

Motivation

GDP growth is of central importance for macroeconomics, welfare and economic policy, but

- ▶ Data quality varies: Most SSA countries have a C or D quality grade in the PWT, other countries are missing.
- ▶ Darajavan (WB lead for SSA) called it a “statistical tragedy”.
- ▶ PPPs are difficult to obtain and also suffer from quality issues.
- ▶ Survey-based alternatives are not uniformly measured across different countries and infrequently undertaken.
- ▶ GDP or surveys are not available for many smaller units.

Night lights are a proxy for GDP and available over time for all of the inhabited surface of Earth.

Illustration: The two Koreas

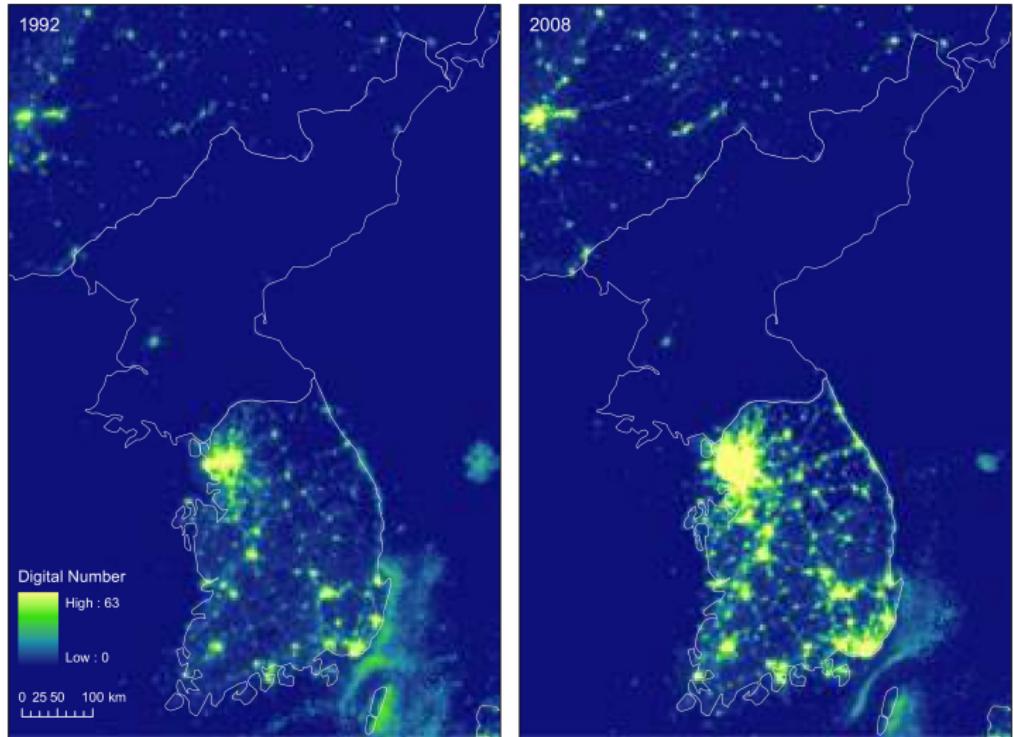
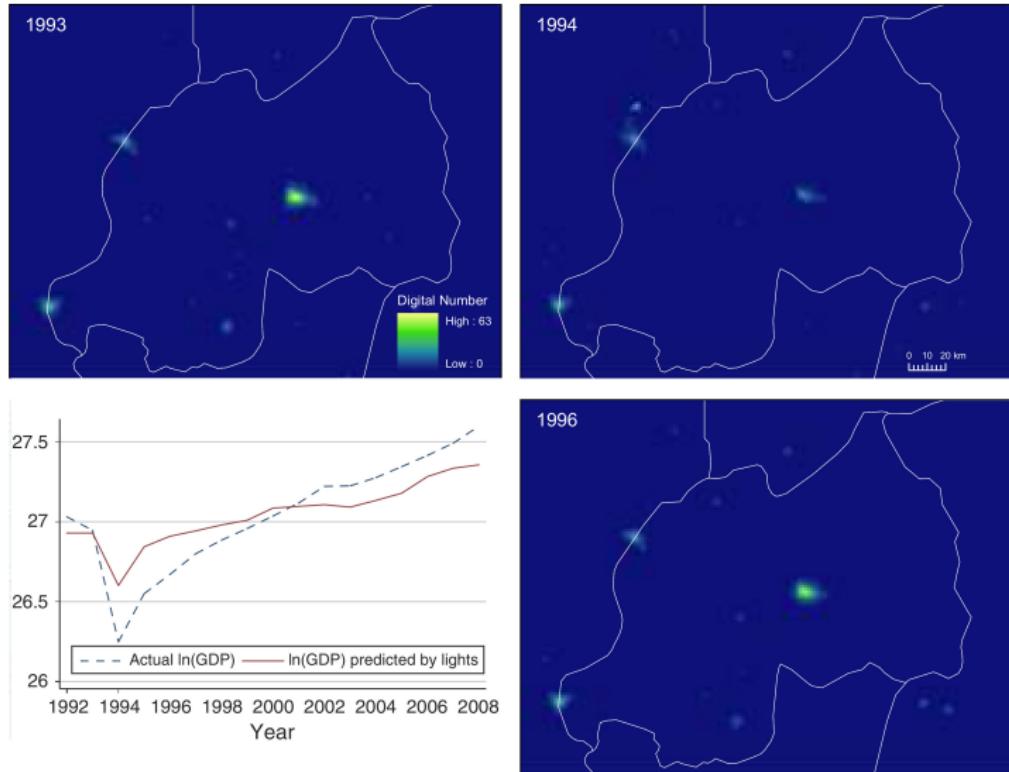


