African History through the Lens of Economics

Mapping Contemporary African Development

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Structure

1. **Measuring Spatial Development**
   — GDP
   — Why?
   — Approach

2. **Main Pan-African Datasets**
   — GIS data: Luminosity, Landcover, Agriculture, Elevation.
   — Surveys: Demographic and Health Surveys, Afrobarometer.
   — Admin data: Country censuses, IPUMS.
   — Other: Conflict, Institutions, Imagery, Machine Learning.

3. **Summary and Takeaways**

Structure
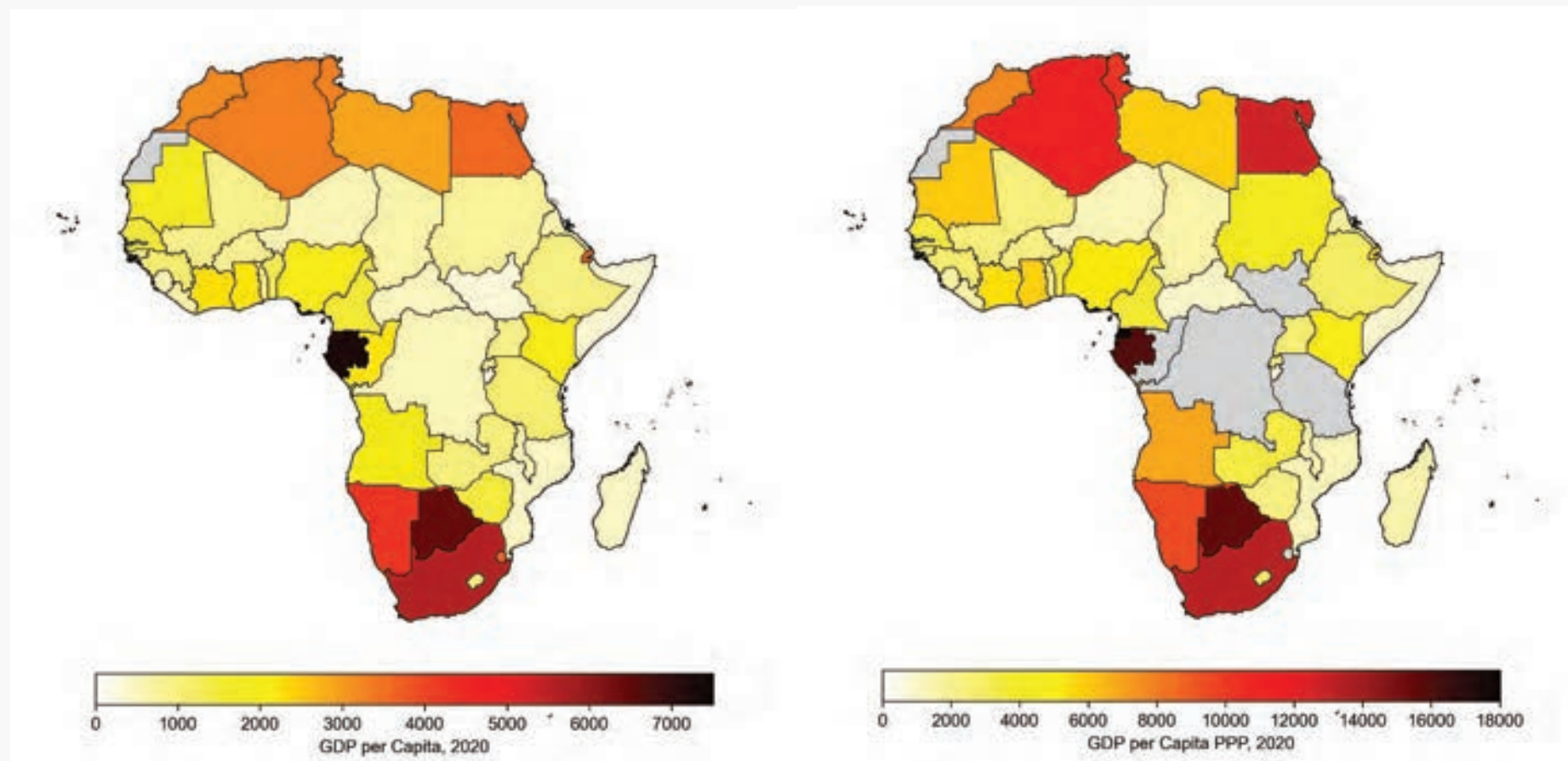
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Africa 2020. GDP p.c. & GDP PPP p.c.

GDP per Capita, 2020

GDP per Capita PPP, 2020

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GDP

— **Missing data and information for a few (many) countries (before 1990)**

— **Data quality**
  - Statistical agencies; PWT [Penn World Tables] "rating"
  - Price and purchasing power adjustments [PPP series]

— **Measurement issues**, especially for agriculture specializing countries
  - Strong correlation between agriculture employment share and GDP p.c.

— **Continuous revisions**
  - According to PWT 6.2 Equatorial Guinea is the second-fastest growing economy among 40 African countries. However, according to PWT 6.1, released four years before, Equatorial Guinea was the slowest growing country [Johnson, Papageorgiou, Larson, and Subramanian (2009)]

— **Conceptual issues, esp. expansion of cross-border investment**
  - GDP - GNP

GDP across Africa. Penn World Tables PWT 6.1 vs 6.2

Table 1. Average growth rates in African countries (1975–1999)

Top 10 countries				
PWT 6.2		PWT 6.1		Countries not appearing on both lists
Country	Growth	Country	Growth	
Botswana	4.50%	Botswana	5.10%	Congo, Republic of
Equ.Guinea	4.00%	Cape Verde	4.70%	Equatorial Guinea
Cape Verde	3.70%	Mauritius	4.30%	Ethiopia
Egypt	3.70%	Egypt	3.70%	Malawi
Mauritius	3.70%	Tunisia	2.50%	Mali
Lesotho	3.50%	Uganda	1.70%	Uganda
Tunisia	2.70%	Morocco	1.70%	
Mali	2.00%	Lesotho	1.50%	
Ethiopia	1.60%	Congo, Rep of	1.50%	
Morocco	1.60%	Malawi	1.20%	

Bottom 10 countries				
PWT 6.2		PWT 6.1		Countries not appearing on both lists
Country	Growth	Country	Growth	
Gabon	-2.60%	Equ. Guinea	-2.70%	Chad
Zambia	-2.10%	Mozambique	-2.40%	Cote d'Ivoire
Madagascar	-1.90%	Zambia	-1.80%	Gabon
Togo	-1.70%	Comoros	-1.60%	Guinea-Bissau
Guinea-Bissau	-1.40%	Madagascar	-1.40%	Mauritania
Comoros	-1.20%	Cote d'Ivoire	-1.40%	Namibia
Niger	-0.70%	Niger	-1.30%	Nigeria
Nigeria	-0.50%	Mauritania	-1.30%	Togo
Chad	-0.50%	Togo	-1.00%	
Mozambique	-0.40%	Namibia	-0.90%	
				Country switching lists: Equ. Guinea

Source: Johnson, Papageorgiou, Larson, and Subramanian (2009)

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Improve GDP. Approach

Complementary Approach. Combine GDP with "other" data

— Micro-individual survey data [Young (JPE 2010)]

— Satellite imagery on light density at night [Henderson *et al.* (AER 2012)]

— Other (Big) Data

Move beyond GDP

— **Regional** (and sectoral) **disaggregation**; important for Africa, given history and considerable spatial and industry differences in productivity

— **Inequality**. Significant challenge, given rising inequality; issue across all countries [see Zucman, Saez, and Blanchet (2022)]

- Need to move beyond mean/averages
- Rural-urban differences
- Spatial differences
- within-city

African Spatial Development

— Anecdotal evidence of large differences in well-being [income, consumption, education, health, public goods access] both across but also within (African) countries

— Spatial differences in well-being across administrative-units, pixels, and ethnic regions appear the largest in Africa [Alesina, Michalopoulos, and Papaioannou (JPE 2016)]

  ▪ On average spatial inequality larger in relatively low(er) income countries [Williamson (EDCC 1965), Kanbur and Venables (book 2005)]

— State capacity [fiscal, legal, and security] on average weaker in relatively low(er) income countries, esp. in Africa

— Noisy macroeconomic aggregates, like income and GDP

African Spatial Development and Policies

— Policies often yield heterogeneous across space impacts

- Agriculture policies of newly-independent African states
- Trade openness and infrastructure investment has on average positive effects that are quite heterogeneous [Hohmann (2018), Storeygard (RES 2016)]
- Foreign aid and foreign direct investment is often clustered

— Pervasive evidence of regional favoritism (discrimination) often with an ethnic angle across many (African) countries

- Pan-African Evidence. [Franck and Rainer (APSR 2012), Amodio, Chiovelli, and Hohmann (2021)]
- Country Case Studies. Kenya [Burgess, et al. (AER 2015)], Zambia [Gisselquist et al. (WD 2016)]

African Spatial Development and History

— **Heterogeneous** impact of large historical events across regions, ethnic, and religious groups in the same (contemporary) country (former colony, protectorate)

— **Example 1.** Slave Trades [Nunn (QJE 2008), Nunn and Puga (REStat 2010)]

  ▪ Huge impact for African societies close to the coast and the major trade routes

  ▪ Smaller –or even nil- direct impact for societies living in the interior

— **Example 2.** Colonization. "Bundle Treatment"

  ▪ Transportation investments differed wildly across areas

  ▪ Colonial and Missionary school

  ▪ Violence, repression, and forced labor

African Spatial Development. Modern Approach

— Geospatial data variation ➔ exploit richness of policies, interventions, history

— Move beyond correlational patterns [though we learn a lot simply visualizing the data and performing simple tabulations]

- Experimental variation. Compare villages with Christian missionary schools to nearby villages without such investments [Wantchekon et al. (QJE 2014)]

- Exploit discontinuities in historical boundaries. Compare areas inside concessionary boundaries facing violence and extortion to areas just outside [Lowes and Montero (QJE 2021]

- Use border artificiality to advance on causality [Michalopoulos and Papaioannou (AER 2016)]

- Quasi-random variation (perhaps conditional on observable features) and historical placebos

African Spatial Development. Modern Approaches

— **Macro designs.** Cross-country Variation

- Ideology of African Independence Movements and Political Modernization [Wantchekon and Garcia-Ponce (AJSP 2021)]

- Slave Trades and Economic Development [Nunn (QJE 2007)]

— **Meso design.** Regional Variation

- The Long-Run Effects of the Scramble for Africa [Michalopoulos and Papaioannou (AER 2016)]

- Precolonial Political Centralization and Contemporary African Development [Michalopoulos and Papaioannou (ECMA 2013)]

— **Micro design.** Individual Level

- Colonial schools and human capital externalities [Wantchekon et al. (QJE 2014)]

Structure

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3. **Summary and Takeways**

GIS data. Luminosity / Light Density at Night Overview

— **Data Overview**

- Proxy: Income / output / development [level and changes]
- Universal coverage
- Every 1 km² across the world
- Every year since 1992 [1992 – 2013, DMSP; 2013-2021 VIIRS]

— **Source: NOA/NASA**

- Download DMSP at the Earth Observation Group
- Download VIIRS at the Earth Observation Group

Source: NASA

GIS data. Luminosity / Light Density at Night Overview

— **Caveats**

- Broad notion of "development" [mixing population and income/output]
- Technical issues [e.g., blooming, top-coding, etc.]
- Many unlit areas

Source: NASA

GIS data. Luminosity / Light Density at Night
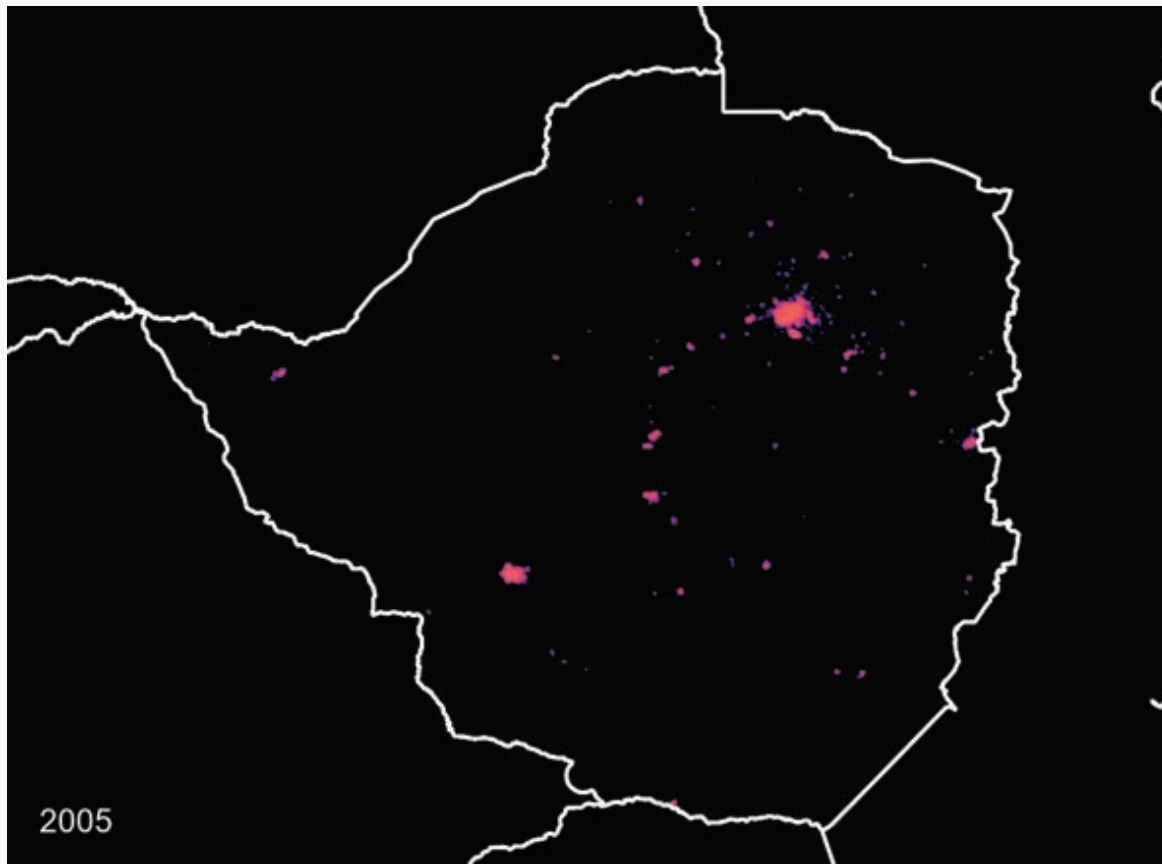## Africa at Night

