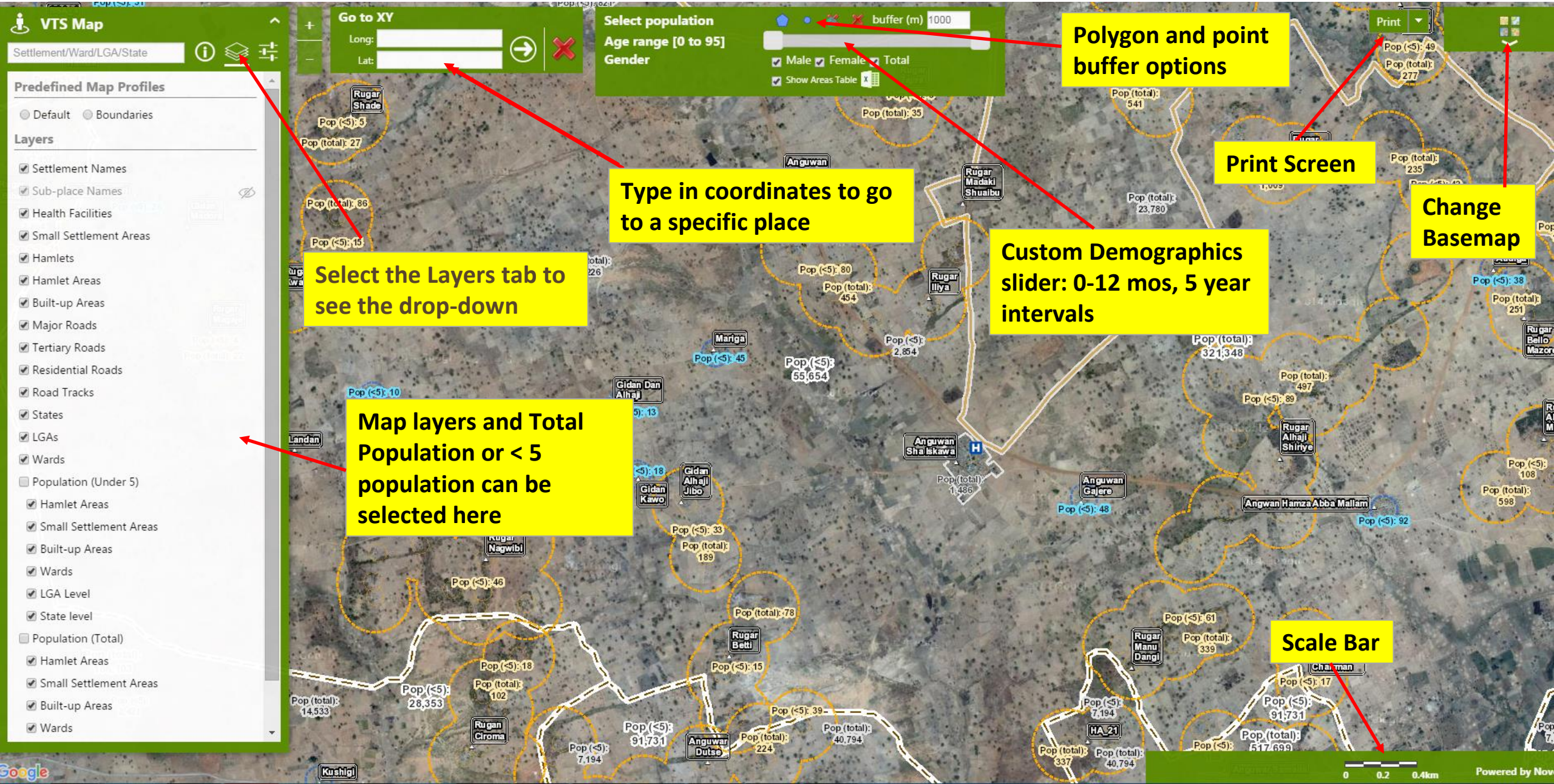
% Children under 5 Varies from North to South, East to West

For an LGA with a total population of 300,000:
11% = 33,000 20% = 60,000 23% = 69,000