Illustration: Rwandan genocide



Alesina et al. (2016)

Motivation

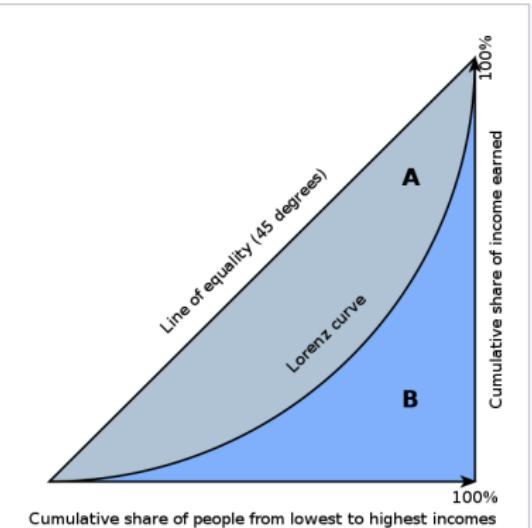
Two large strains of literature concerned with

- ▶ the effect of ethnic diversity on development, and
- ▶ the effect of income (or spatial) inequality on development.

Both effects are theoretically ambiguous and especially the latter has literally been estimated to have almost every conceivable sign and magnitude.

Study conjectures that what matters is really the combination of the two, that is, within-country differences in well-being across ethnic groups—or, ethnic inequality.

A major concern is data quality. Comparable survey-based data at the ethnic group level are not available across the globe.



Graphical representation of the Gini coefficient



The graph shows that the Gini coefficient is equal to the area marked A divided by the sum of the areas marked A and B , that is, $\text{Gini} = A/(A + B)$. It is also equal to $2A$ and to $1 - 2B$ due to the fact that $A + B = 0.5$ (since the axes scale from 0 to 1).