African History through the Lens of Economics. Measuring Contemporary African Development
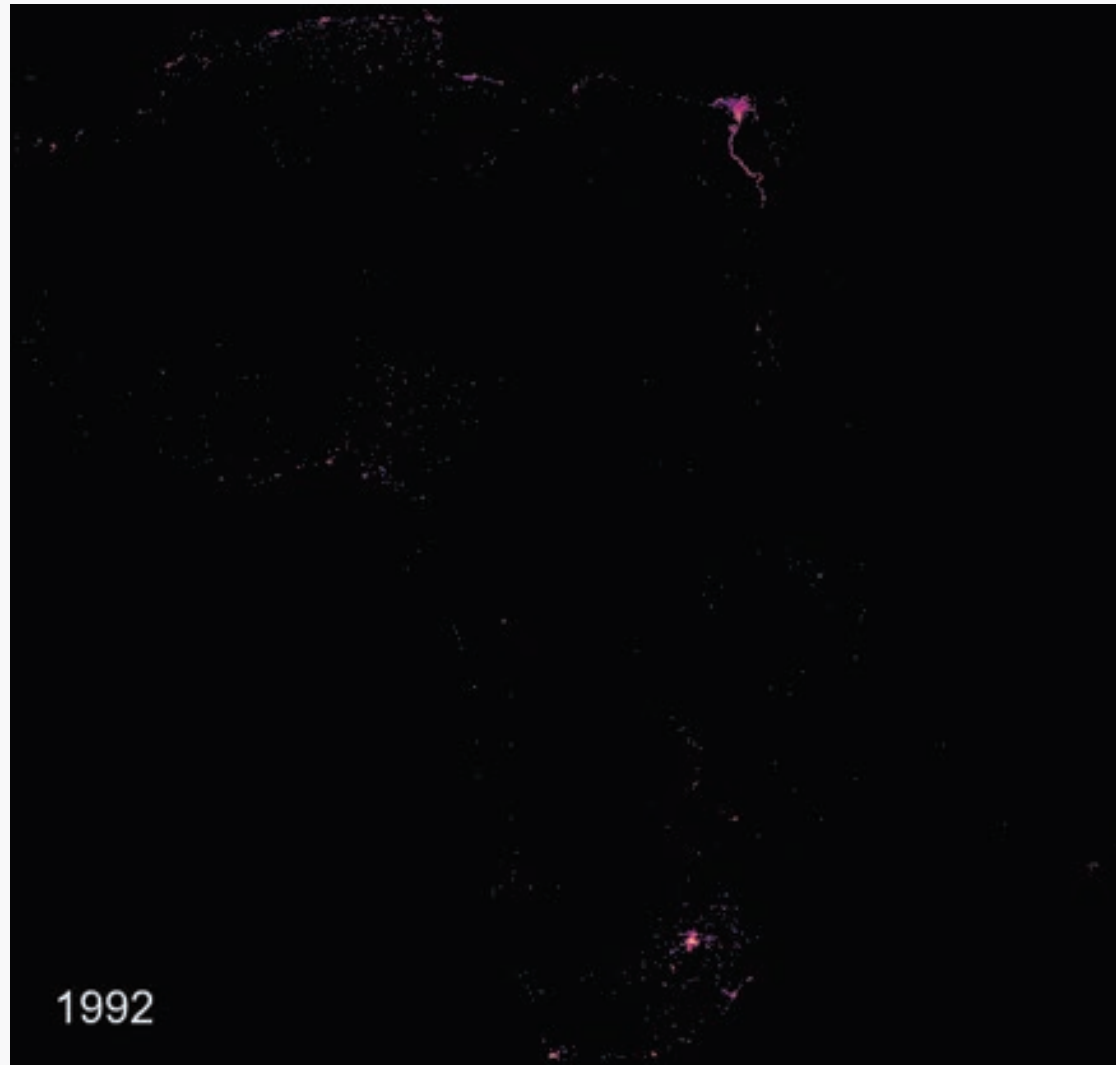
GIS data. Luminosity / Light Density at Night
A Contrast with the North America
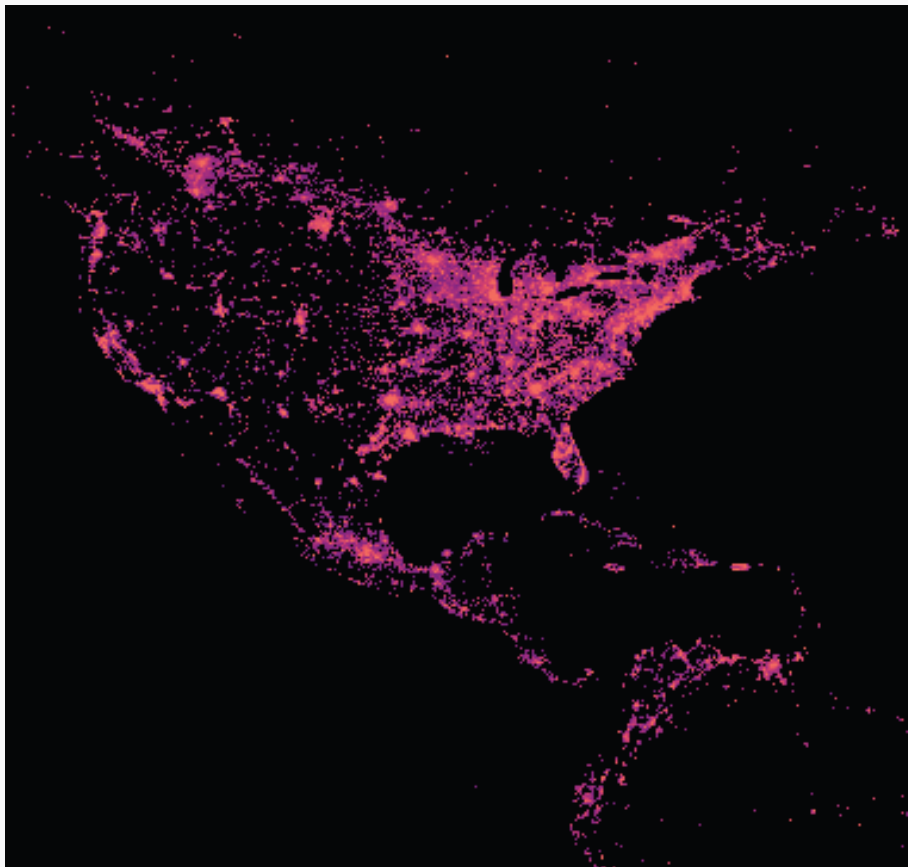
GIS data. Luminosity as Proxy of Spatial Development. Example 1. Zimbabwe. 2005-2010 Hyperinflation
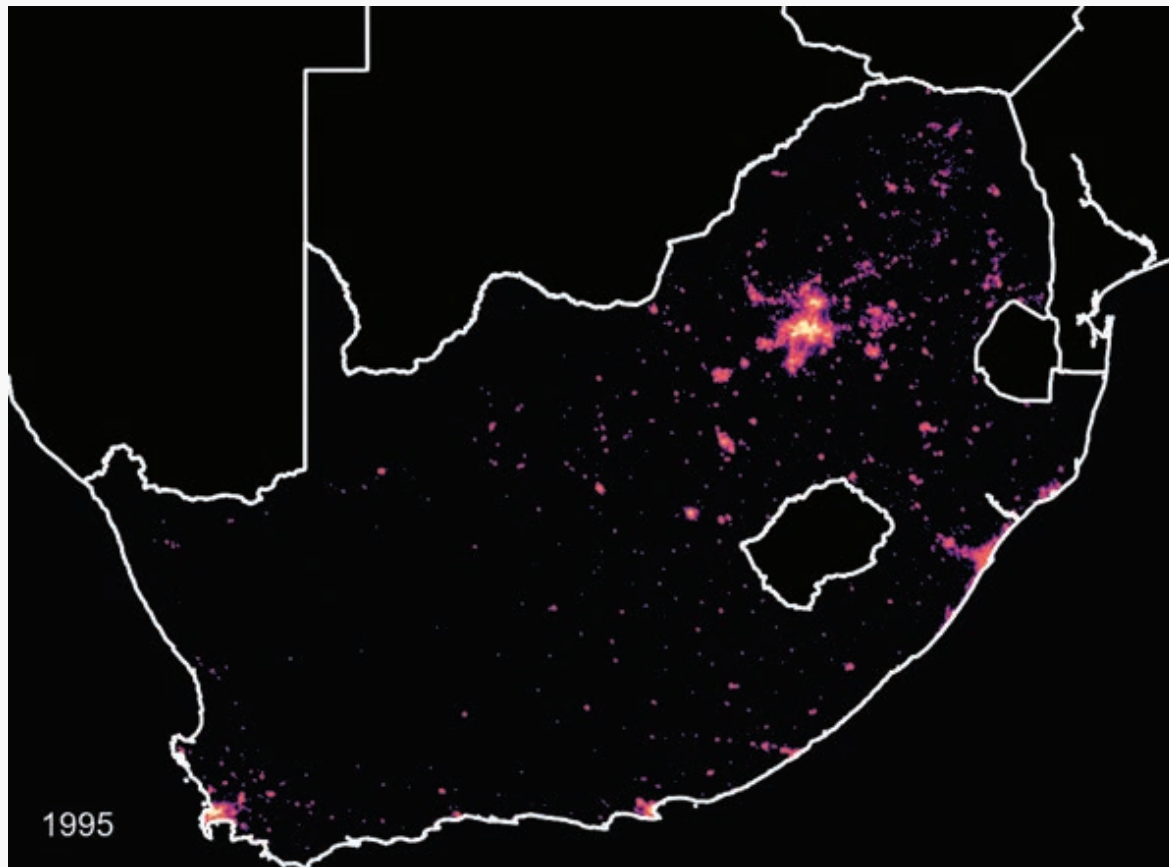

Hyperinflation in Zimbabwe
- Inflation increased rapidly, peaking in 2008 [79,600,000,000% in Nov.]
- Official statistics stop in 2008

Nightlights show
- declining light to 2008
- Slight rebound afterwards

GIS data. Luminosity as Proxy of Spatial Development. Example 2. South Africa. Democratic Era


South Africa Post-Apartheid
- Population growth 44% since 1995
- GDP growth 97% since 1995

Nightlights show
- Growth of Johannesburg/Durban
- Growth in the hinterlands
- Drop in spatial inequality

GIS data. Luminosity Application.
["Landmines and Spatial Development". Chiovelli, Michalopoulos, and Papaioannou. (2021).]

African History through the Lens of Economics. Measuring Contemporary African Development
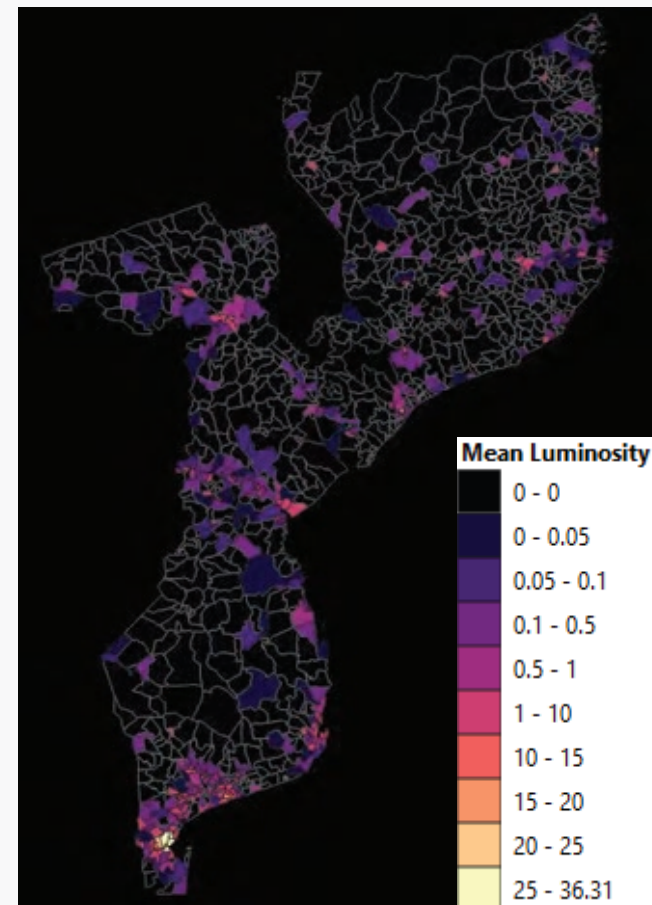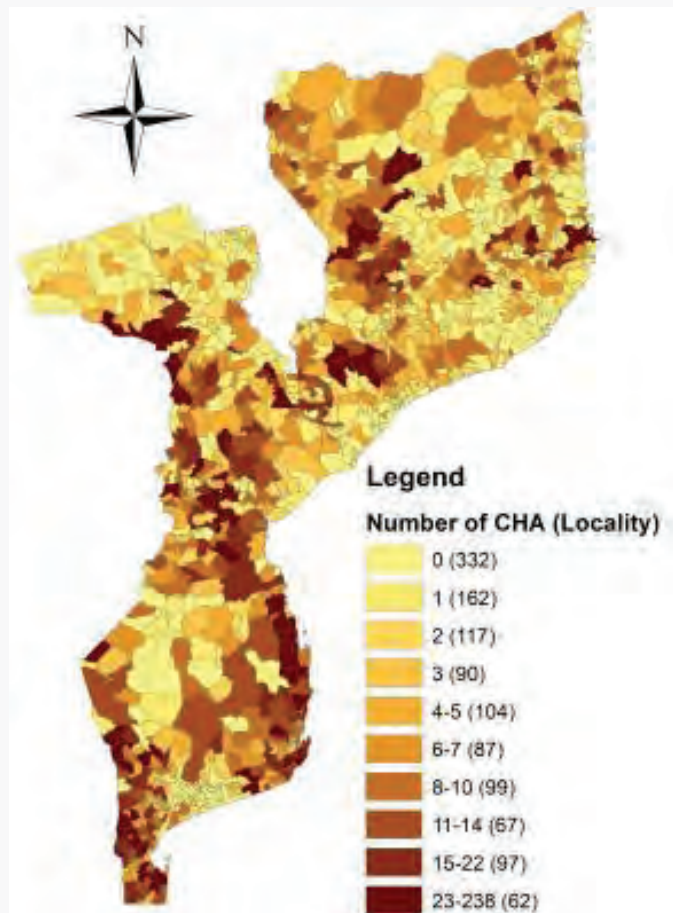
GIS data. Luminosity Applications.
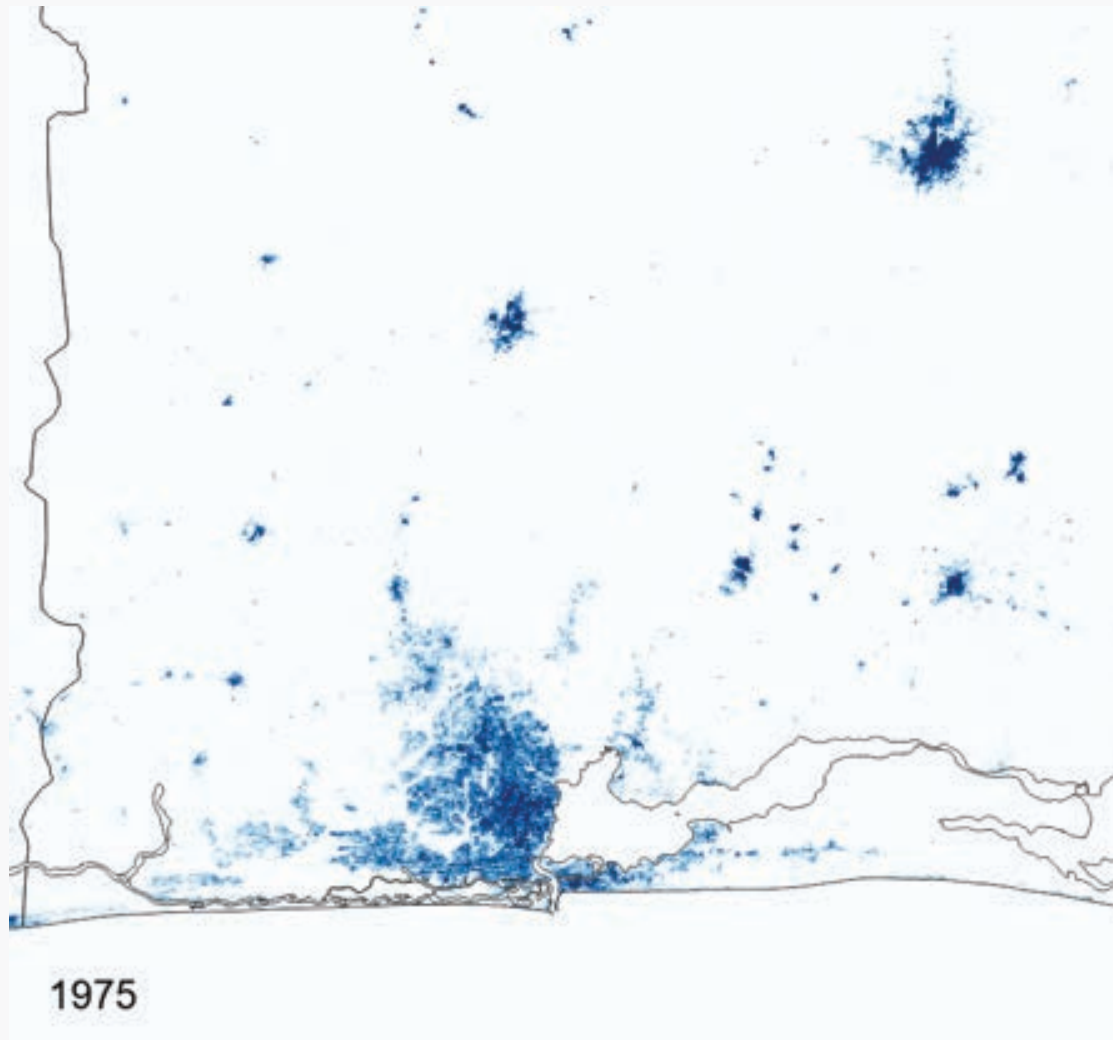# Historical African Development