Alegana, et al. 2015 http://rsif.royalsocietypublishing.org/

USER-FRIENDLY INTERFACE FOR POPULATION/MAPPING DATA

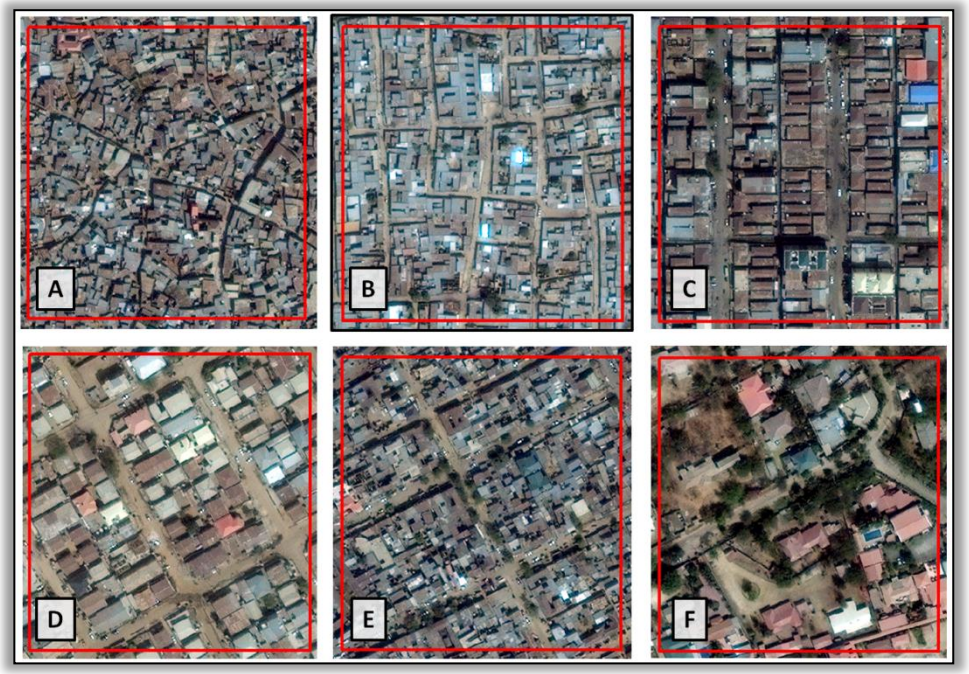
http://geopode.world/



Neighborhood Classification

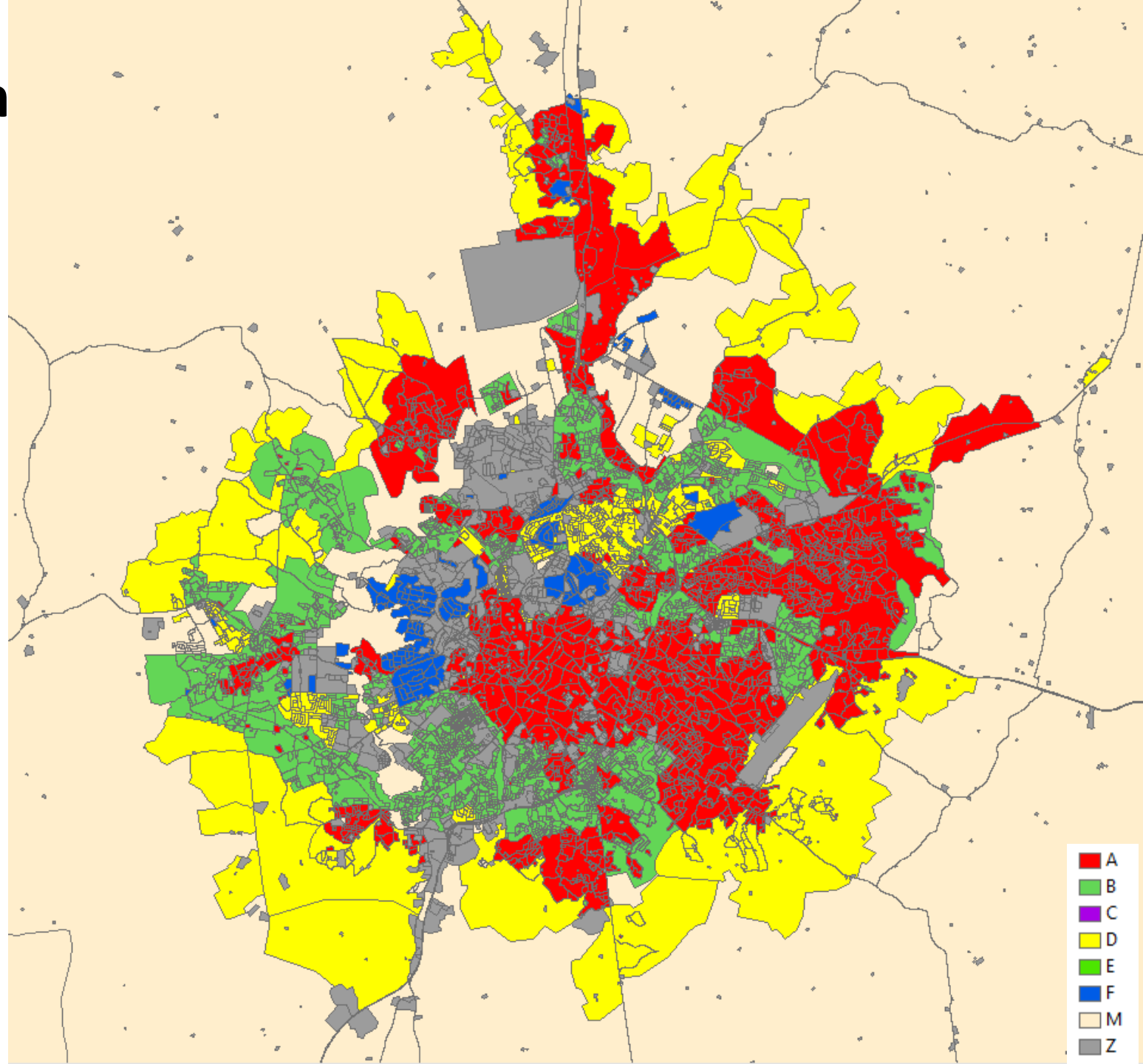
Ibadan Metro Area

Oyo State, Nigeria

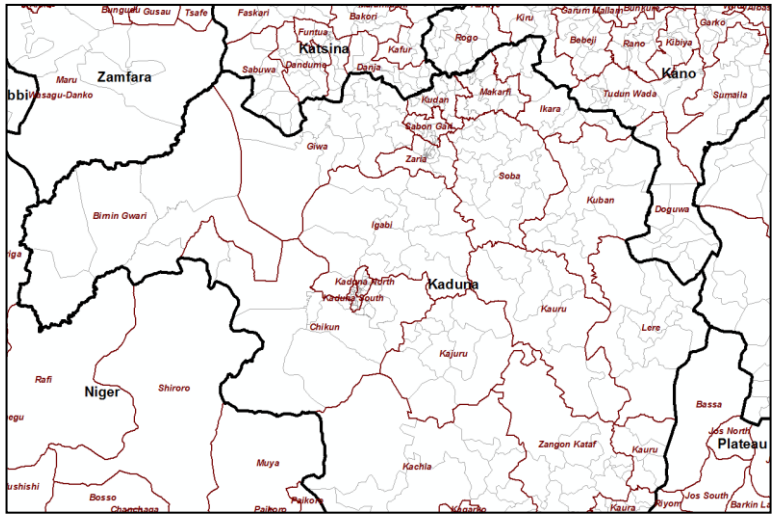


M: rural

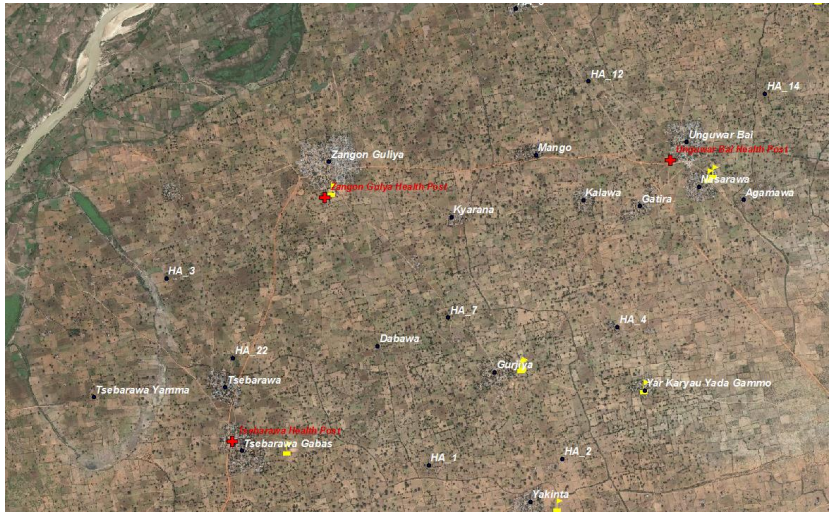
Z: non-residential



Settlement Features are the basic *Geospatial Reference Data*



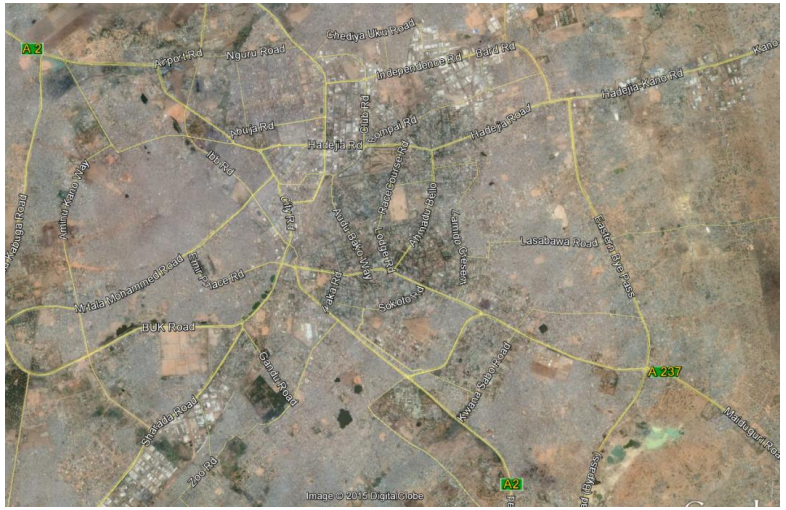
Administrative Boundaries



