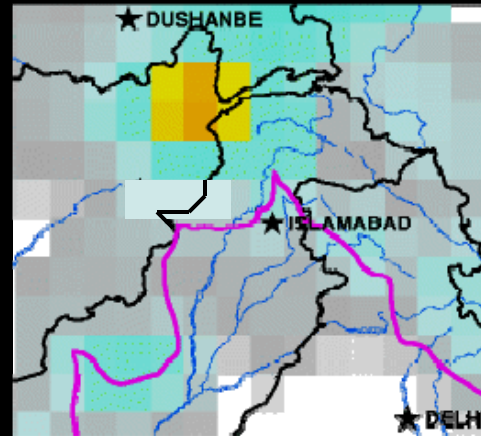
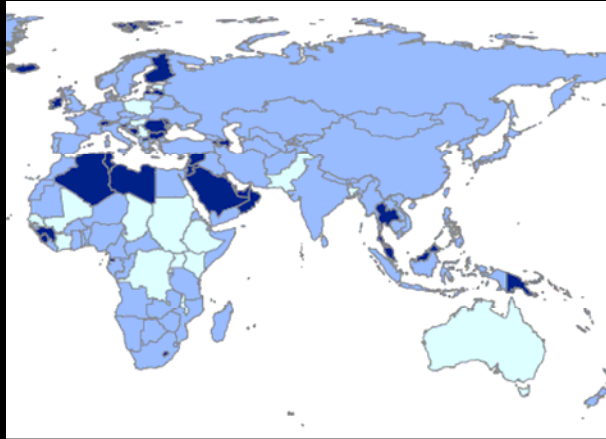


Estimating and Mapping International Populations at Risk from Disasters



Joshua Comenetz
U.S. Census Bureau

This report is released to inform interested parties of ongoing research and to encourage discussion of work in progress. The views expressed on methodological issues are those of the author and not necessarily those of the U.S. Census Bureau.

Research Needs Identified by National Research Council, 2007

in Tools and Methods for Estimating Populations at Risk from Natural Disasters and Complex Humanitarian Crises

- Called for improvement in international, subnational population estimates and wider availability of these data
- Recommended that U.S. Census Bureau produce the data

U.S. Census Bureau Global Populations at Risk Database goals

Global – worldwide map and demographic data coverage

Populations at Risk – higher priority for countries likely to require outside assistance with humanitarian disasters

Database – available online and frequently updated

Save Lives – through efficient access to data before, during, and after events

National Research Council:

Ideal data set

Up-to-date, 100% population register with all attributes for everyone in all countries at all times of day and year, tied to digital maps

Minimally essential data set

- Total population
- Age and sex
- Other variables as needed according to stage of recovery

Examples could include housing characteristics, literacy, language

Problem

Difficult to collect comprehensive data and to provide data on short notice

Existing Census Bureau Products

International Data Base

Based on census data and surveys with age/sex information

National-level estimates and projections for 1950 to 2050

227 countries and territories

Existing Census Bureau Products

Subnational Data for Oak Ridge LandScan Global Population Database

Annual subnational estimates for 1st, 2nd, and 3rd-level administrative areas

- Based on census data or (rarely) official estimates
- Total population and age/sex data

National totals controlled to International Data Base

266 countries, territories, and islands; 40,000+ subnational areas

The Challenge

1. Volume of Data

Administrative Level	Approximate world total
Nation/territory ADM0	260
State/province ADM1	4,200
District/county ADM2	50,000 ?
Municipality/township ADM3	250,000 ?

2. Data Issues

Availability of digital demographic data

- Age/sex data in 5- or 10-year bands
- Other attributes, e.g., literacy
- Migration estimates