— Michalopoulos, S., & Papaioannou, E. (2013). Pre-colonial ethnic institutions and contemporary African development. *Econometrica*, *81*(1), 113-152. **week 2**

— Jedwab, R., Kerby, E., & Moradi, A. (2017). History, path dependence and development: Evidence from colonial railways, settlers and cities in Kenya. *The Economic Journal*, *127*(603), 1467-1494.

— Michalopoulos, S., & Papaioannou, E. (2014). National institutions and subnational development in Africa. *The Quarterly journal of economics*, *129*(1), 151-213.

— Dickens, A. (2018). Ethnolinguistic favoritism in african politics. *American Economic Journal: Applied Economics*, *10*(3), 370-402.

— Chiovelli, G., Michalopoulos, S., & Papaioannou, E. (2018). *Landmines and spatial development*. NBER working paper (no. w24758).

GIS data. Luminosity.
Bibliography

— Hodler, R., & Raschky, P. A. (2014). Regional favoritism. *The Quarterly Journal of Economics*, *129*(2), 995-1033.

— Henderson, J. V., Storeygard, A., & Weil, D. N. (2012). Measuring economic growth from outer space. *American economic review*, *102*(2), 994-1028.

— Pinkovskiy, M., & Sala-i-Martin, X. (2016). Lights, camera… income! Illuminating the national accounts-household surveys debate. *The Quarterly Journal of Economics*, *131*(2), 579-631.

— Donaldson, D., & Storeygard, A. (2016). The view from above: Applications of satellite data in economics. *Journal of Economic Perspectives*, *30*(4), 171-98.

— Besley, T., & Reynal-Querol, M. (2014). The legacy of historical conflict: Evidence from Africa. *American Political Science Review*, *108*(2), 319-336.

GIS data. Landcover (GHSL).
Brief summary

1975

— **Share of land that is 'built-up'**
  - Worldwide
  - Epochs: 1975, 1990, 2000, 2014
— **Built space at a very fine level**
  - Growth of cities and towns
  - Pattern of urban development ('leap-frogging')
— **Application:**
  - "Colonial Legacies: Shaping African Cities". Baruah, Henderson, and Peng (JEGeo 2017).
— **Source: European Commission**
  - Download at GHSL

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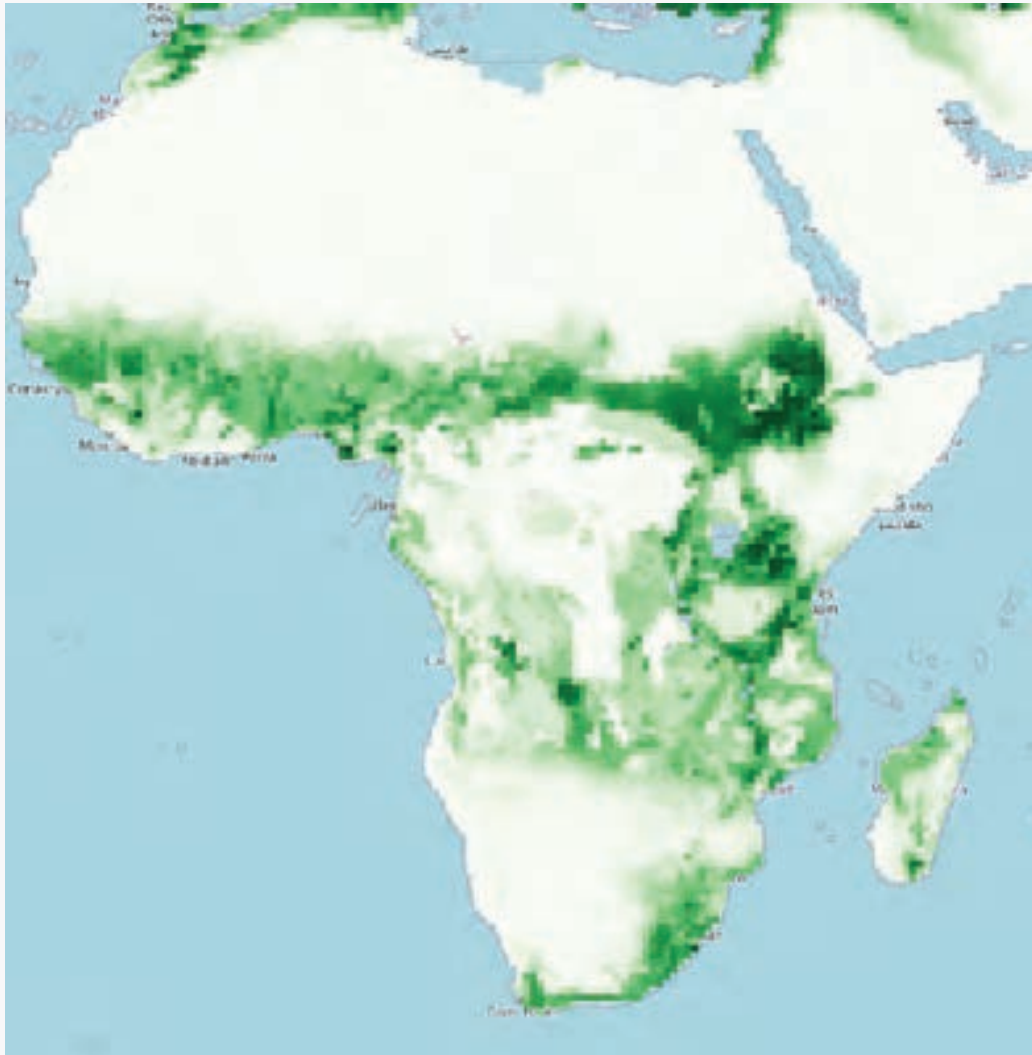# GIS data. Elevation (SRTM).
Brief summary

— **Height above sea level**
  - Worldwide
  - One point in time
— **Measure features of the terrain**
  - Important for agriculture, flooding, conflict, etc.
— **Application:**
  - "Ruggedness: The Blessing of Bad Geography in Africa". Nunn and Puga (REStat 2017).
— **Source: USGS**
  - Download from the EROS Center

GIS data. Agricultural Suitability.
Brief summary

— **Fraction of land suitable for agriculture.**
  - Worldwide
  - One point in time

— **Application:**
  - "The Origins of Ethnolinguistic Diversity". Michalopoulos (AER 2012).

— **Source: University of Wisconsin-Madison**
  - Download from the CSGE

Surveys. Demographic and Health Survey (DHS). Overview
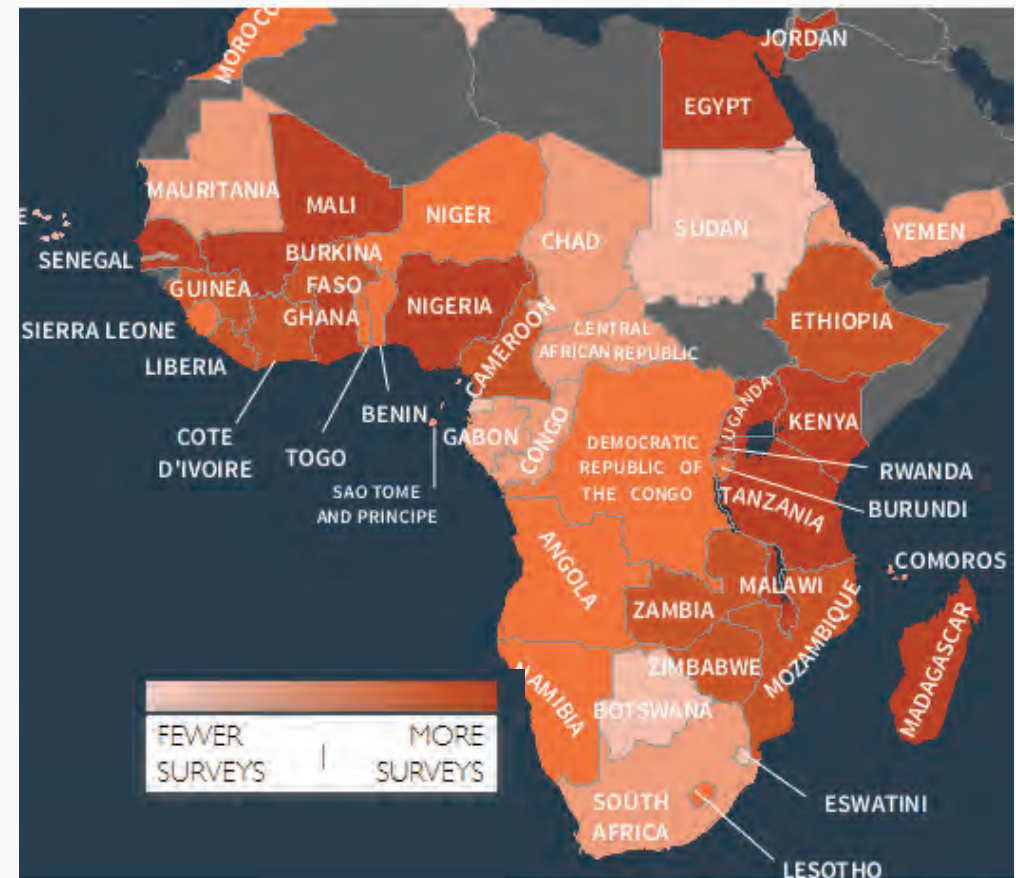
— **Aspects:**

  ▪ Fertility, education, household structure, assets and wealth, immunization, access to public goods, …

— **Coverage (see map)**

— Samples of the population for a given country and year [from 1985]
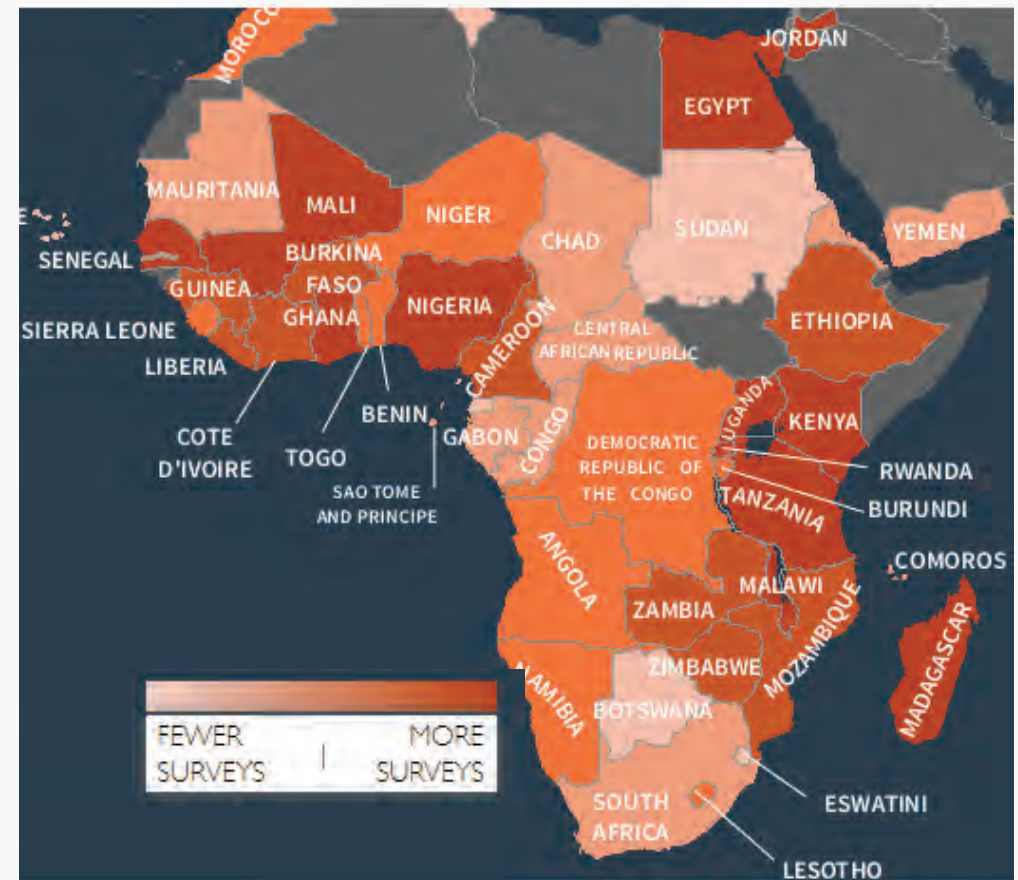
— **Source: USAID, DHS Program**