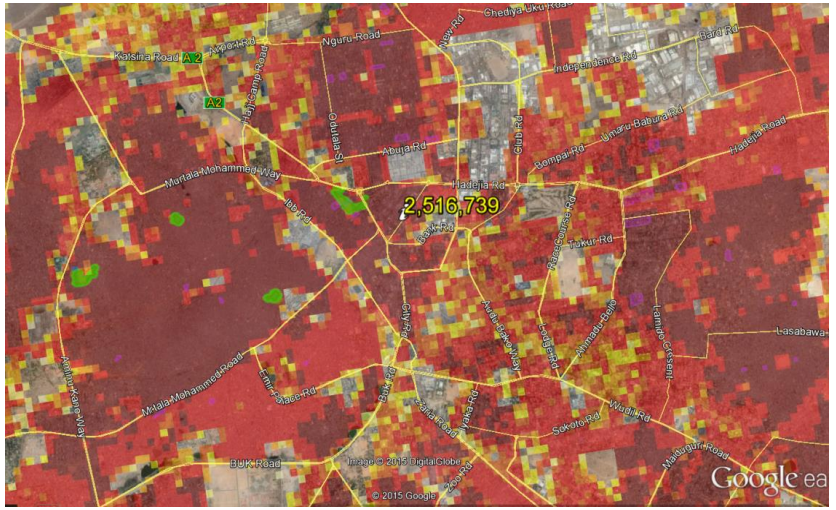
Settlements and Points of Interest

GRID

(Core Data Layers)



Transportation Network

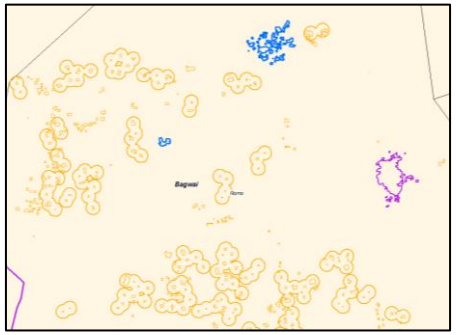


Population / Demographics

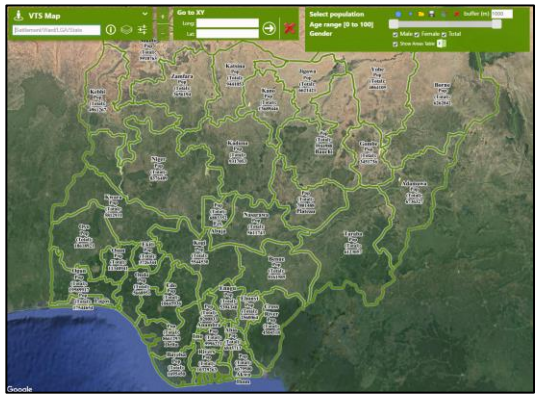
TRADITIONAL GIS MAPPING & POPULATION ESTIMATES – FIELD BASED

Satellite Imagery
- *0.5m, panchromatic*
- *<10% cloud cover, <18 months old*
- *Avg Cost: $1/km²*

Extracted Settlement Layer (Feature Extraction)
- *3 settlement types: (BUA, SSA, Hamlet)*
- *>95% accuracy*
- *Avg Cost: $0.60/km²*