Measuring ethnic inequality

The Gini coefficient for a country with n groups with values of luminosity per capita for the historical homeland of group i , with $i = 1$ to n , indexed in non-decreasing order ($y_i \leq y_{i+1}$) is

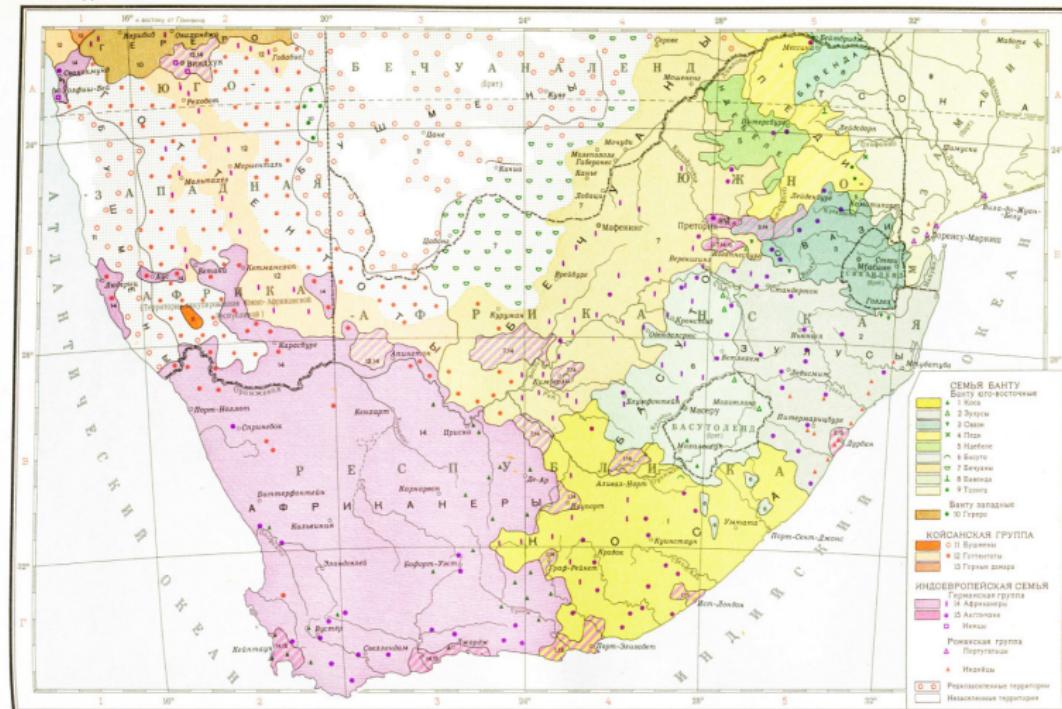
$$G = \frac{1}{n} \left[n + 1 - 2 \left(\left(\sum_{i=1}^n (n + 1 - i)y_i \right) \Bigg/ \sum_{i=1}^n y_i \right) \right].$$

The group means, y_i , are computed in a number of ways:

- ▶ Two linguistic maps (the Atlas Narodov Mira and Ethnologue).
- ▶ All groups, without capital cities, without smaller groups.
- ▶ Perturbed homelands, 2.5° cells, administrative boundaries.