  ▪ Download at the DHS Program
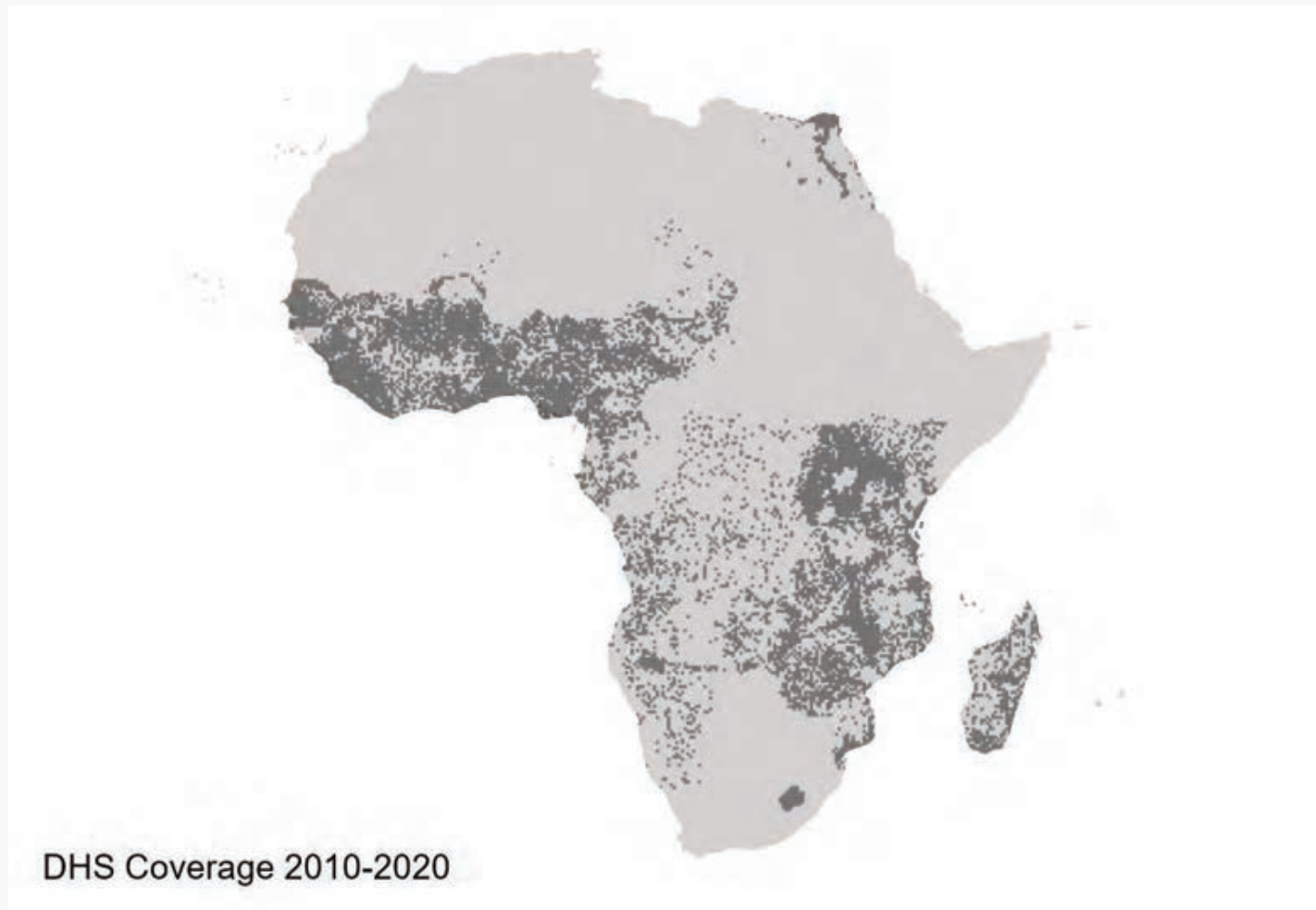
Surveys. Demographic and Health Survey (DHS). Caveats

— Same locations not necessarily repeated over time

— Sample may differ (only female in some year, all citizens in others, not all surveys give location)

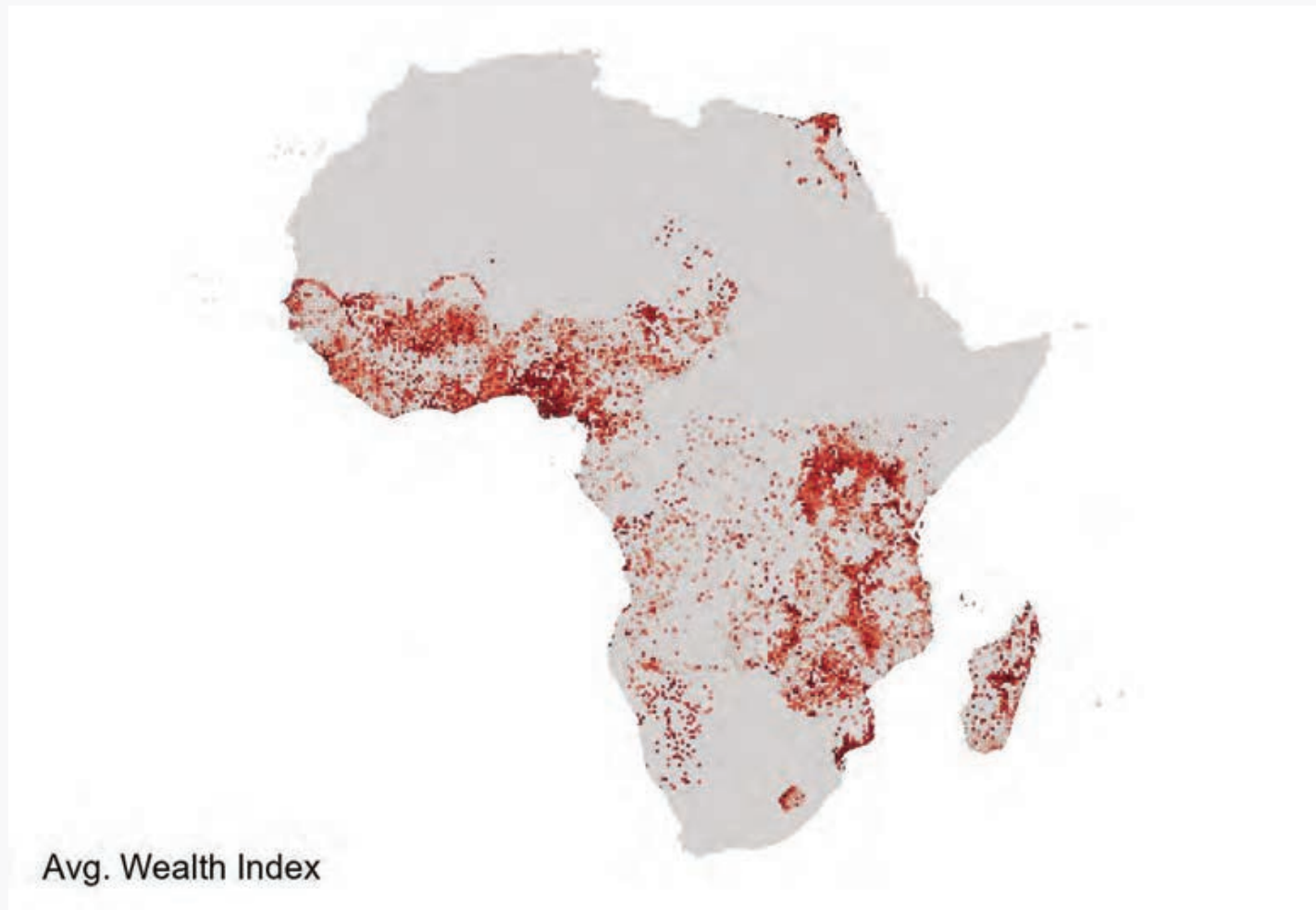— Oversampling of proximate to capitals and other big cities areas

Surveys. Demographic and Health Survey (DHS).
Example 1. Pan-African coverage.
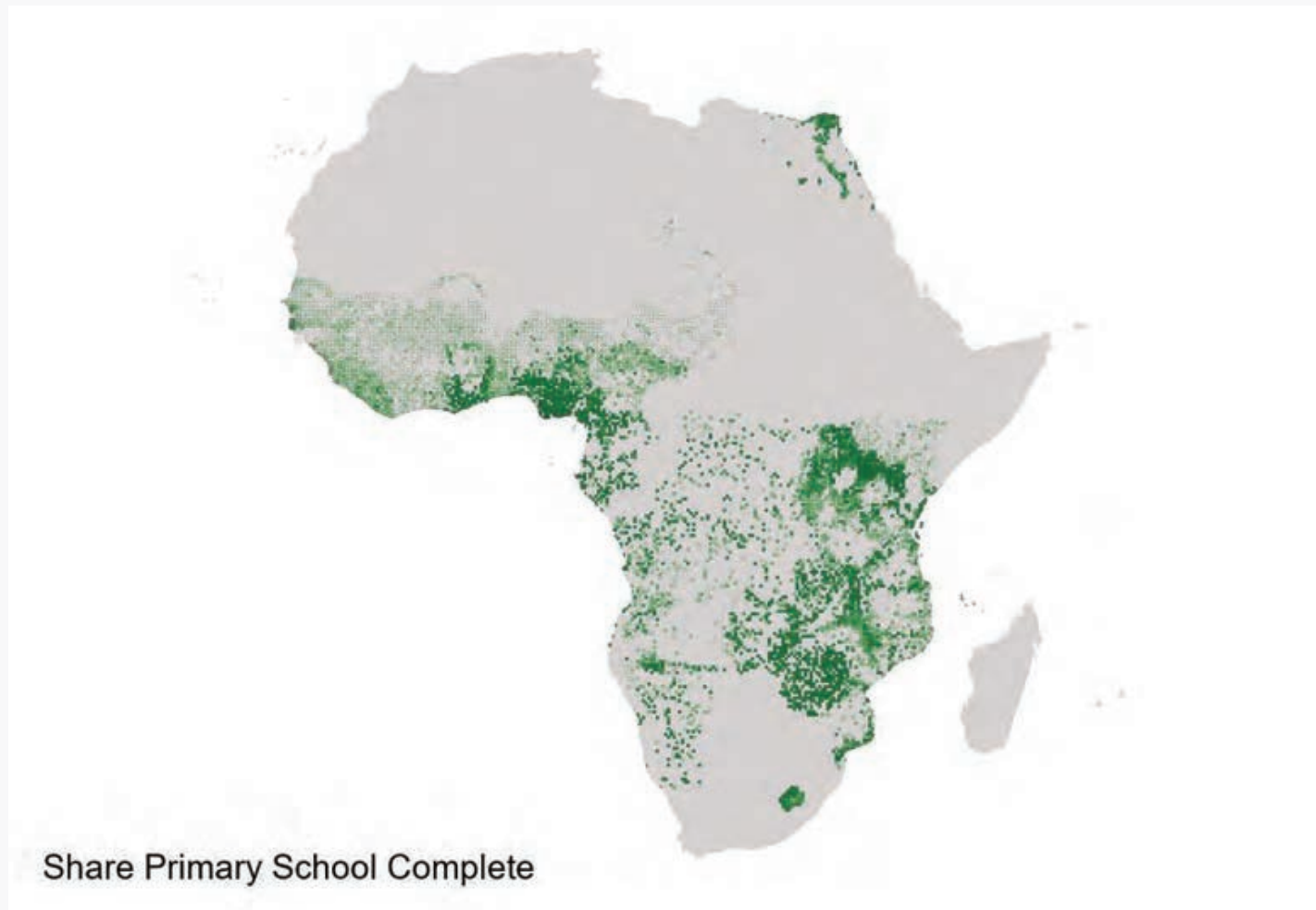

DHS Coverage 2010-2020

Surveys. Demographic and Health Survey (DHS).
Example 1. Pan-African coverage: Wealth.

Avg. Wealth Index

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Surveys. Demographic and Health Survey (DHS). Example 1. Pan-African coverage: Education.

Share Primary School Complete

Surveys. Demographic and Health Survey (DHS). Example 1. Pan-African coverage: Water Access.