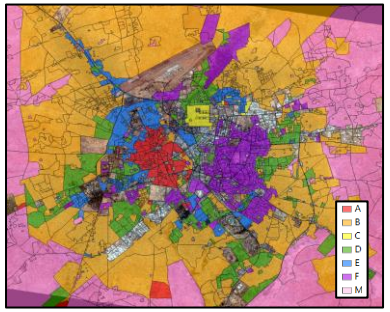


Field Data Collection:
- *Settlements*
- *POIs*
  - *HFs*
  - *markets*
  - *schools*
  - *water points*



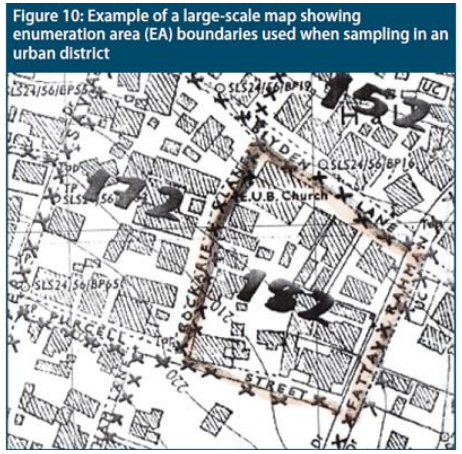
Dashboard/Data Platform:
VTS Website

Estimated Cost:
$5 – 7 million/country



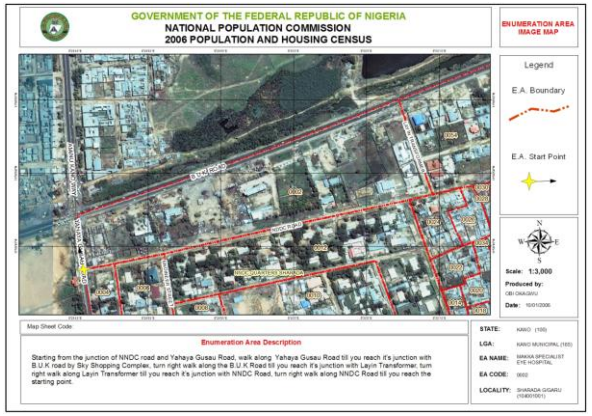
Population/Demographic Modeling:
Neighborhood Types/HH Survey Data

Field Data Collection:
Microcensus



Traditional census data

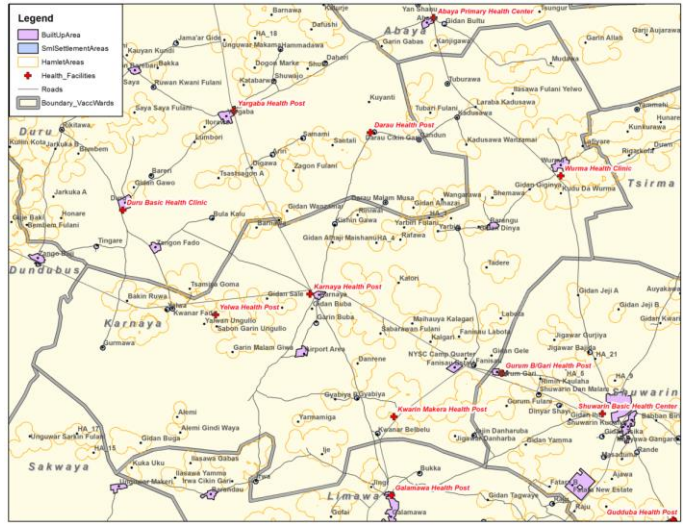
Enumeration areas created manually – not geo-referenced



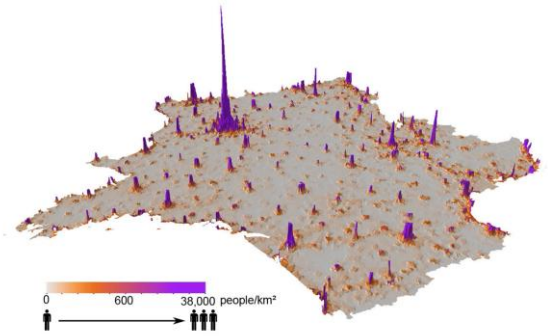
Geo-referenced census data

HH or Enumeration Area level

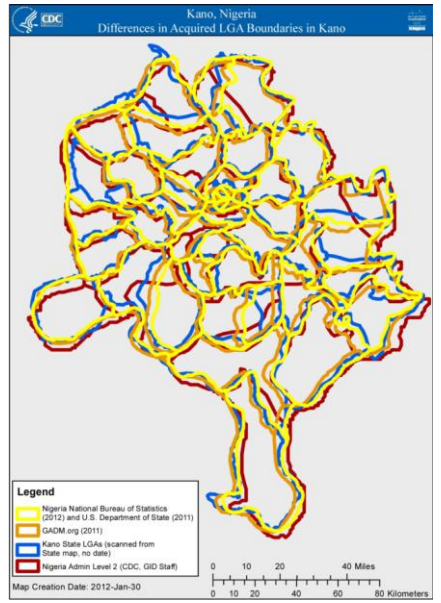
National Geo-referenced census database



Complete Settlement map



GIS-Based Population Model



Accurate Administrative boundaries

Supports sophisticated geospatial analyses of all census-related metrics

DfID-BMGF Partnership to co-fund GRID and other Key Geospatial and Data-related Projects

Leverages existing BMGF-DFID Collaborative Agreement
DfID Contribution: £15 million over 5 years beginning in 2017

- **75% of funds will be allocated to support the creation of Core Geo-Spatial Reference Layers and GIS/data management Capacity-Building in priority countries (GRID)**
- **25% of funds will be allocated to other data-related projects (TBD)**
- **BMGF expected to contribute an equal or greater amount for each project**

Priority BMGF-DfID GRID Geographies - 2017

BMGF Leads

Vince Seaman | Deputy Director| **Io Blair-Freese** | APO | Strategy, Data & Analytics Team | Global Development