Availability of GIS-format boundary maps

- Shapefile or compatible format
- Quality of digitizing
- Use permissions

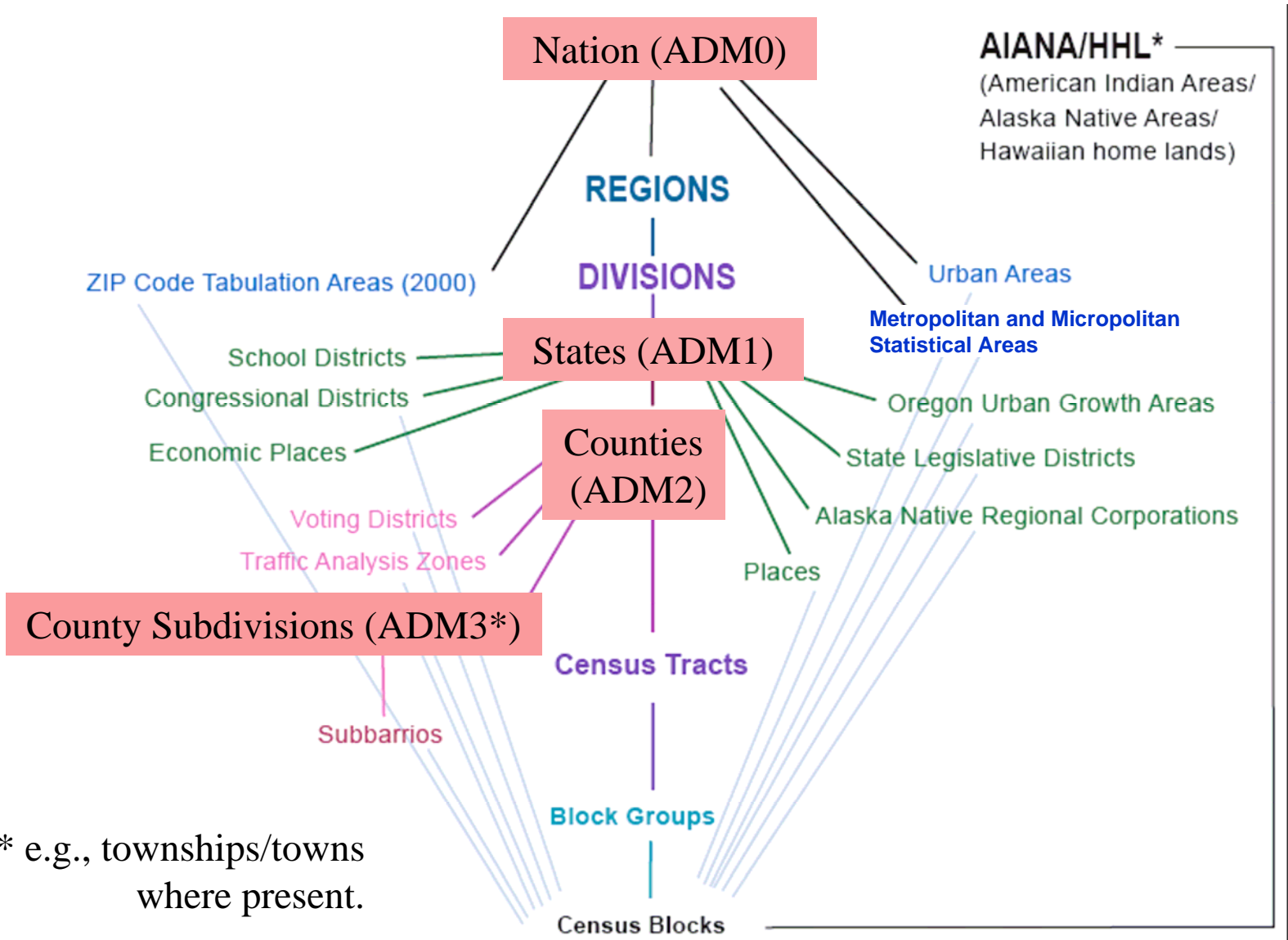
Both data and maps

- Currency