Atlas Narodov Mira

НАРОДЫ ЮЖНО-АФРИКАНСКОЙ РЕСПУБЛИКИ



Main results I

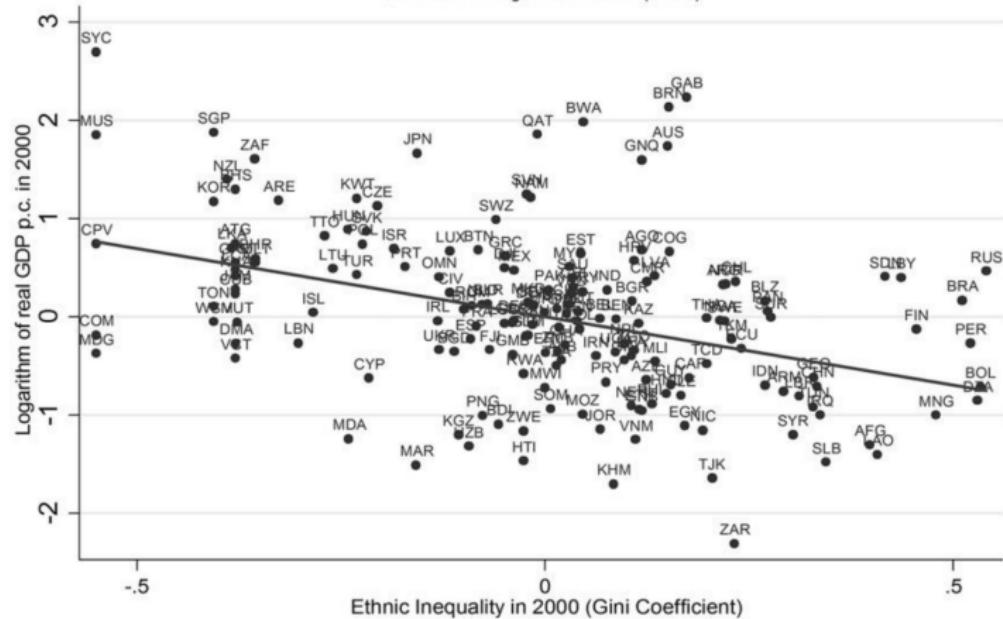
TABLE 2
BASELINE ESTIMATES: ETHNIC INEQUALITY AND ECONOMIC DEVELOPMENT IN 2000

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
A. <i>Atlas Narodov Mira</i> (GREG)									
Ethnic inequality (Gini)	-1.3911*** (.2588)		-1.3900*** (.3416)		-.9518** (.3953)	-.9276* (.4845)	-1.3449*** (.4943)	-1.1032** (.5188)	-1.1172** (.5492)
Spatial inequality (Gini)		-.9973*** (.2774)	-.0015 (.3510)			-.0315 (.3568)	-.0046 (.3539)	.0104 (.3591)	-.5592 (.4749)
Log number of ethnicities				-.3136*** (.0612)	-.1429 (.0908)	-.1433 (.0917)		-.2174* (.1277)	-.1863 (.1440)
Ethnic inequality in population (Gini)							.6517 (1.1500)	1.1554 (1.1554)	1.0858 (1.2546)
Ethnic inequality in size (area; Gini)								-.7933 (1.1732)	-.8276 (1.1060)
Log land area									.1442 (.0879)
Log population (in 2000)									-.1368 (.0829)
Adjusted R^2	.654	.623	.652	.646	.657	.655	.65	.656	.662
Observations	173	173	173	173	173	173	173	173	173
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Main results II

Ethnic Inequality and Economic Development

Conditional on Region Fixed Effects (GREG)



Main results III

TABLE 5
ETHNIC INEQUALITY, ADMINISTRATIVE UNIT INEQUALITY, AND ECONOMIC DEVELOPMENT

	ATLAS NARODOV MIRA (GREG)						ETHNOLOGUE			
	UNCONDITIONAL		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Inequality across Administrative Units (First-Level)										
Administrative unit inequality (Gini)		-1.6717*** (.4004)	-1.0139** (.4188)	-1.0185** (.4230)	-1.5074*** (.4096)	-1.2651*** (.4307)	-1.0080** (.4446)	-1.0150** (.4486)	-1.5177*** (.4333)	-1.2752*** (.4494)
Ethnic inequality (Gini)			-1.0252*** (.2611)	-1.0401*** (.2765)	-1.0478*** (.3557)	-.8087** (.3197)	-.8527*** (.2487)	-.8280*** (.2856)	-.7952** (.3158)	-.6096** (.2941)
Ethnic-linguistic fragmentation				.0584 (.3479)	-.0206 (.3387)	.1337 (.3062)		-.0548 (.2783)	-.1103 (.2736)	.0239 (.2572)
Adjusted R^2	.642	.667	.665	.686	.741	.667	.665	.686	.738	
Observations	173	173	173	173	173	173	173	173	173	
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Simple controls	No	No	No	Yes	Yes	No	No	Yes	Yes	
Geographic controls	No	No	No	No	Yes	No	No	No	Yes	