DfID Leads

Seb Mhatre | Data Innovation Lead | Data For Development Team

Partnership to Develop Core Geo-Spatial Reference Layers and Build Capacity

- *Collect basic geospatial reference data (access geo-referenced national census data where available)*
- *Build capacity within Census/Population Commission, Bureau of Statistics (UNFPA, Flominder)*
- *Develop Population/Demographics & Population dynamics modeling*
- *Build data management/use capacity across all sectors*

DFID UKaid from the British people

UNFPA

FLOWMINDER.ORG PROVIDING PRICELESS INFORMATION FOR FREE FOR THE BENEFIT OF THOSE WHO NEED IT THE MOST

worldpop

Center for International Earth Science Information Network
EARTH INSTITUTE | COLUMBIA UNIVERSITY

PROJECT 1 (census-based)
Support National Statistics Office/Population Council to conduct georeferenced census & manage data

PROJECT 2 (no census)
Support National Statistics Office/Population Council to collect/model geospatial reference data

GRID Layers
- Settlement names/locations
- Key Points of Interest
- Administrative Boundaries
- Population Estimates

GRID PROJECT DELIVERABLES

1. Geo-referenced layer of all settlements and key POIs (from feature extraction layer)

2. Validated sub-national boundary layers (from settlement attributes)

3. Population & demographic estimates at 90 meters (from neighborhood classification and microcensus data)

4. Capacity-building for NSO, NGA, and other government agencies

5. Country and Global Data Platforms

Intensive Capacity-Building *(minimum 24 months)*

NATIONAL STATISTICS OFFICE/POPULATION COMMISSION

- Training, software & hardware provision, technical support
- Manage, use and curate census data and other national statistics

NATIONAL GEOSPATIAL AGENCY

- Training, software & hardware provision, technical support
- Manage, use and curate national geodatabase
- Regular updates of boundaries, settlements, & POIs

OTHER GOVERNMENT MINISTRIES/AGENCIES (FINANCE, ELECTORAL, EDUCATION, UTILITIES, ETC.)

- Identify priority use-cases & applications
- Assist NSO and NGA in supporting other agencies

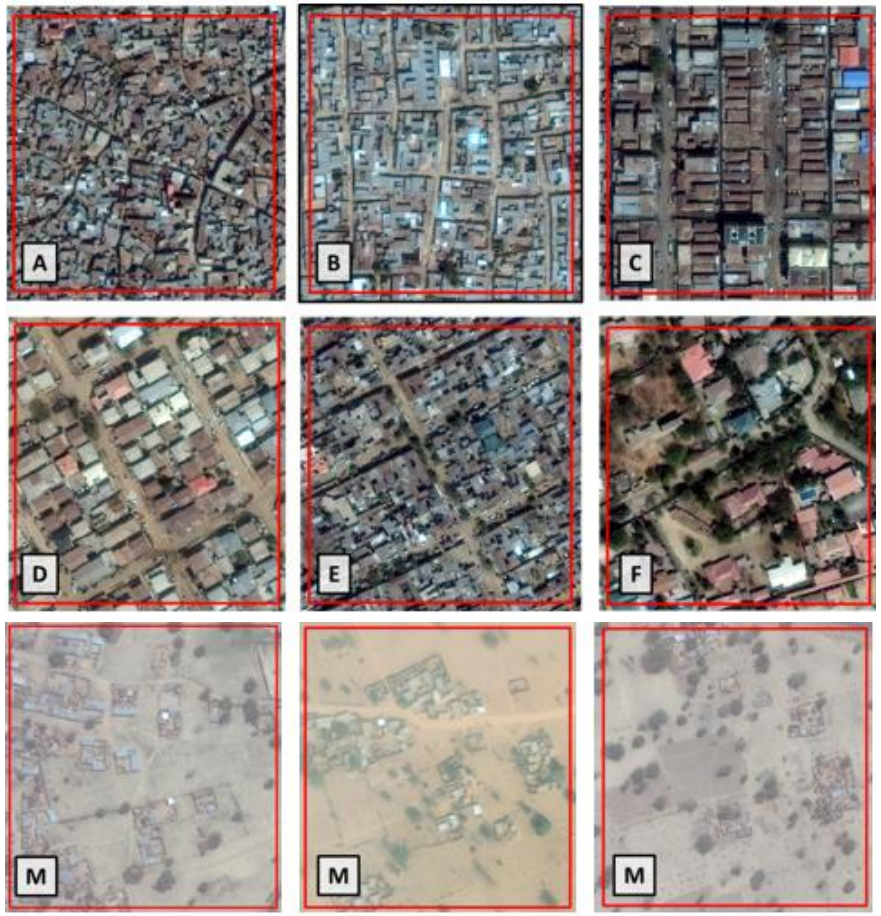
REGIONAL WORKSHOPS & TRAINING

- Additional opportunities to enhance GIS skills
- Network and share best practices with other AFRO country teams