- Whole country coverage
- **Do they cover same ADMs?**

Administrative Unit (ADM) Maps

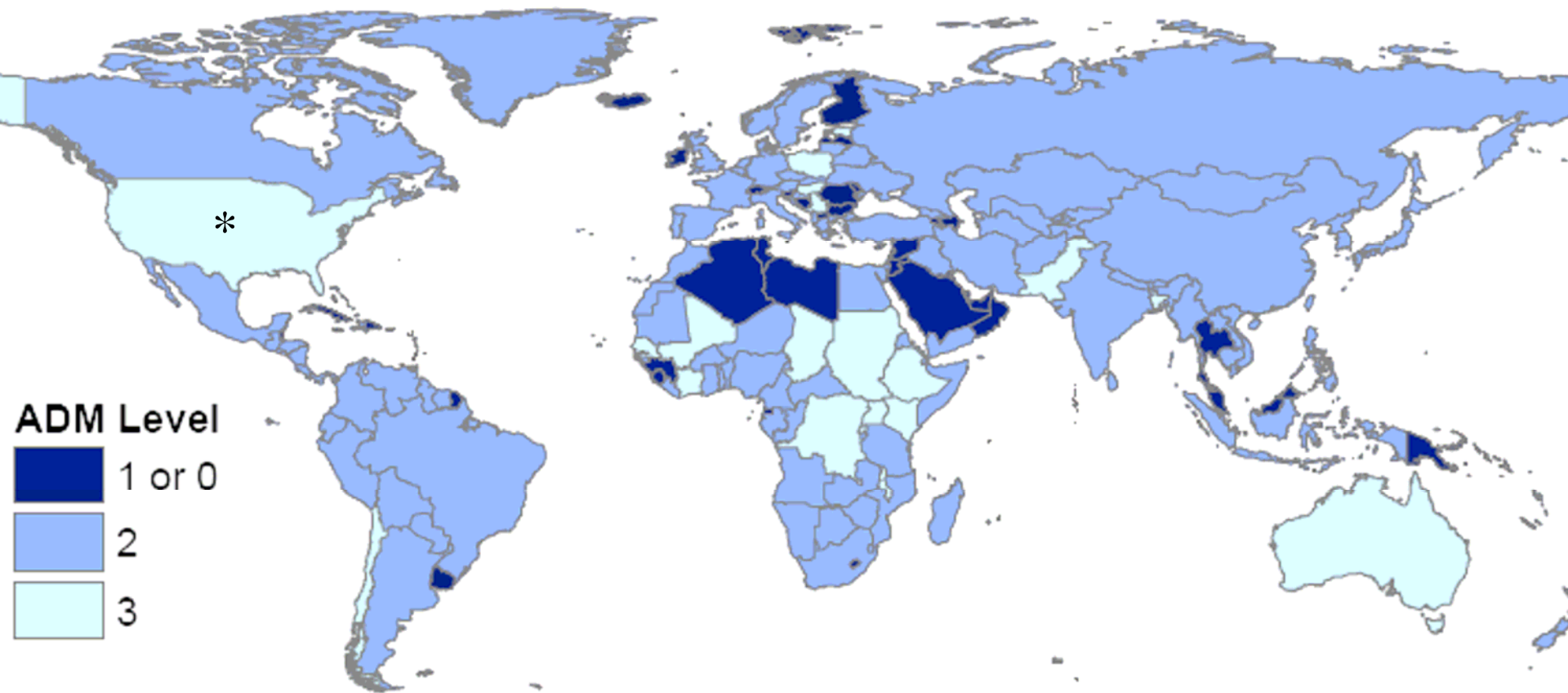
U S C E N S U S B U R E A U