Share with Piped Water

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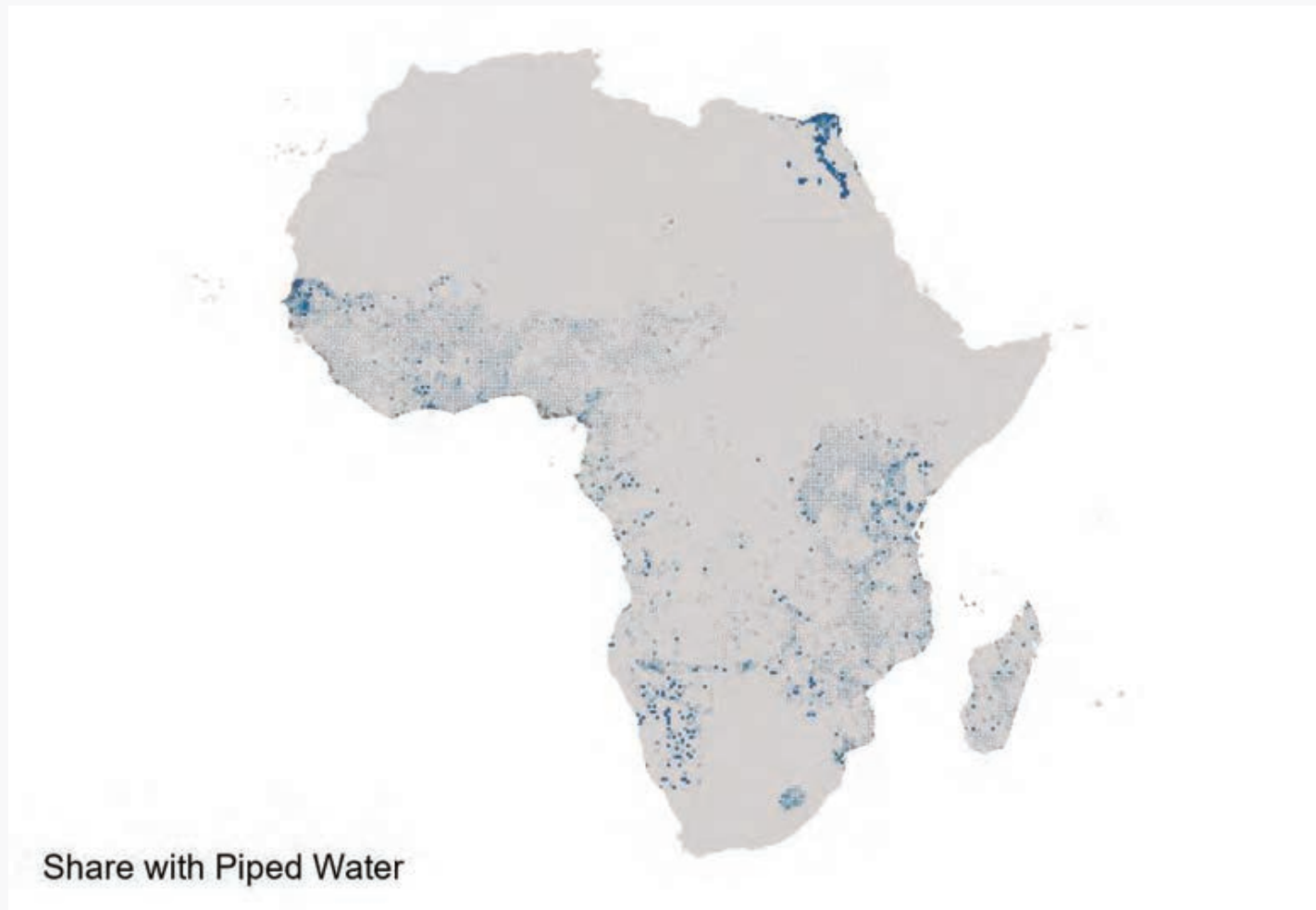
Surveys. Demographic and Health Survey (DHS). Example 2. Nigeria coverage.

DHS Clusters in Nigeria
(o = 2003, x = 2018)
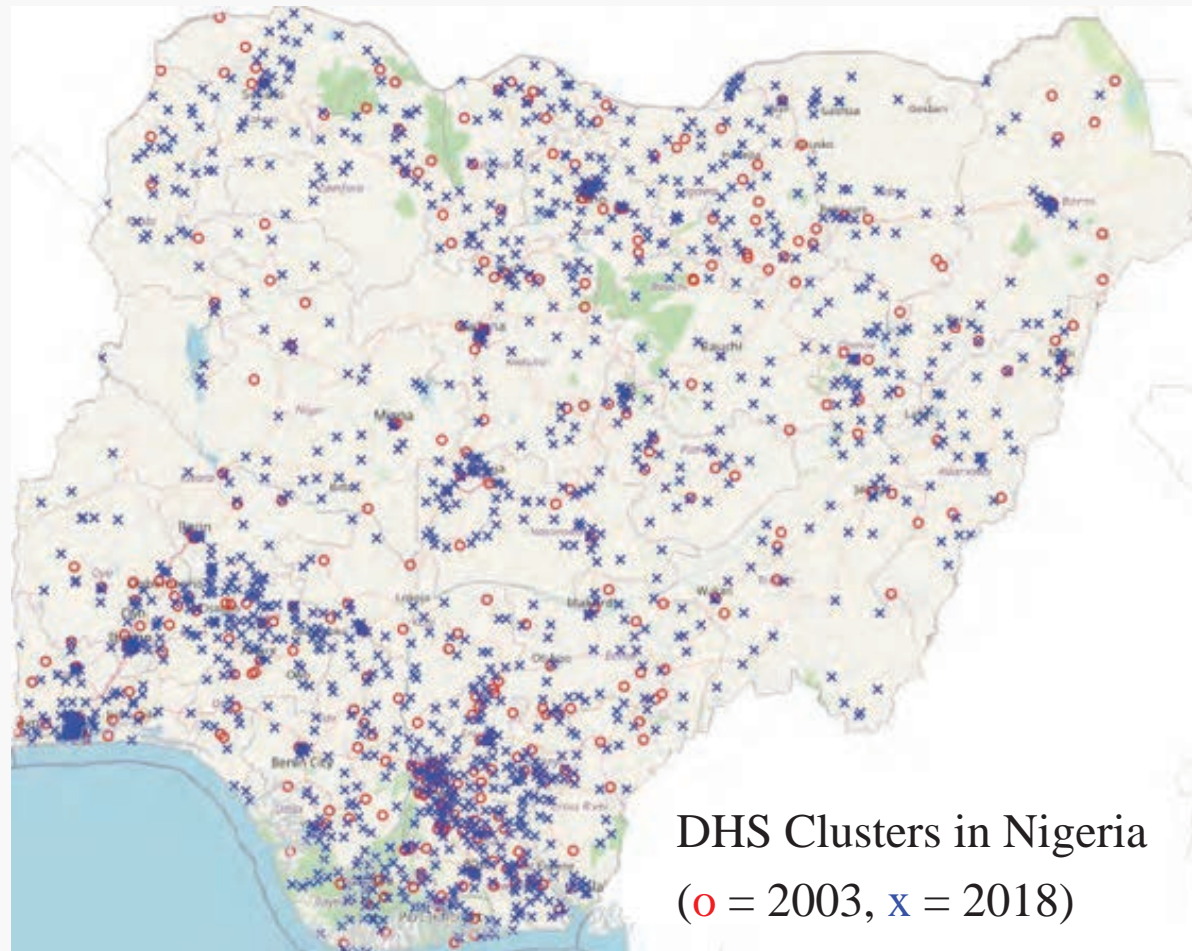
Surveys. Demographic and Health Survey (DHS).
Example 2. Nigeria Composite Wealth Index.

2003

2018
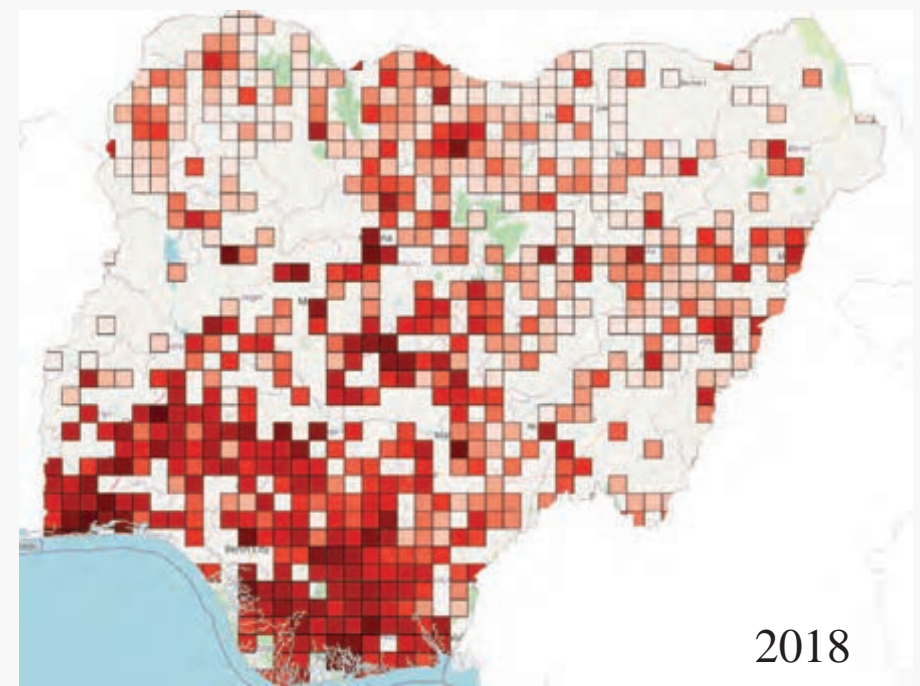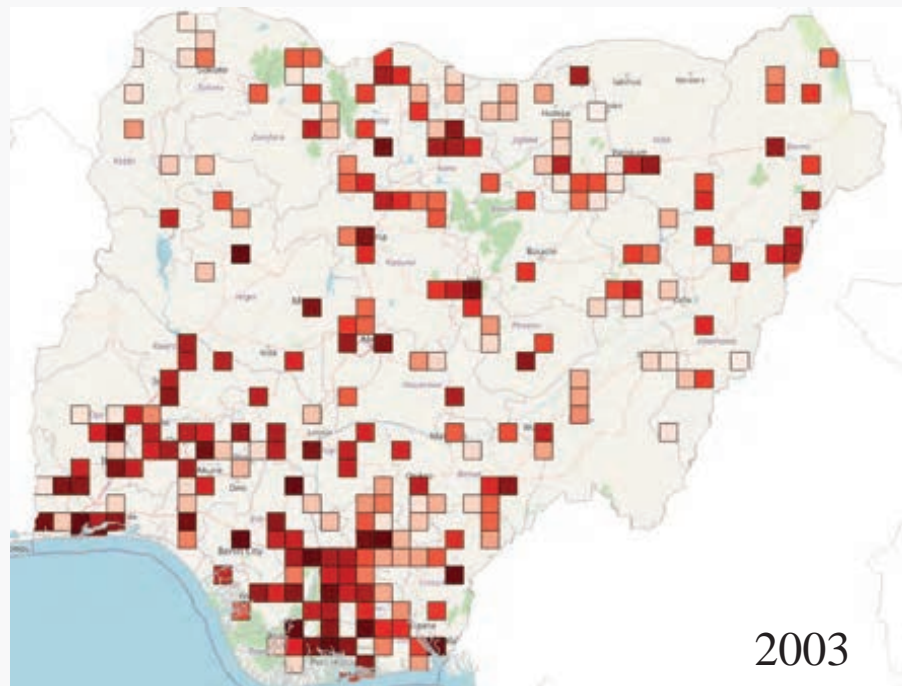
Surveys. Demographic and Health Survey (DHS). Example 3. DRC coverage.

DHS Clusters in DRC
(o = 2007, x = 2013)

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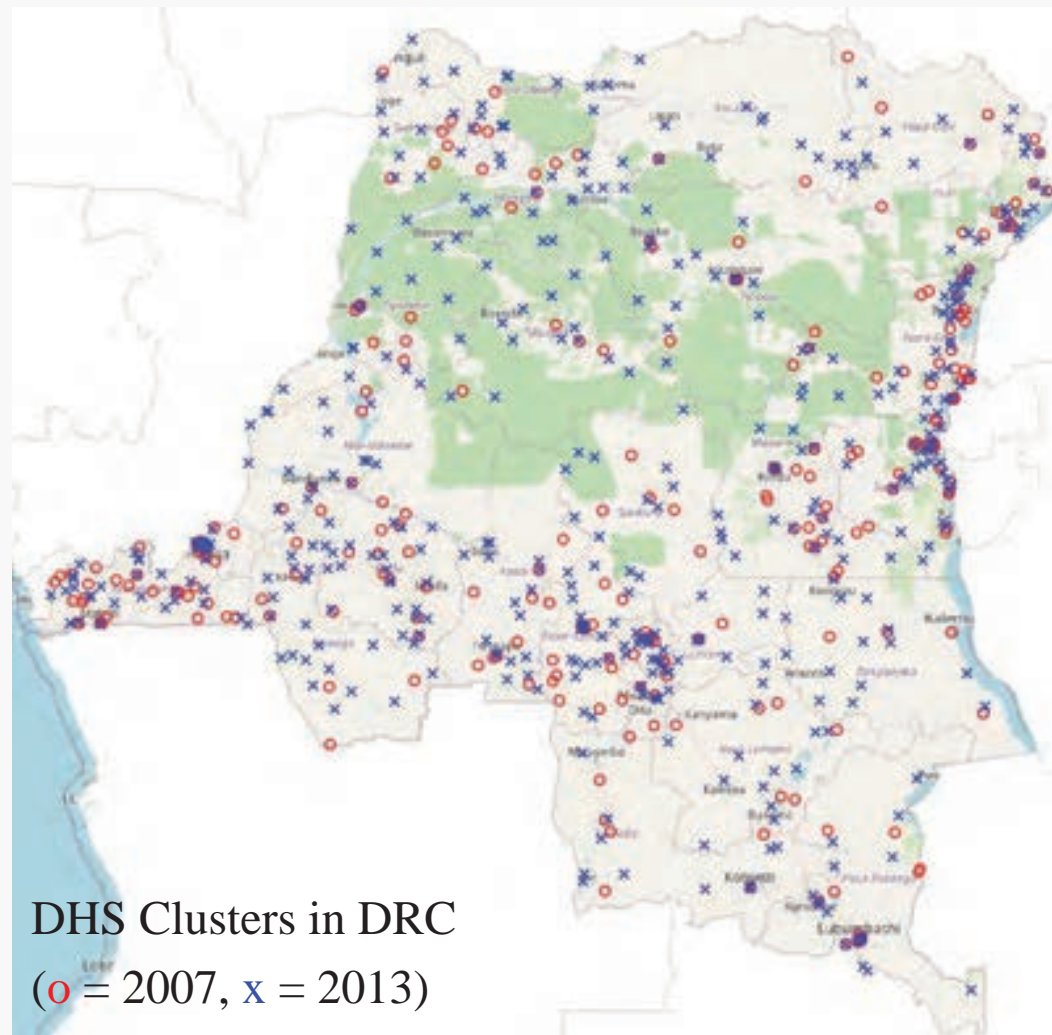
Surveys. Demographic and Health Survey (DHS). Example 3. DRC Composite Wealth Index.