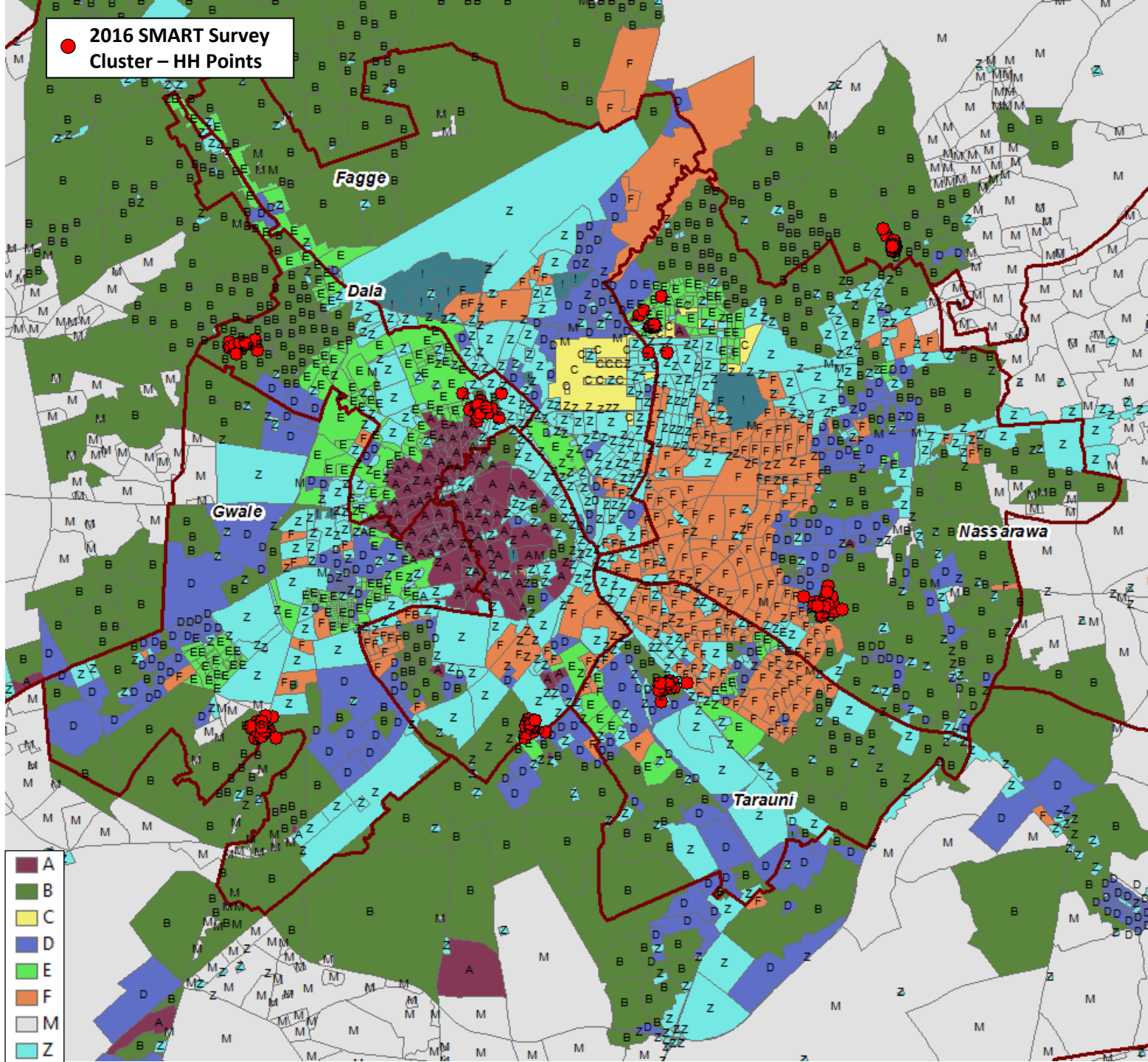
SMART Survey 2016

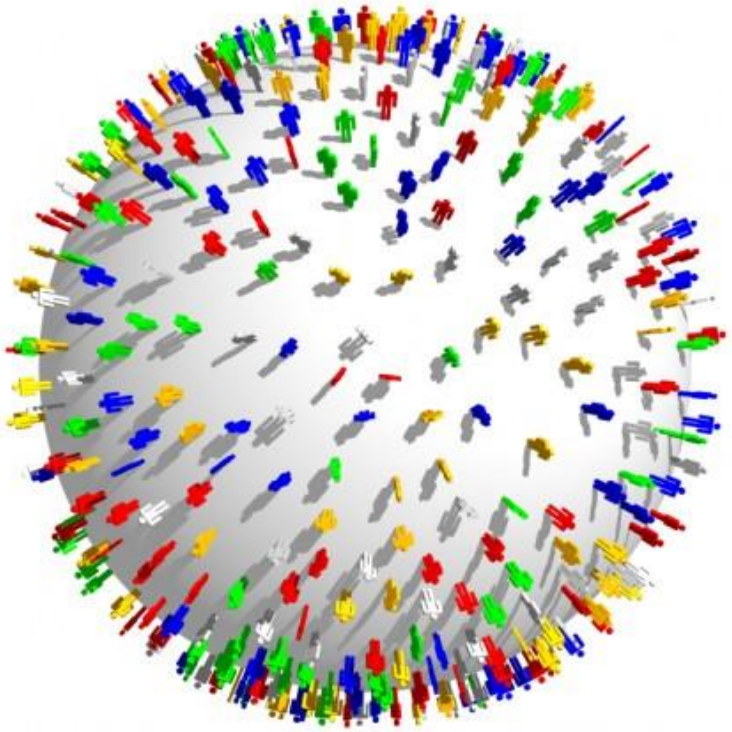
Cluster locations – Kano Metro LGAs

Neighborhood Types - Kano Metro Area



Z = Non-Residential





Share the VISION!

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C +1.206.669-7259
E Vincent.Seaman@gatesfoundation.org

Upcoming Censuses 2017-2019

Census 2017	Census 2018	Census 2019
Burkina Faso	Algeria	Azerbaijan
Chile	DPRK	Belarus
	El Salvador	Cambodia
	Liberia	
Comoros	Malawi	Djibouti
Cameroon	Nigeria	Guinea Bissau
Ethiopia		Kenya
Fiji	Wallis and Futuna	
	Congo	Mali
	Colombia	
Madagascar	Guatemala	Mongolia
Mozambique	Nicaragua	New Caledonia
		Solomon Islands
Peru		Somalia
Pakistan		
Palestine		Vietnam
Swaziland		Vanuatu