Statistical and Other Geographic Areas in the United States



* e.g., townships/towns where present.

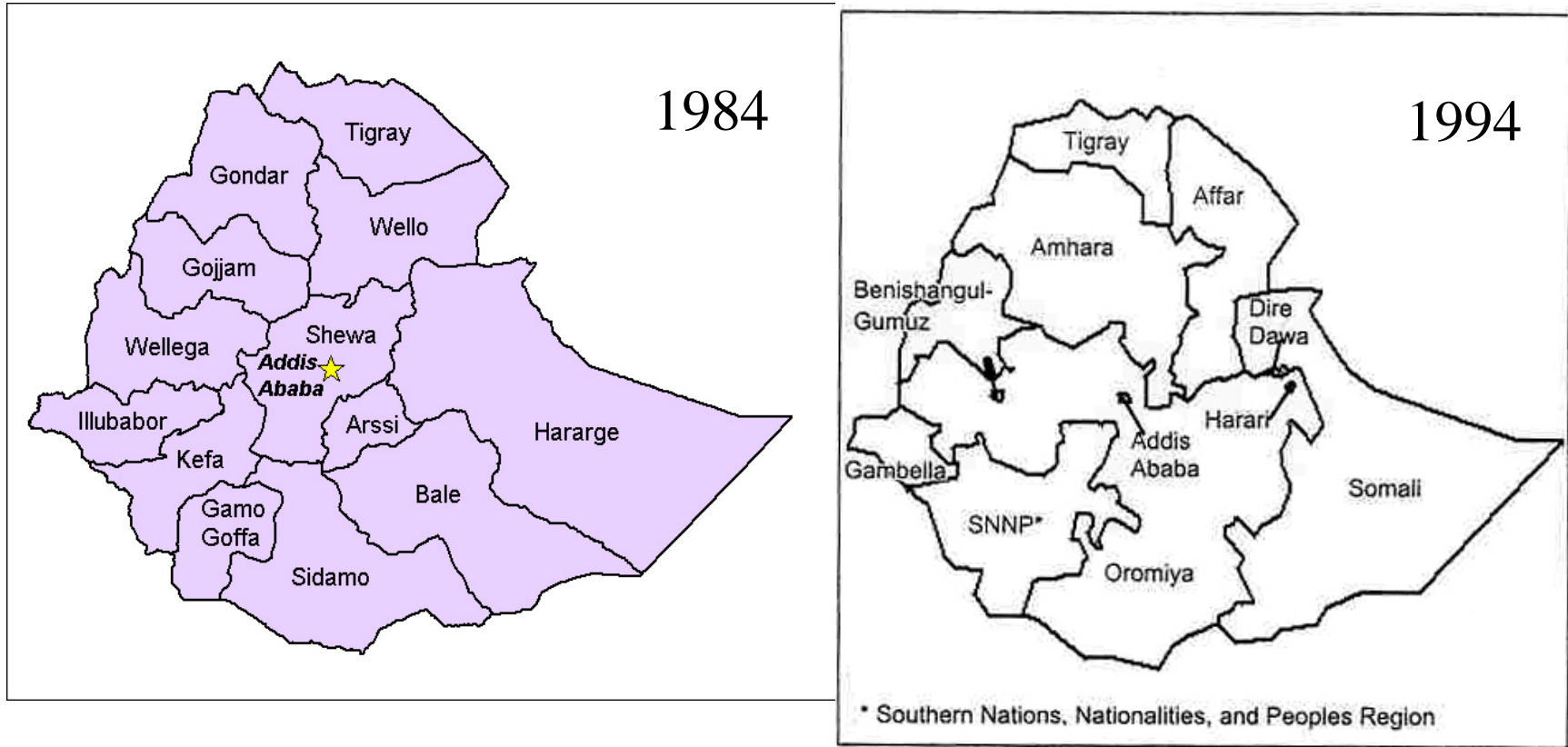
Administrative Unit Shapefiles in Populations at Risk Database