2007

2013

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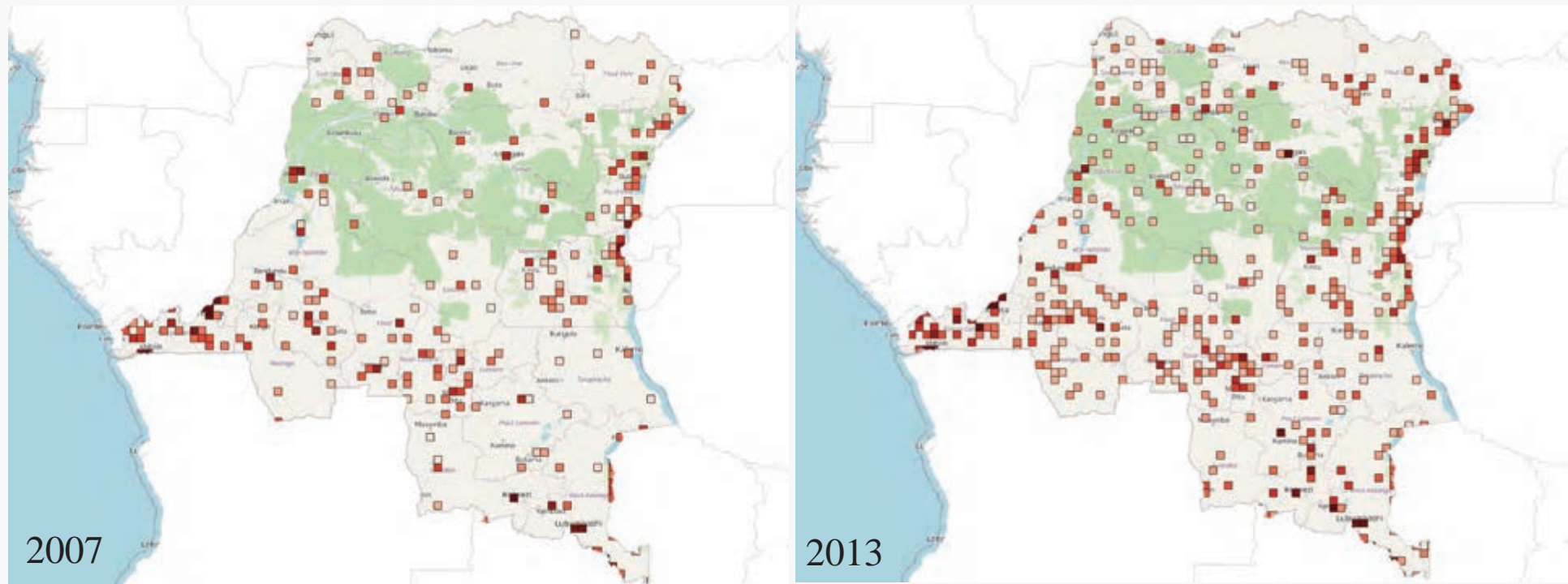
Surveys. Demographic and Health Survey (DHS). Applications

— Lowes, S., & Montero, E. (2021). Concessions, violence, and indirect rule: Evidence from the congo free state. *The Quarterly Journal of Economics*, *136*(4), 2047-2091. **week 9**

— Anderson, S. (2018). Legal origins and female HIV. *American Economic Review*, *108*(6), 1407-39.

— Michalopoulos, S., Putterman, L., & Weil, D. N. (2019). The influence of ancestral lifeways on individual economic outcomes in Sub-Saharan Africa. *Journal of the European Economic Association*, *17*(4), 1186-1231.

— Fenske, J. (2015). African polygamy: Past and present. *Journal of Development Economics*, *117*, 58-73.

— Young, A. (2012). The African growth miracle. *Journal of Political Economy*, *120*(4), 696-739.

Surveys. Afrobarometer.
Overview

— **Aspects:**
  ▪ priorities, preferences, experiences, and opinions of citizens

— **Coverage (see map)**

— **Seven rounds of samples [1999-2019]**

— **Source: Afrobarometer**
  ▪ Download at <u>Afrobarometer</u>
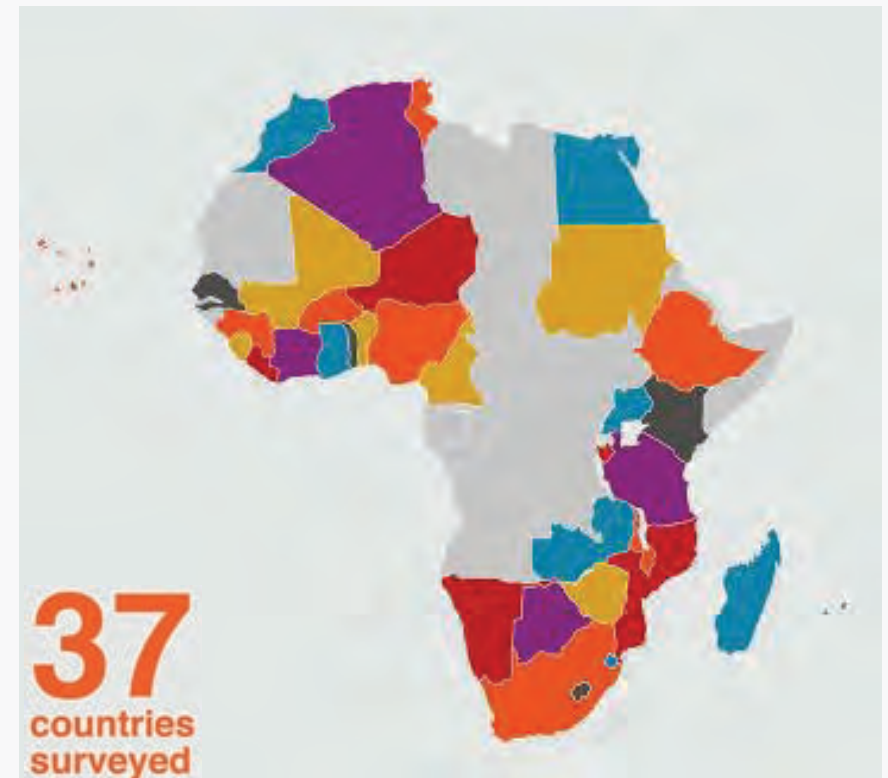
Surveys. Afrobarometer.
Caveats

— **Representative at country level**
  - About 1,200-1,400 per sample
— **Coverage is sparse**
— **Same countries and areas not necessarily repeated over time**
— **Fewer countries as one goes back**
— **Incomplete coverage in conflict areas and countries**

37 countries surveyed
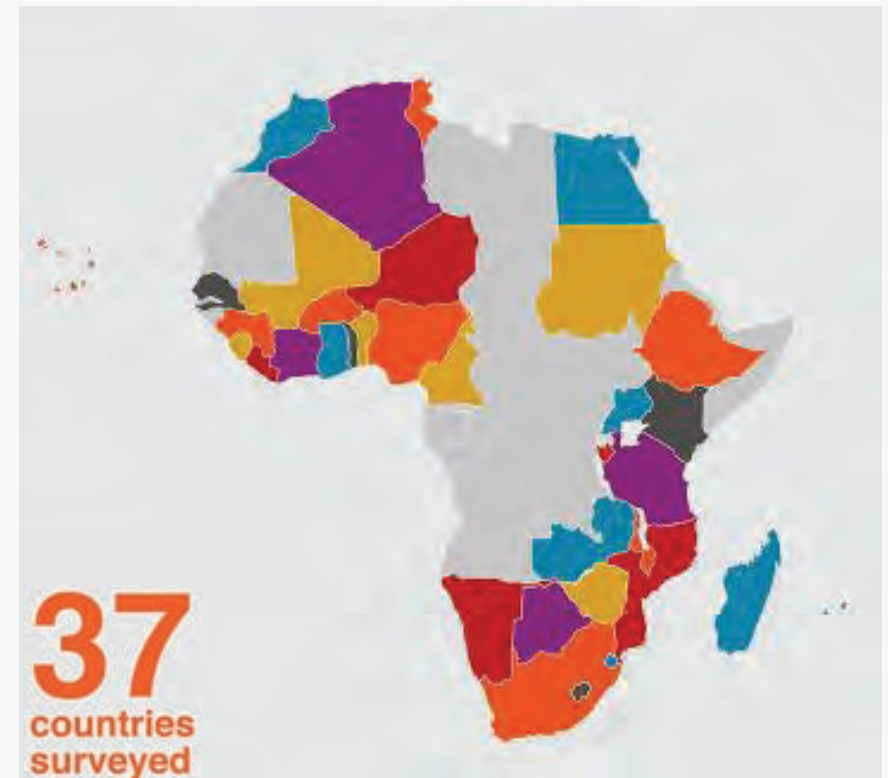
Surveys. Afrobarometer.
Example 1. Pan-Africa.
How would you describe the present economic condition of this country?

Gap indicator [Fairly Good,Very good] (-) <------> (+) [Very Bad,Fairly Bad]

Lowest Index | Low | Medium | High | Highest Index

-100   -50   0   50   100

African History through the Lens of Economics. Measuring Contemporary African Development
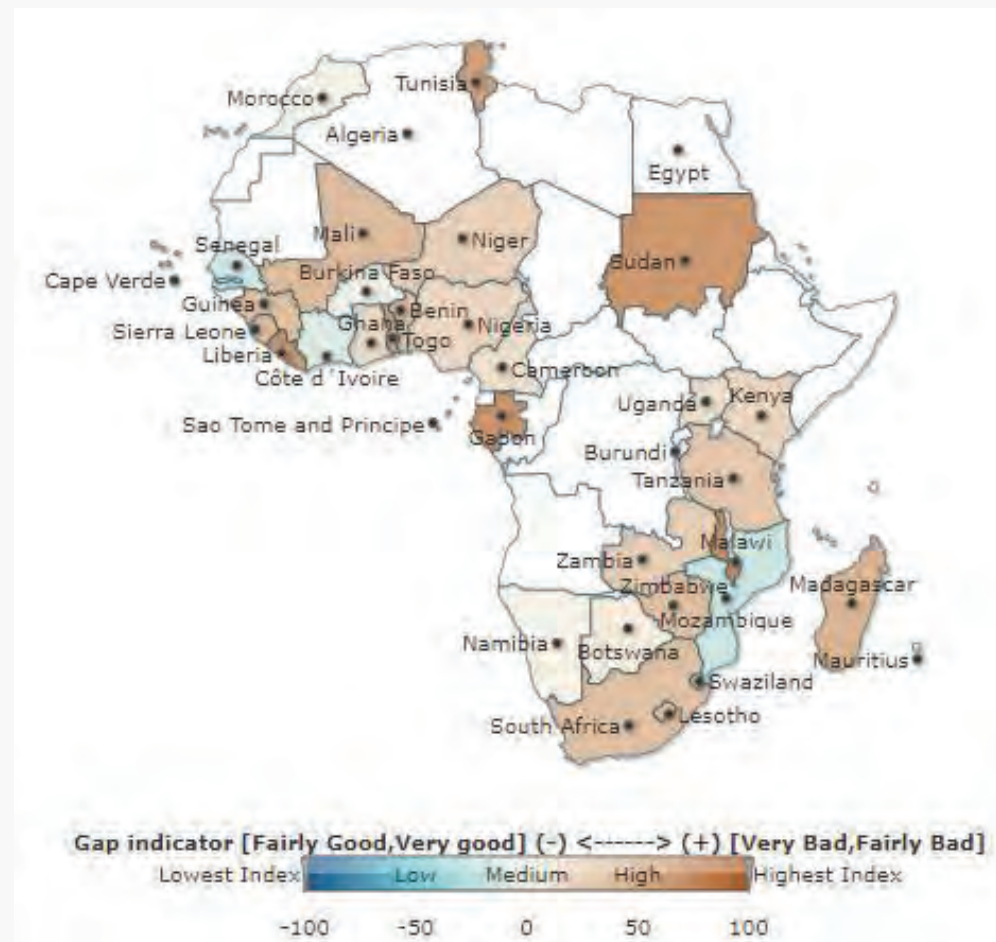
Surveys. Afrobarometer.
Example 2. Nigeria and Tanzania.
How would you describe the present economic condition of this country?

African History through the Lens of Economics. Measuring Contemporary African Development
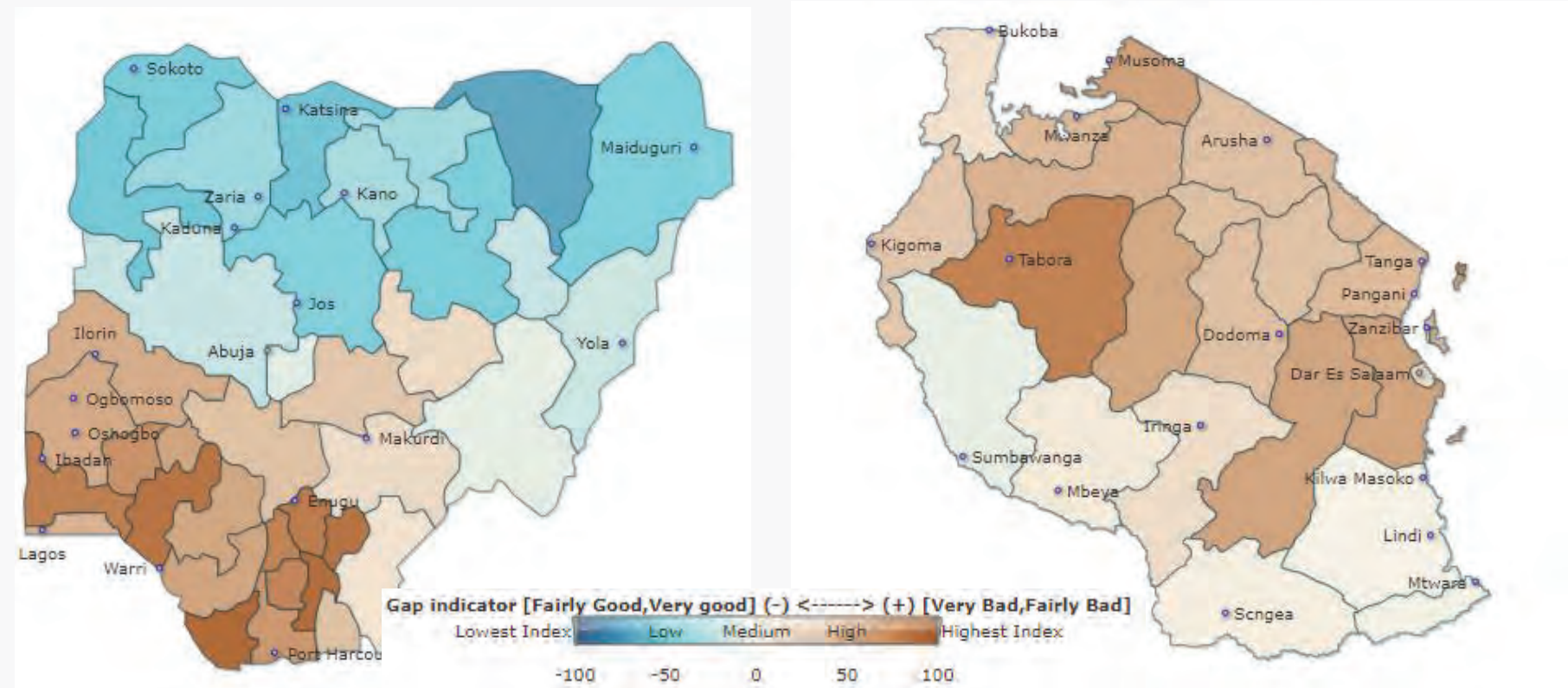
Surveys. Afrobarometer.
Example 3. Ethnicity or Nation?
Which Institutions are trusted? Which are perceived as less corrupt?