Main results IV

TABLE 6
ETHNIC INEQUALITY AND DEVELOPMENT CONDITIONING ON PERTURBED ETHNIC HOMELANDS

	ATLAS NARODOV MIRA (GREG)				ETHNOLOGUE			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ethnic inequality (Gini)	-.9510*	-.9566*	-.8652*	-.9276**	-1.4389***	-1.4365***	-1.2413***	-.8063*
	(.5004)	(.5074)	(.5174)	(.4383)	(.4075)	(.4115)	(.4159)	(.4166)
Perturbed ethnic inequality (Gini)	-.5371	-.5457	-.8223	-.2645	.3302	.3376	.0259	-.1845
	(.5258)	(.5262)	(.5469)	(.4829)	(.4640)	(.4718)	(.4950)	(.4410)
Ethnic-linguistic fragmentation	.0446	-.0107	.1614		-.0213	-.0147	.1510	
	(.3521)	(.3498)	(.3159)		(.2962)	(.2962)		(.2656)
Adjusted R^2	.654	.652	.662	.721	.653	.650	.657	.718
Observations	173	173	173	173	173	173	173	173
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Simple controls	No	No	Yes	Yes	No	No	Yes	Yes
Geographic controls	No	No	No	Yes	No	No	No	Yes

New spatial tools for the replication

Voronoi diagrams

A Voronoi diagram partitions the plane with n points into convex polygons such that each polygon contains exactly one generating point and every point in such a polygon is closer to its generating point than to any other.

A Voronoi diagram is sometimes also known as a Dirichlet tessellation. The cells go by many names; they are called Dirichlet regions, Thiessen polygons, or Voronoi polygons.

Voronoi diagrams have been famously used in the analysis of the 1854 cholera epidemic in London. John Snow showed a strong correlation of deaths with proximity to an infected water pump on Broad Street.

Voronoi diagrams in R

Let's create Voronoi polygons using African countries.

```
# Get file
africa_sf <- st_read("./data/africa_scale.shp",
                      quiet = T)

# Transform to an equal area projection
africa_sf <- st_transform(africa_sf, "+proj=aeqd")

# Snapping the object to itself by 1m kills slivers
# Obtain union for outlines
second_sf <- africa_sf %>%
  st_snap(africa_sf, tolerance = 1) %>%
  group_by(continent) %>% summarize()
```

Voronoi diagrams in R

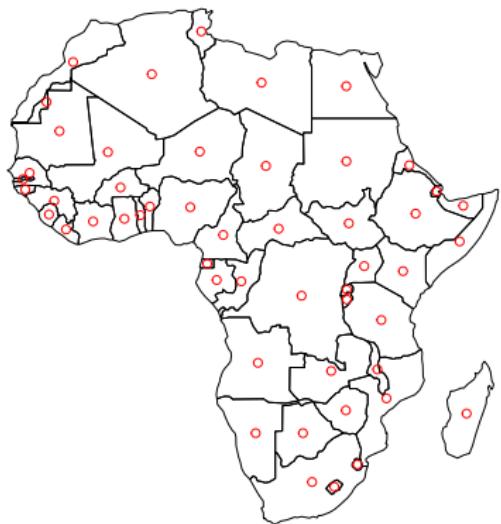
We will create the diagram based on the centroid of each country. Careful, `st_voronoi()` requires one single combined input feature and also returns a single feature.

```
# Here's a full workflow
africa_vo_sf <- africa_sf %>%
  st_centroid() %>% st_combine() %>%
  st_voronoi() %>% st_cast() %>% st_sf() %>%
  st_intersection(second_sf) %>% st_transform(4326)
africa_sf <- africa_sf %>% st_transform(4326)
```