* There are no ADM3s in some U.S. states

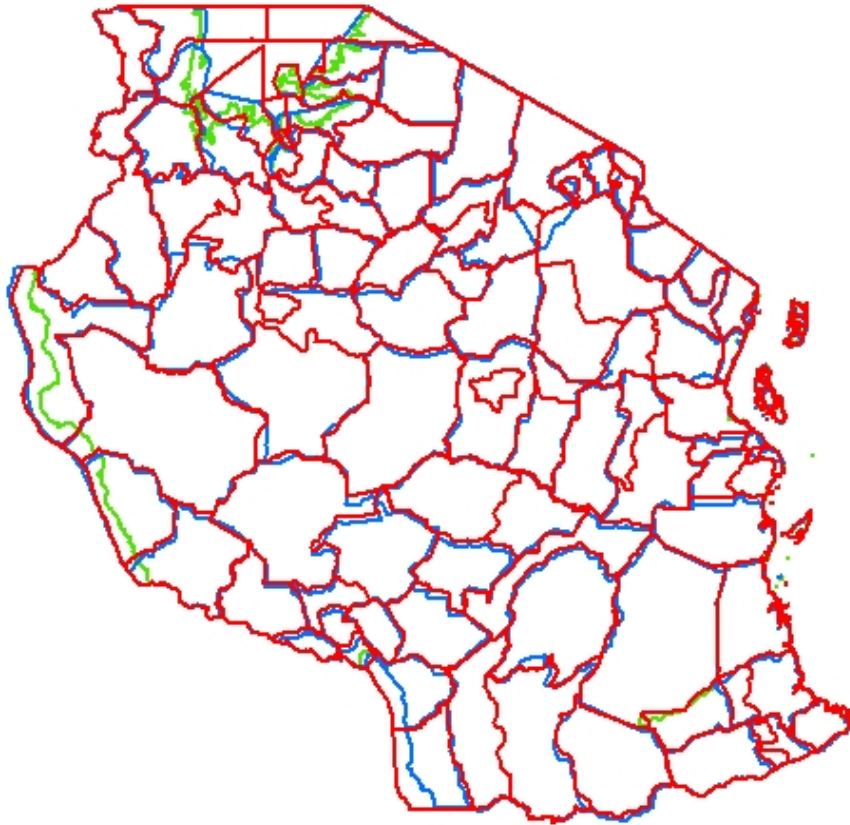
Problem: Base Map Changes

Example: Ethiopia

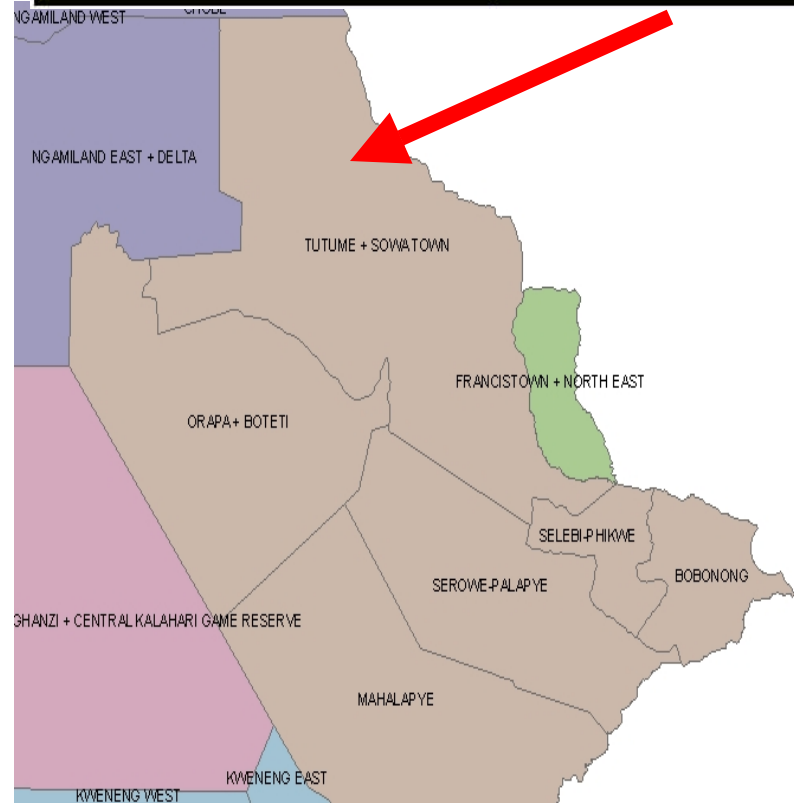


Problem: Shapefile and Data Mismatch

Examples: Tanzania, Botswana



AREA	2010 ESTIMATE
TUTUME	139,137
SOWA TOWN	3,243
TUTUME + SOWA TOWN	142,380



Shapefile Sources

National statistical and mapping agencies

State Department and other USG agencies

Internet archives such as World Health Organization and Global Administrative Areas databases

NGO websites

Satellite image analysis – for verification of boundaries

Demographic Data

U S C E N S U S B U R E A U

Demographic Source Data examples

Tanzania: National census data

Age	Total		
	Both Sexes	Male	Female
TOTAL	428090	212497	215593
0 - 4	72584	36712	35872
5 - 9	69376	35698	33678
10 - 14	60989	31778	29211
15 - 19	42756	23364	19392
20 - 24	30990	13483	17507
25 - 29	27860	12190	15670
30 - 34	24213	11381	12832
35 - 39	19596	9396	10200
40 - 44	16298	7938	8360
45 - 49	12758	5948	6810
50 - 54	11119	5127	5992
55 - 59	8344	3981	4363
60 - 64	9727	4569	5158
65 - 69	6945	3427	3518
70 - 74	6363	3277	3086
75 - 79	3536	1870	1666
80+	4636	2358	2278

Syria: Projection by U.S. Census Bureau

Table 094. Midyear Population, by Age and Sex

Country or area/
Year/

Age	Both sexes	Male	Female

Syria/2008			
Total, all ages	19,747,586	10,109,770	9,637,816
0- 4	2,531,377	1,302,773	1,228,604
5- 9	2,426,017	1,249,205	1,176,812
10-14	2,189,175	1,127,495	1,061,680
15-19	2,136,901	1,100,609	1,036,292
20-24	2,105,409	1,083,892	1,021,517
25-29	1,826,868	937,814	889,054
30-34	1,500,750	768,207	732,543
35-39	1,260,545	648,537	612,008
40-44	1,028,667	530,806	497,861
45-49	773,529	395,474	378,055
50-54	574,039	289,963	284,076
55-59	422,996	211,089	211,907
60-64	312,131	153,068	159,063
65-69	245,960	117,711	128,249
70-74	184,329	86,332	97,997
75-79	126,428	59,275	67,153
80+	102,465	47,520	54,945