Upcoming Census

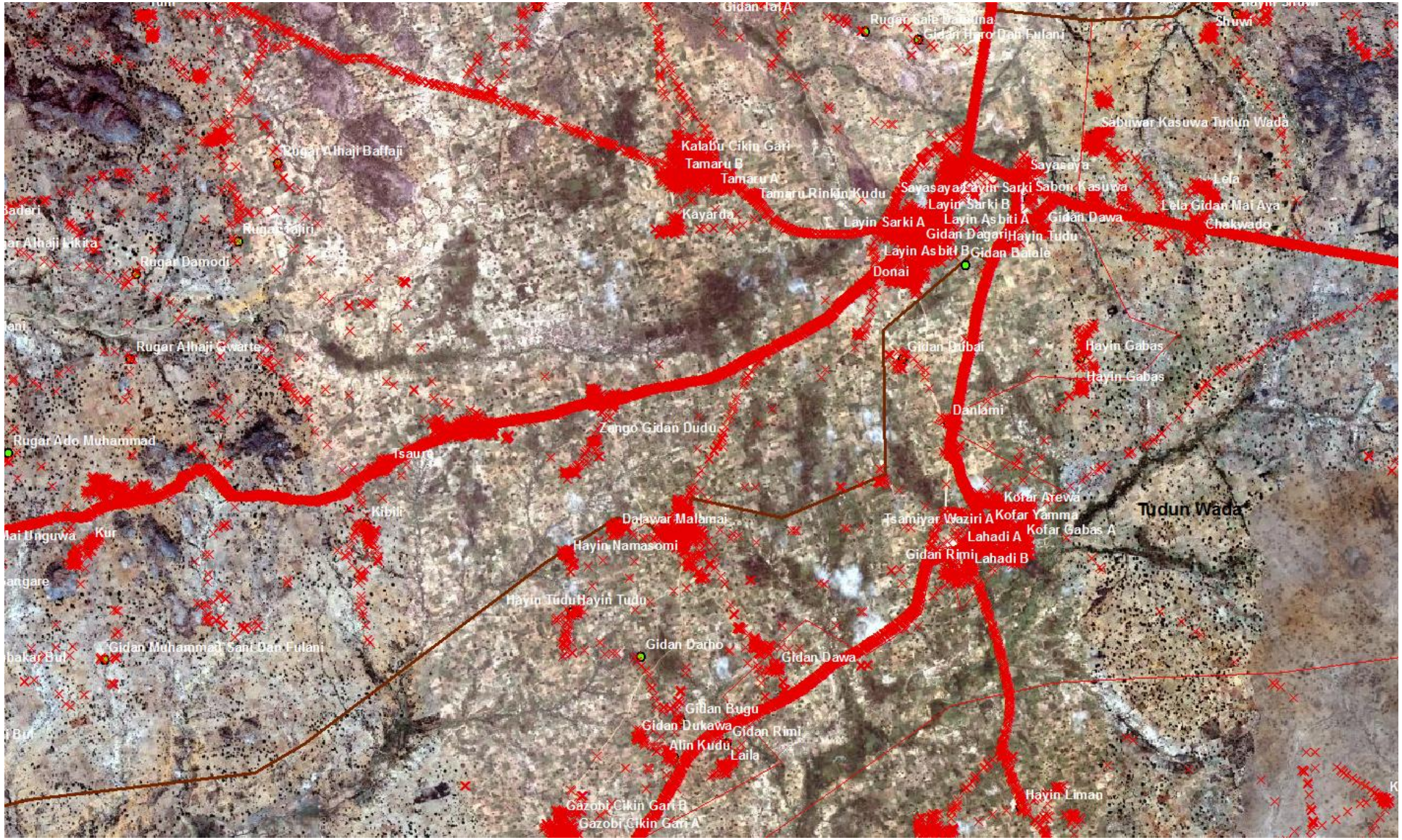
NoCensus

Recent Census

Status of Census 2010 round georeferencing in DfID priority countries

Country	Geo-reference status	Census Date (upcoming)
Afghanistan	No census in 2010 round	
Bangladesh	Yes- EA Level	2011
Burma/Myanmar	No	2014
Cambodia	Yes- EA level	2008 (2019)
DR Congo	No census in 2010	
Ethiopia	No	2007 (2017)
Ghana		2010
India	Yes- EA Level	2011
Kenya	Yes-EA Level	2009
Kyrgyzstan	No	
Liberia	Yes- EA Level	2008
Malawi	Yes- EA Level	2008
Mozambique	Yes	2007
Nepal		2011
Nigeria	Yes- EA Level	2006 (2018)
Pakistan	No census in 2010 round	
Rwanda	?	2012
Sierra Leone	Yes- EA Level	2015
Somalia	No census in 2010 round	
South Africa	Yes- EA level	2011
South Sudan	No	
Sudan		2008
Tajikistan	No	2010
Tanzania		2012
Uganda	Yes- EA level	2014
West Bank and Gaza		
Yemen		
Zambia	Yes- EA Level	2010
Zimbabwe	No	

Aggregated tracks show road network



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GIS IPV Microplanning

Problem:

IPV Health Camps (HCs) had to be located no further than 1km from any resident.