Trust
towards National Parliament, Local Assembly, and Traditional Leaders

1.68269
1.58489
1.77257
1.94394

National Parliaments
Local Assembly
National Courts
Traditional Leaders

Source: Afrobarometer Surveys 4th Round

Corruption Perceptions
towards National Parliament, Local Assembly, Government Officials, and Traditional Leaders

1.2757
1.28283
1.41867
.950836

Members of Parliament
Elected Local Assembly Officials
Government Officials
Traditional Leaders

Source: Afrobarometer Surveys 4th Round

Source: Michalopoulos and Papaioannou (2014); Afrobarometer

Surveys. Afrobarometer.
Applications

— Nunn, N., & Wantchekon, L. (2011). The slave trade and the origins of mistrust in Africa. *American Economic Review*, *101*(7), 3221-52. **week 4**

— Ali, M., Fjeldstad, O. H., Jiang, B., & Shifa, A. B. (2019). Colonial legacy, state-building and the salience of ethnicity in sub-Saharan Africa. *The Economic Journal*, *129*(619), 1048-1081.

— Depetris-Chauvin, E., Durante, R., & Campante, F. (2020). Building nations through shared experiences: Evidence from African football. *American Economic Review*, *110*(5), 1572-1602. **very topical**

— Michalopoulos, S., & Papaioannou, E. (2015). On the ethnic origins of African development: Chiefs and precolonial political centralization. *Academy of Management Perspectives*, *29*(1), 32-71.

— Rohner, D., Thoenig, M., & Zilibotti, F. (2013). Seeds of distrust: Conflict in Uganda. *Journal of Economic Growth*, *18*(3), 217-252.

Admin data. Country Censuses.
Overview

— **Aspects:**

  ▪ Education, household structure, employment, birthplace and nativity, births and deaths, housing materials

— **Covers entire population**

— **Repeats every 10 years (typically)**

— **Source:**

  ▪ Available through individual country statistics bureaus

Admin data. Country Censuses.
Caveats

— **Spatially coarse**

— **Infrequent (each 10 years)**

— **Not standardized across countries**

— **Can be difficult to gain access (not publicly available)**

Admin data. Country Censuses.
Example 1. Education in Mozambique

1997

2007
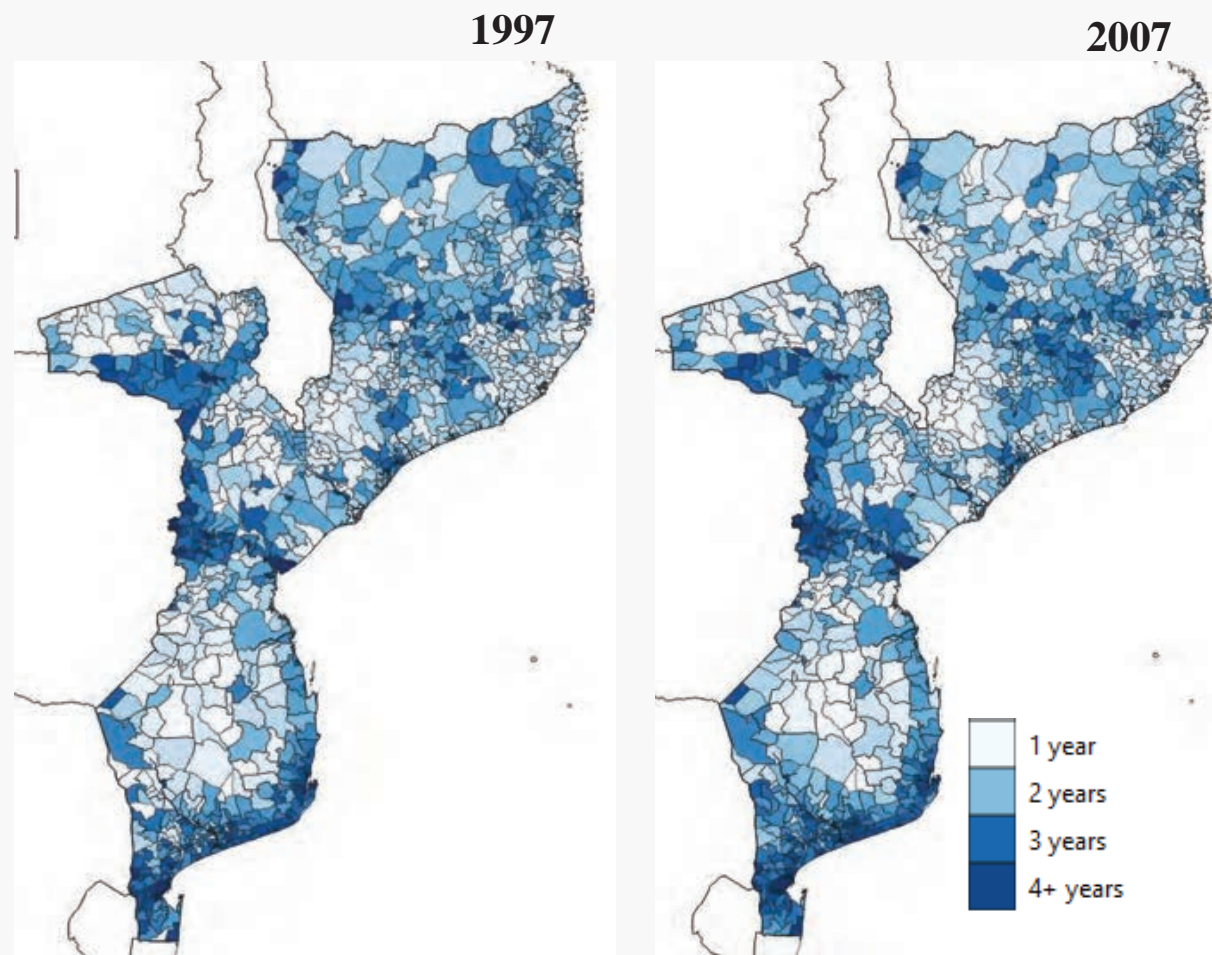
— **Mean years of school for adults 15+**

— **Education is rising**
  - Some areas gain
  - Some losing

Legend:
- 1 year
- 2 years
- 3 years
- 4+ years

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Admin data. Country Census
Applications

— Dupraz, Y. (2019). French and British colonial legacies in education: Evidence from the partition of Cameroon. *The Journal of Economic History*, *79*(3), 628-668. **week 6**
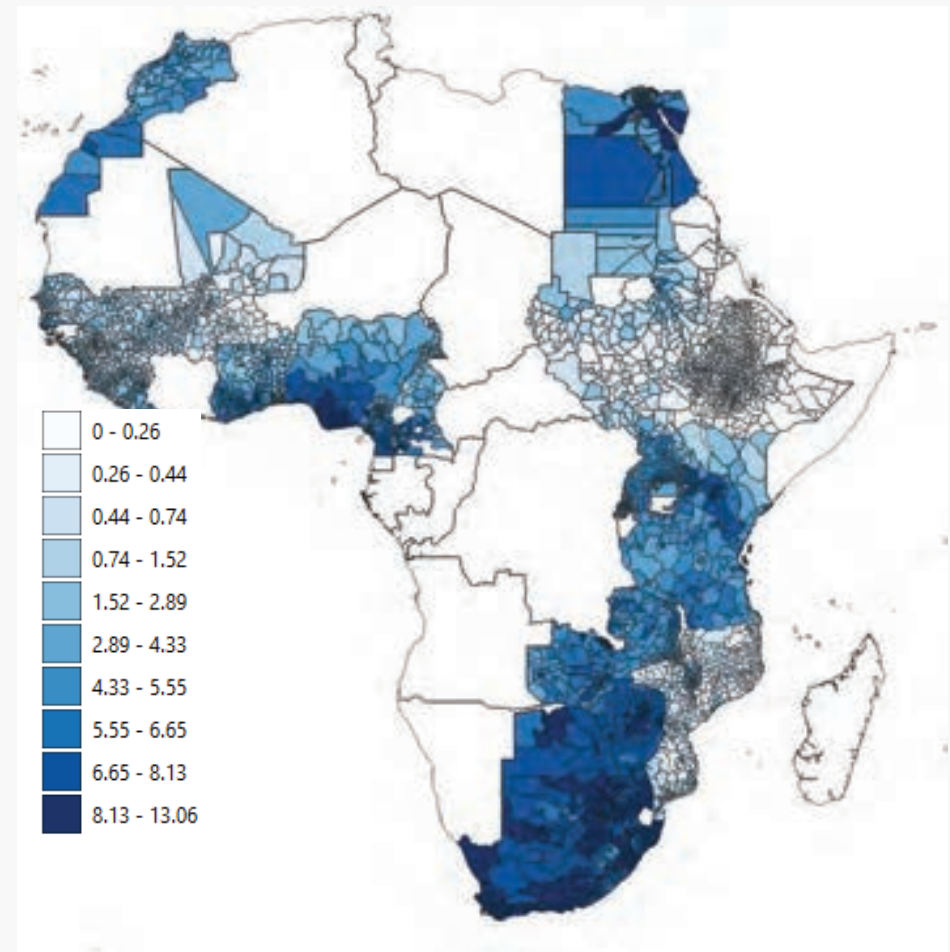
— Nunn, N., & Wantchekon, L. (2011). The slave trade and the origins of mistrust in Africa. *American Economic Review*, *101*(7), 3221-52. **week 4**

— Chiovelli, G., Michalopoulos, S., & Papaioannou, E. (2018). *Landmines and spatial development* (No. w24758). National Bureau of Economic Research.

— Acemoglu, D., Reed, T., & Robinson, J. A. (2014). Chiefs: Economic development and elite control of civil society in Sierra Leone. *Journal of Political Economy*, *122*(2), 319-368.

Admin data. IPUMS.
Overview

— **"Integrated Public Use Microdata Series"**

— **Standardized censuses from many countries**

— **Aspects:**

  ▪ Education, household structure, employment, birthplace and nativity, births and deaths, housing materials.

— **Repeats every 10 years (typically)**

— **Source: University of Minnesota**

  ▪ Download at <u>IPUMS international</u>

	0 - 0.26
	0.26 - 0.44
	0.44 - 0.74
	0.74 - 1.52
	1.52 - 2.89
	2.89 - 4.33
	4.33 - 5.55
	5.55 - 6.65
	6.65 - 8.13
	8.13 - 13.06

Admin data. IPUMS.
Caveats

— **Sampled (~10%) from censuses**

— **Not many censuses for many countries**

— **Sometimes loses details from the country censuses**
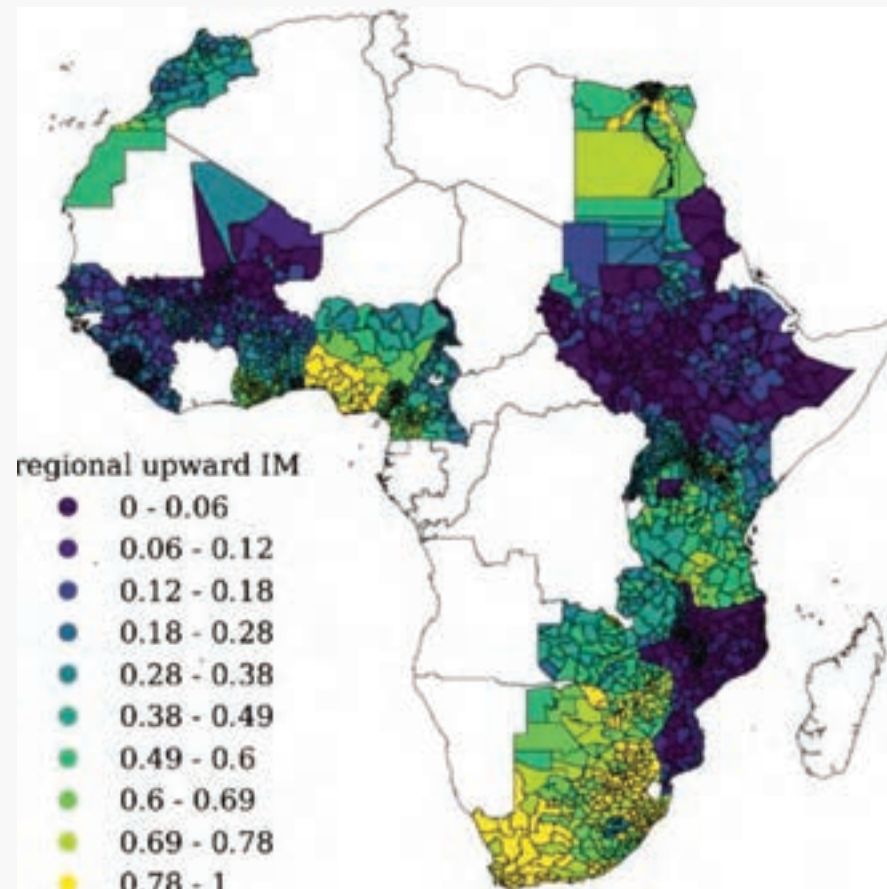
  ▪ E.g. location of household