Subnational Population Data

Example: Part of Ethiopia

Combined with shapefiles for Oak Ridge National Laboratory LandScan

FIPS	COUNTRY	ADM1 NAME	ADM2 NAME	ADM3 NAME	GEO MATCH	Name Change/ Alternate Name	CONTI NENT	IDB YEAR	TOTAL	TOT 0-4	TOT 80+
ET	ETHIOPIA						Africa	2007	76511887	12372169	227988
ET48	ETHIOPIA	DIRE DAWA				DIRE DAWA PROVISIONAL ADM1	Africa		360351	58270	1074
ET48	ETHIOPIA	DIRE DAWA	DIRE DAWA		003ETH015001001		Africa		235858	38139	703
ET48	ETHIOPIA	DIRE DAWA	GURGURA		003ETH015001002		Africa		124493	20131	371
ET49	ETHIOPIA	GAMBELA HIZBOCH				GAMBELLA	Africa		260197	42074	775
ET49	ETHIOPIA	GAMBELA HIZBOCH	ZONE 1				Africa		64679	10459	193
ET49	ETHIOPIA	GAMBELA HIZBOCH	ZONE 1	GAMBELA	003ETH012001004		Africa		37827	6117	113
ET49	ETHIOPIA	GAMBELA HIZBOCH	ZONE 1	ITANG	003ETH012001003		Africa		26852	4342	80
ET49	ETHIOPIA	GAMBELA HIZBOCH	ZONE 2				Africa		51791	8375	154
ET49	ETHIOPIA	GAMBELA HIZBOCH	ZONE 2	ABOBO	003ETH012002005		Africa		19992	3233	60
ET49	ETHIOPIA	GAMBELA HIZBOCH	ZONE 2	GOG	003ETH012002009		Africa		21651	3501	65
ET49	ETHIOPIA	GAMBELA HIZBOCH	ZONE 2	JOR	003ETH012002010		Africa		10148	1641	30

Demographic Data Sources

National censuses and official estimates/projections

Other Census Bureau products such as PEPFAR releases

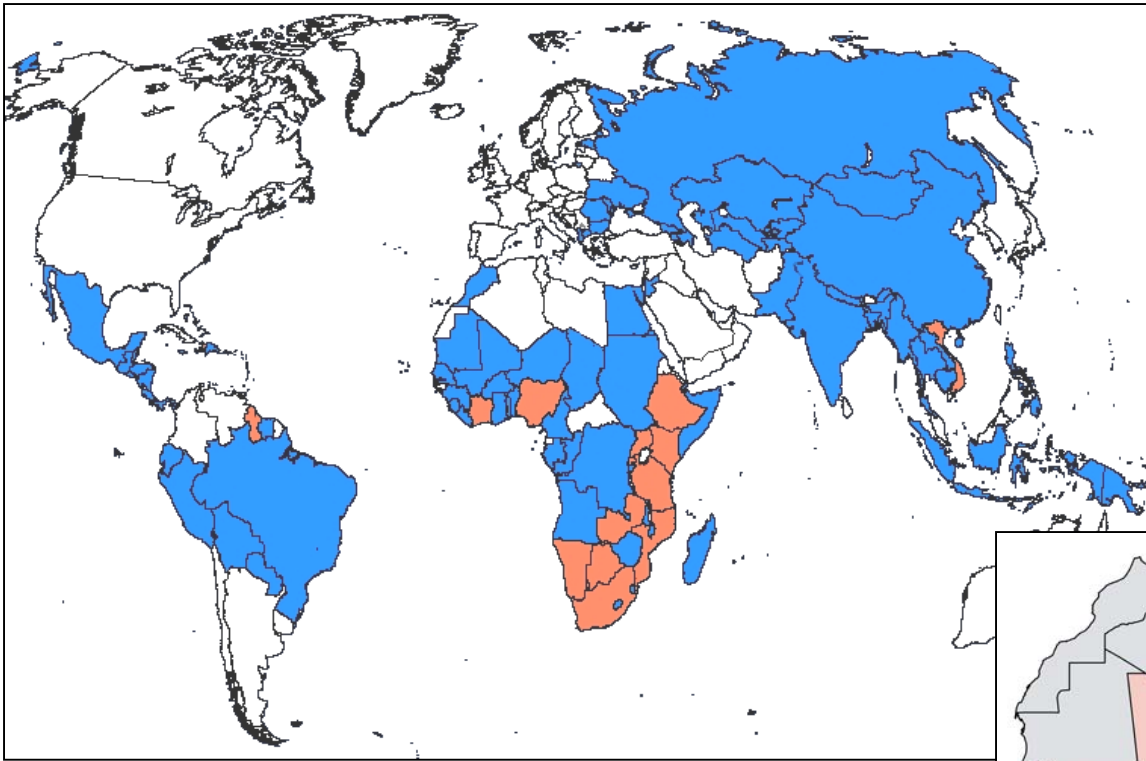
Census Bureau International Data Base (for national age/sex data and total populations)