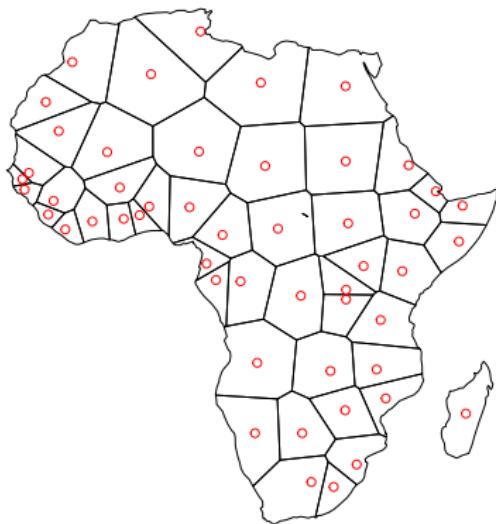
We intersect the Voronoi diagram with the unioned boundaries at the end, since the diagram fills the entire bounding box.

Thiessen polygons in Africa

Original



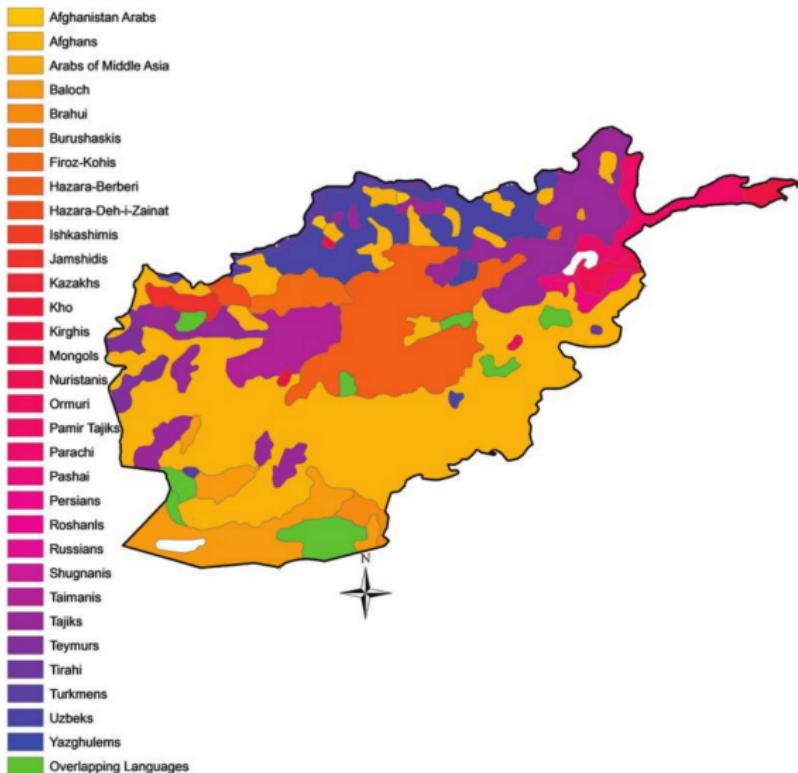
Voronoi



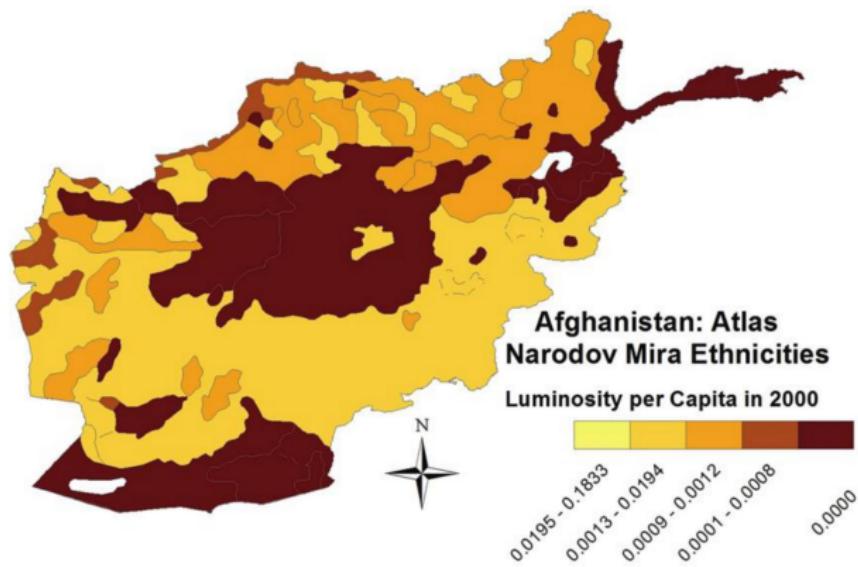
Partial replication of Alesina et al. (2016)