— **Not *everything* is standardised**

  ▪ E.g. locations and their geographical boundaries

Legend:
- 0 - 0.26
- 0.26 - 0.44
- 0.44 - 0.74
- 0.74 - 1.52
- 1.52 - 2.89
- 2.89 - 4.33
- 4.33 - 5.55
- 5.55 - 6.65
- 6.65 - 8.13
- 8.13 - 13.06
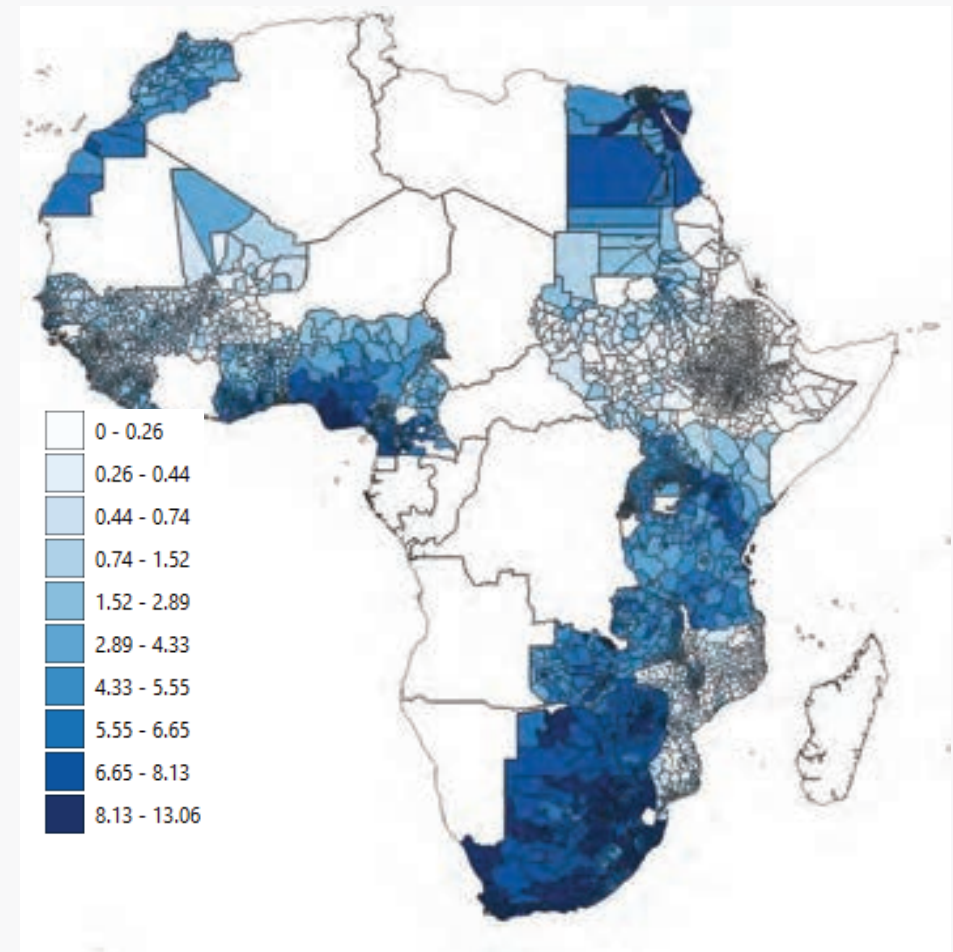
Admin data. IPUMS.
Example 1. Intergenerational Mobility
["Intergenerational Mobility in Africa". Alesina, Hohmann, Michalopoulos, and Papaioannou. (2021).]

regional upward IM
- 0 - 0.06
- 0.06 - 0.12
- 0.12 - 0.18
- 0.18 - 0.28
- 0.28 - 0.38
- 0.38 - 0.49
- 0.49 - 0.6
- 0.6 - 0.69
- 0.69 - 0.78
- 0.78 - 1

— **Intergenerational mobility in education**
  - household structure → how well children do relative to their parents

— **Effect of places**
  - Children of uneducated parents more likely to complete school if mobility in their region is high

Admin data. IPUMS.
Applications

— Alesina, Hohmann, Michalopoulos, & Papaioannou. (2021). Intergenerational Mobility in Africa. *Econometrica,* 89(1), 1-35. **week 10**

— Alesina, Hohmann, Michalopoulos, and Papaioannou. (2020). Religion and Educational Mobility in Africa. NBER Working Paper 28270.

— Storeygard. (2016). Farther on down the Road: Transport Costs, Trade and Urban Growth in Sub-Saharan Africa. *Review of Economic Studies*, 83(3):1263-1295.

— Adhvaryu, Fenske, and Nyshadham. (2019). Early Life Circumstance and Adult Mental Health. *Journal of Political Economy*, 127(4).

Admin data. Admin Boundaries (GADM).
Summary

— **Administrative boundaries**
  - Worldwide
  - One point in time

— **Variability in quality**
  - Some countries highly localised boundaries, others not.

— **Source: GADM**
  - Download from GADM

Other data. Conflict.
Overview

1. **UCDP-GED**
   - Major and minor civil wars, civilian violence. 1989-2019.
   - Standard definition of conflict
   - Number of casualties

2. **ACLED**
   - Riots, protests, battles, etc. 1997-2022
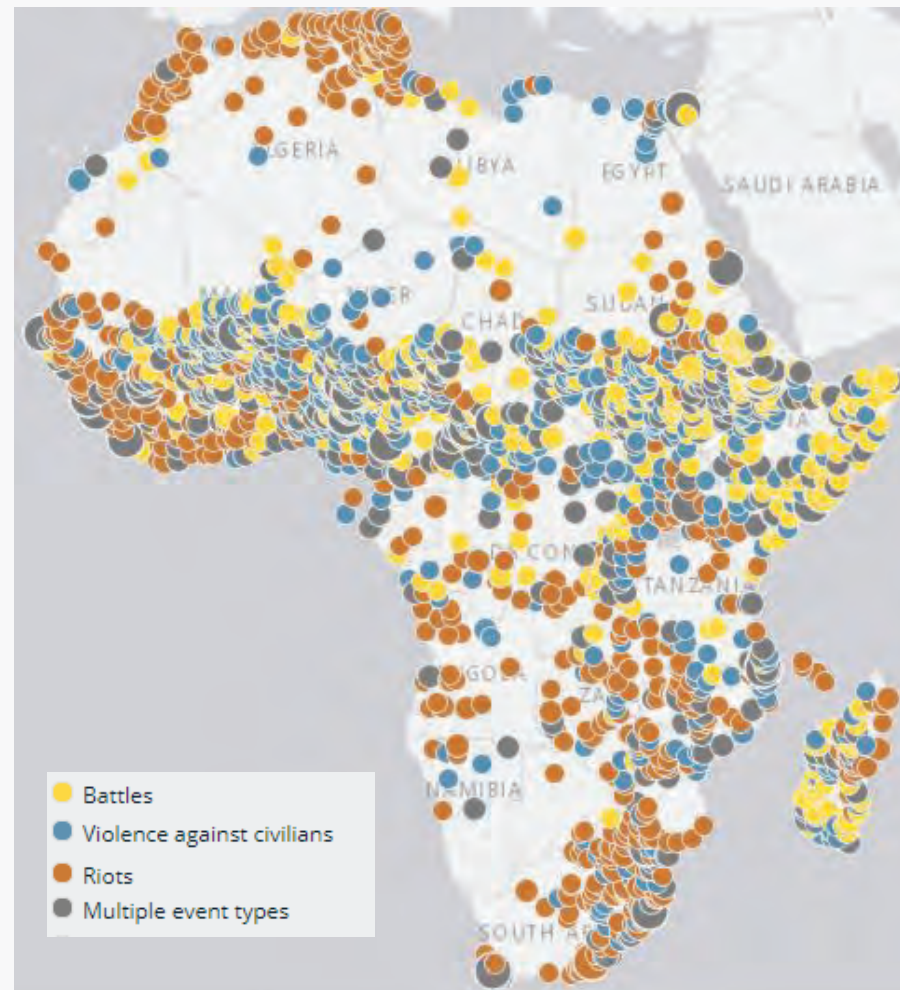   - Aggregation of news sources.

— **Source: Uppsala University & ACLED**
   - Download UCDP-GED
   - Download ACLED

Other data. Conflict.
Example 1. ACLED conflict events

Battles
Violence against civilians
Riots
Multiple event types

African History through the Lens of Economics. Measuring Contemporary African Development

Other data. Conflict (ACLED).
Example 2. Ethiopia Recently
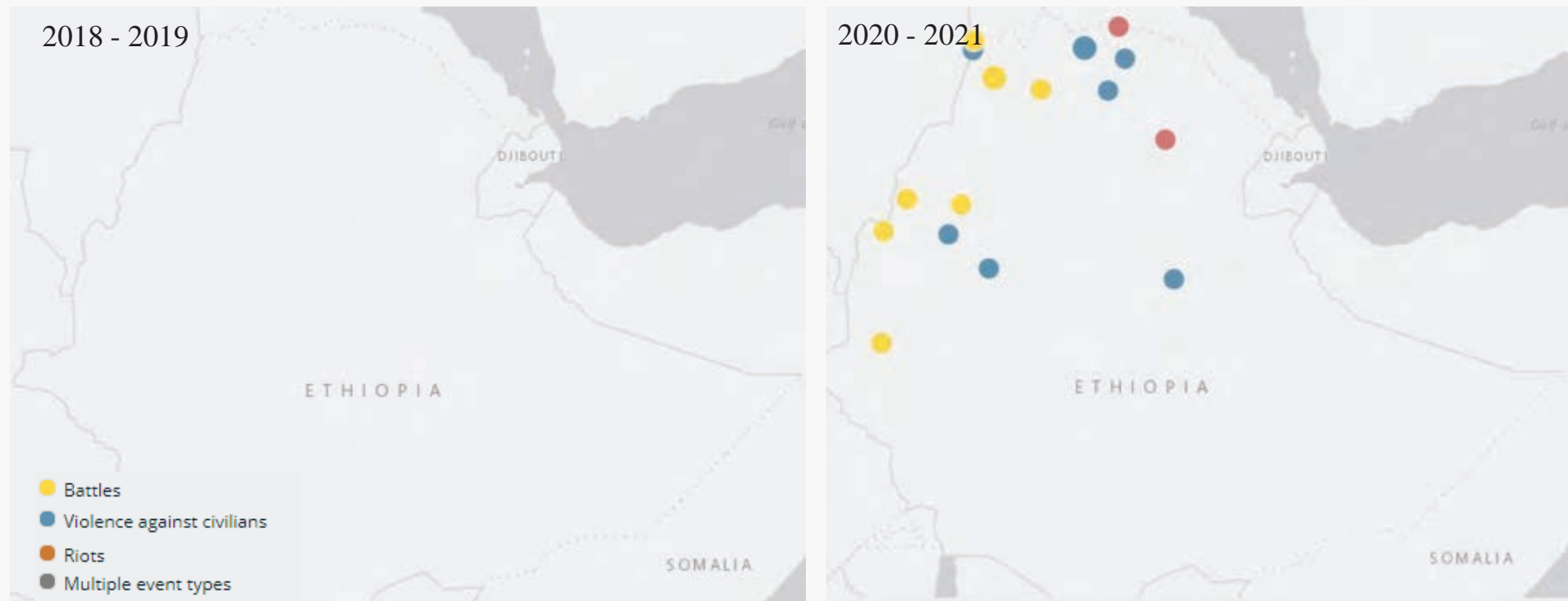
Other data. Conflict.
Applications.

— Michalopoulos, S., & Papaioannou, E. (2016). The long-run effects of the scramble for Africa. *American Economic Review*, *106*(7), 1802-48. **week 5**

— Besley, T., & Reynal-Querol, M. (2014). The legacy of historical conflict: Evidence from Africa. *American Political Science Review*, *108*(2), 319-336.

— "Berman, N., Couttenier, M., Rohner, D., & Thoenig, M. (2017). This mine is mine! How minerals fuel conflicts in Africa. *American Economic Review*, *107*(6), 1564-1610.

— Depetris-Chauvin, E., Durante, R., & Campante, F. (2020). Building nations through shared experiences: Evidence from African football. *American Economic Review*, *110*(5), 1572-1602.

— Manacorda and Tesei. 2020. Liberation Technology: Mobile Phones and Political Mobilization in Africa. *Econometrica*, 88(2), 533-567.

Other data. High Resolution Satellite Images (VHR). Summary

Kibera, Nairobi VHR image for 2004 (left) and 2015 (right).

Kibera, Nairobi classified buildings for 2004 (left) and 2015 (right) - unchanged (blue), demolished (red), redeveloped (green).

— **Modern satellites can take very accurate photos**
  - Measure build capital allocation at a very fine scale

— **Caveats**
  - Data is expensive
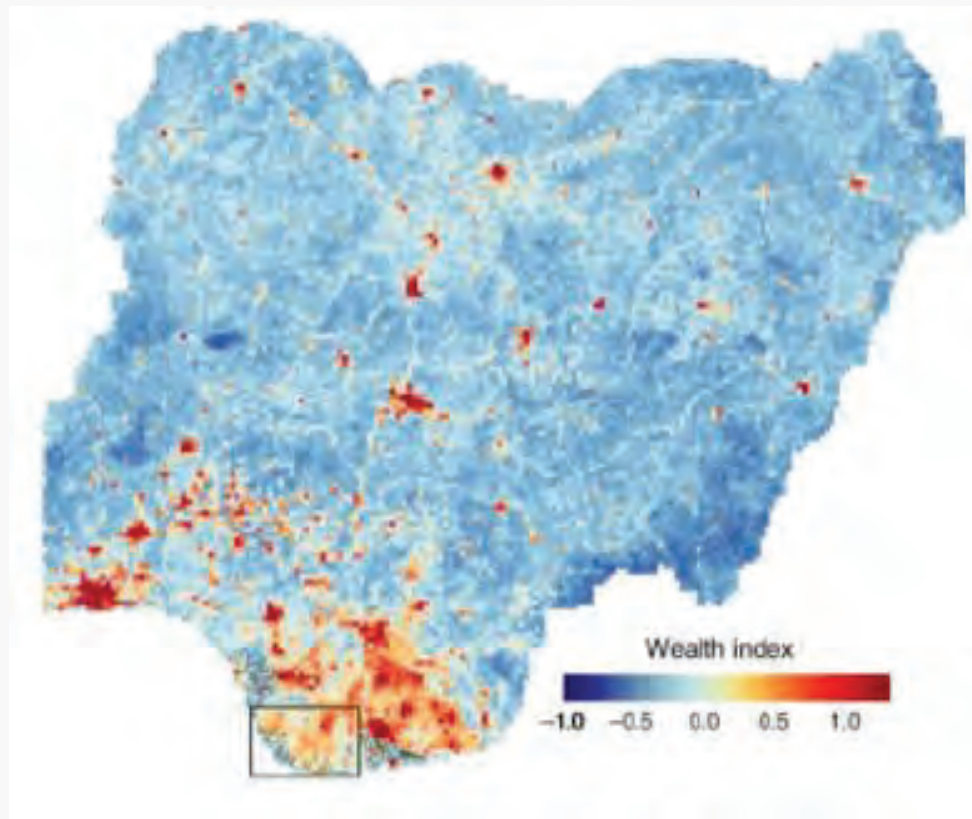 - Difficult computationally to scale across broad areas

— **Application**
  - "Building the City: From Slums to a Modern Metropolis". Henderson, Regan and Venables (RES 2021).

Other data. Modelled wealth and income.
Summary

Predicted wealth across Nigeria

— **Machine learning + GIS + survey data**
  - Complete coverage spatially and annually
  - Asset wealth/Spending

— **Caveats**
  - Proprietary data
  - Not easily implementable from first principles

— **Implementation**
  - "Using publicly available satellite imagery and deep learning to understand economic well-being in Africa". Yeh et al. (Nature 2020).

Summary

— **This has been an overview**

- GIS data [Luminosity/Landcover/Elevation]
- Surveys [DHS/Afrobarometer]
- Admin data [Censuses/IPUMS]
- Other [Conflict/Institutions/VHR/Modelled Wealth]

— **There are many data out there**

- Can you think of data sources not mentioned here?
- What kind of questions are poorly answered by typical data in Economics?
- Can you find novel data sources to fill that gap?

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