UN data derived from national sources

Demographic and Health Surveys

Local surveys by governments or NGOs

Satellite image analysis – for settlement and population change mapping

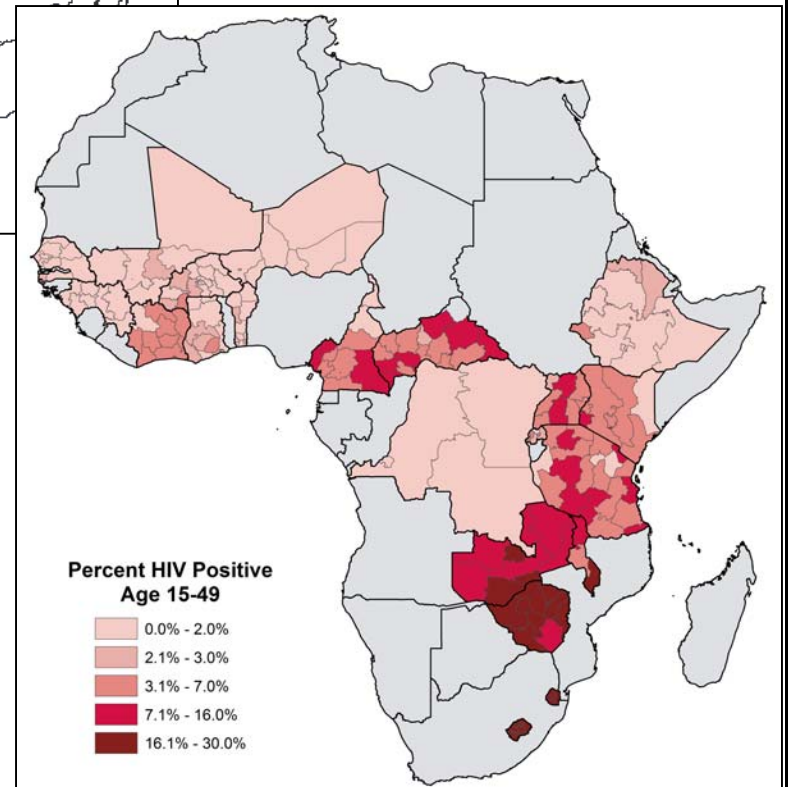


PEPFAR countries of interest (left)

Sample PEPFAR repository map (below)

Example

Population Base and Maps for President's Emergency Plan for AIDS Relief



Satellite Image Analysis

U S C E N S U S B U R E A U

Mapping built-up areas using satellite imagery

Port-au-Prince, Haiti



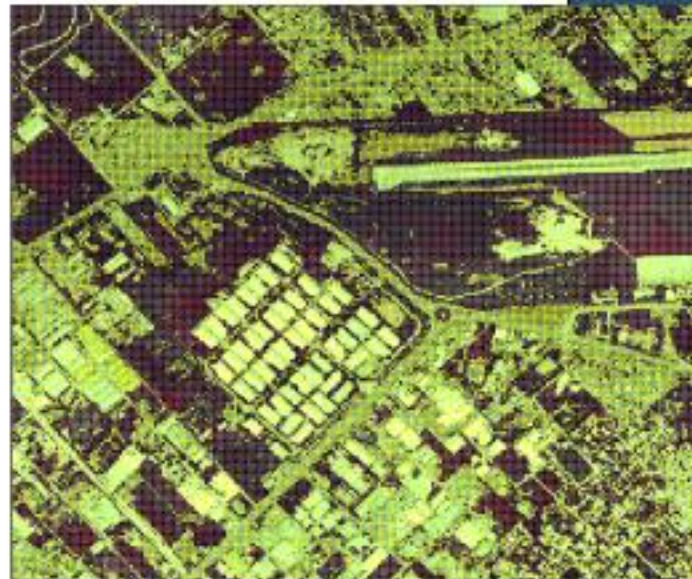
3. Landsat 7 (30 m)