Replication goal 1

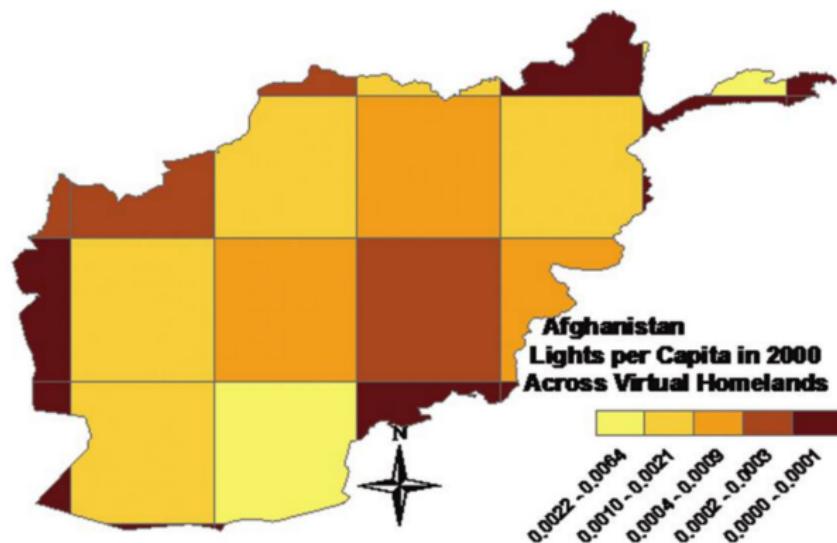
Ethnic Homelands in Afghanistan



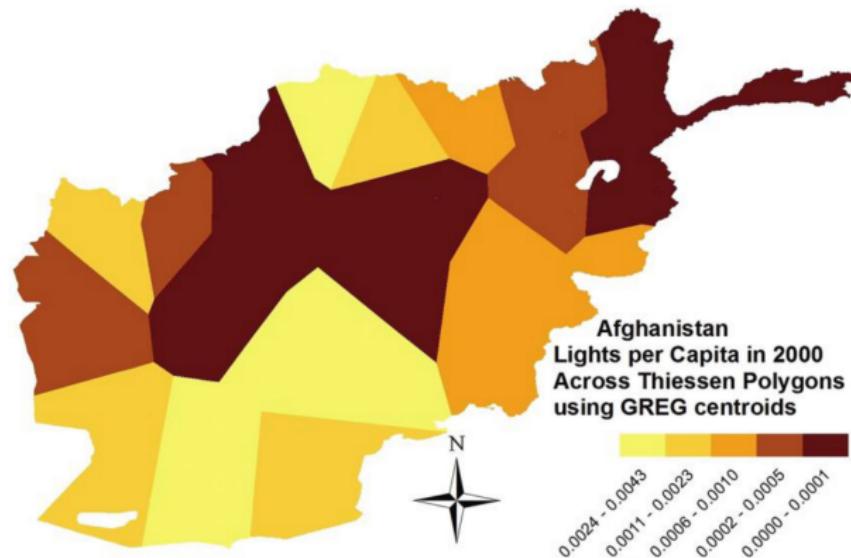
Replication goal 2



Replication goal 3



Replication goal 4



Replication goal 5