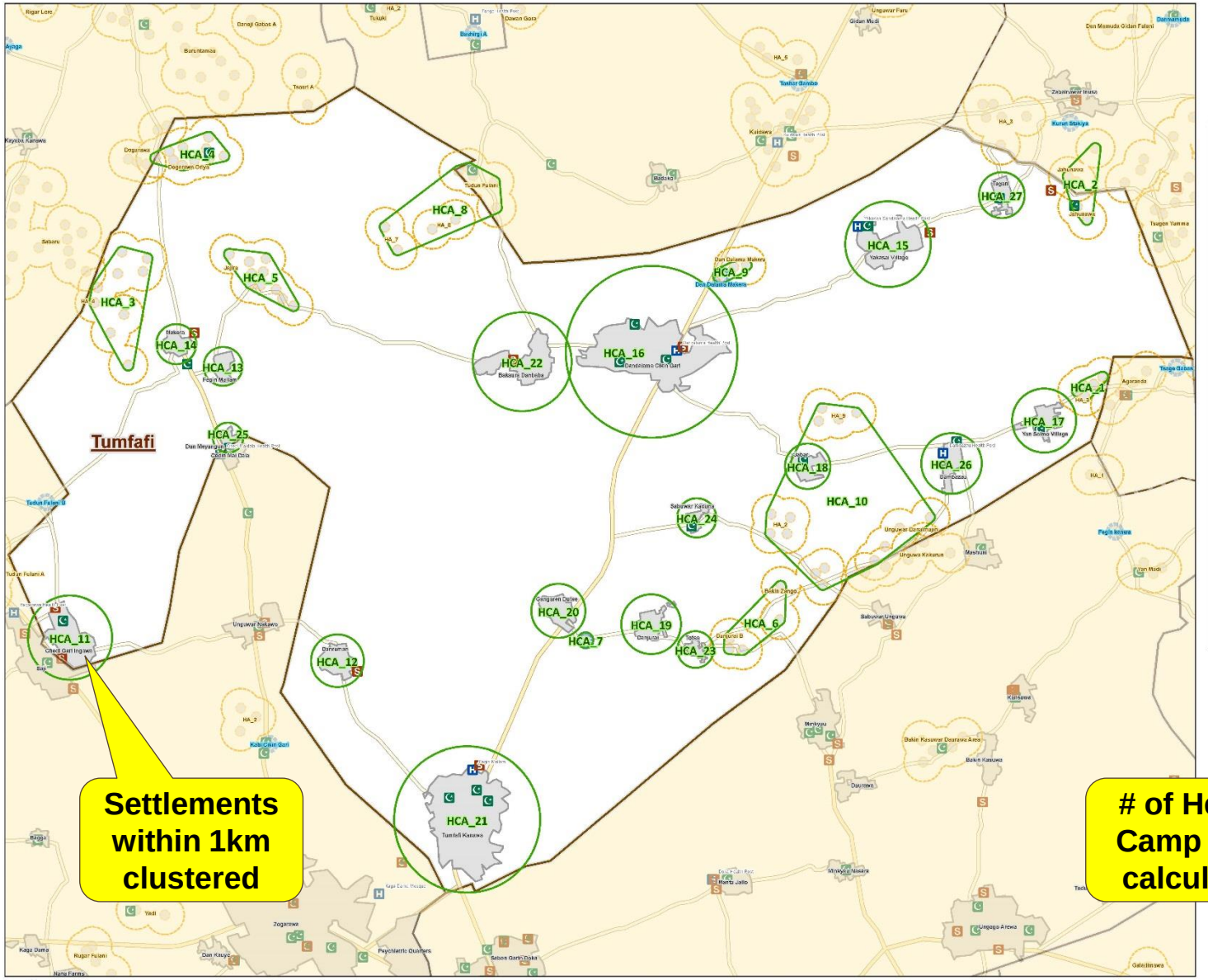
Solution:

An automated tool was created that clustered settlements within 1km of one another.

Target populations were then used to determine the number of days the HC would work in a cluster.

Result:

>95% coverage overall, no missed settlements



Ward: Tumfafi
LGA: Dawakin Tofa
State: Kano

Total targeted population: 56334
Total # of HCs : 96

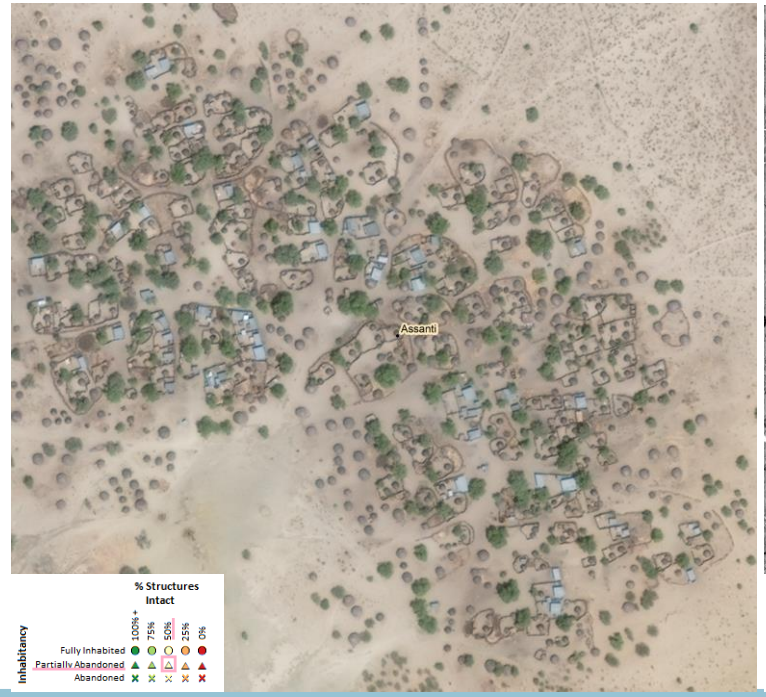
Area Name	Rural Target Pop	Urban Target Pop	# HC Days
HCA_1	128	0	2
HCA_2	128	0	2
HCA_3	231	0	4
HCA_4	257	0	4.5
HCA_5	257	0	4.5
HCA_6	128	0	2
HCA_7	0	154	1.5
HCA_8	231	0	4
HCA_9	51	154	2.5
HCA_10	385	0	6.5
HCA_11	0	3848	38.5
HCA_12	0	1744	17.5
HCA_13	0	1077	11
HCA_14	0	1077	11
HCA_15	0	4156	41.5
HCA_16	0	13339	133.5
HCA_17	0	1539	15.5
HCA_18	0	1334	13.5
HCA_19	0	1796	18
HCA_20	0	1847	18.5
HCA_21	0	14058	140.5
HCA_22	0	4002	40
HCA_23	0	667	6.5
HCA_24	0	667	6.5
HCA_25	0	462	4.5
HCA_26	0	1488	15
HCA_27	0	1129	11.5
Total	1796	54538	576.5

Production date: 03.11.2014
Powered by Novel-T

Borno WPV Outbreak – 2016

Change Analysis of 2013 vs 2016 Imagery Identified Damaged/Destroyed Settlements by Boko Harum.

2013



2016