1. QuickBird (2.4 m)



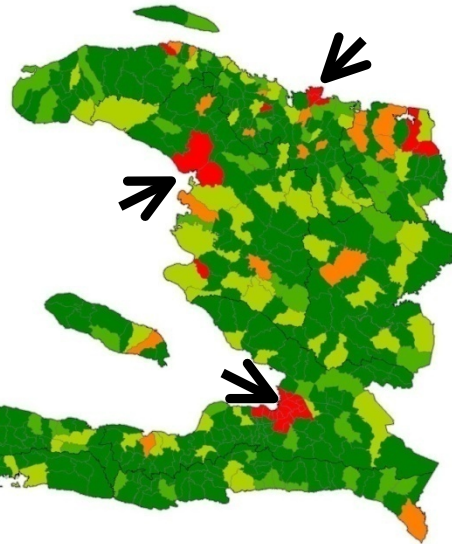
2. Impervious Surfaces



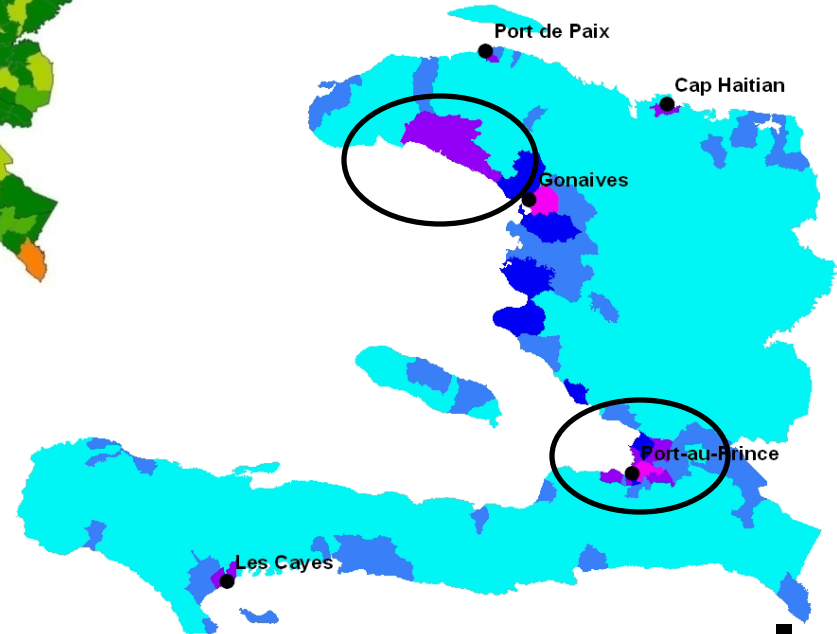
Impervious Surface, Urban Population, and Topography



Red, orange
= majority urban



Darker colors
= more impervious

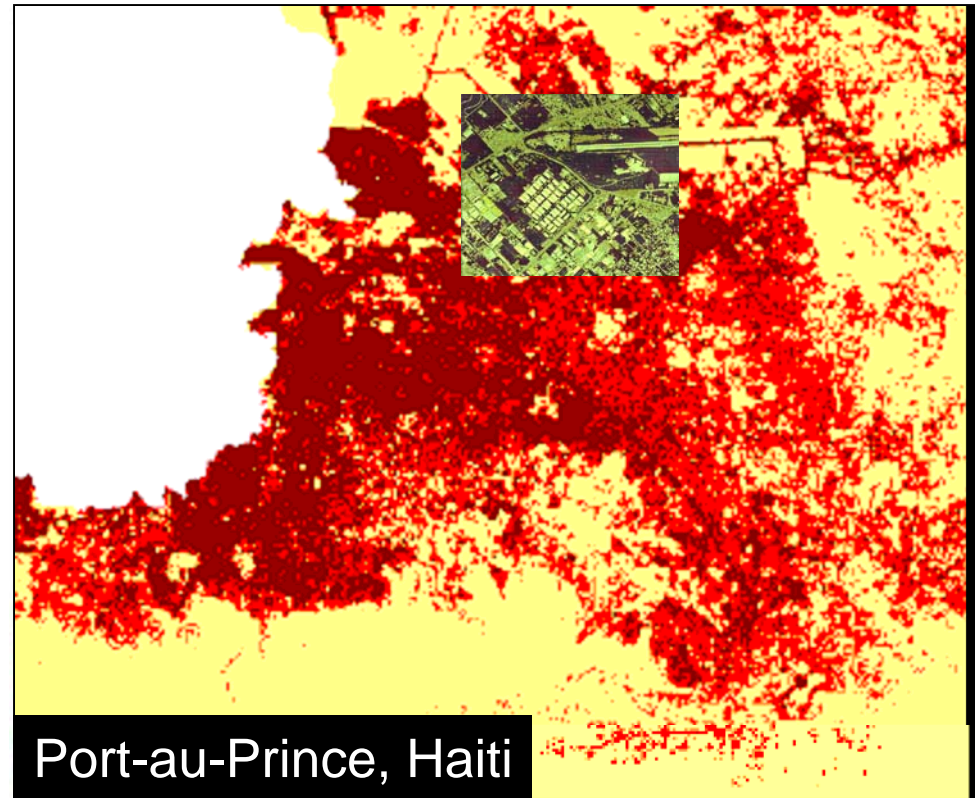


Impervious Surfaces and Population Density

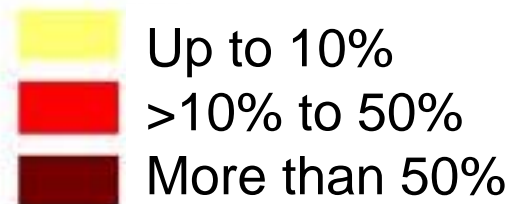
Questions

How well do % impervious numbers correlate with population density?

How does the impervious-density relationship vary regionally or among countries?



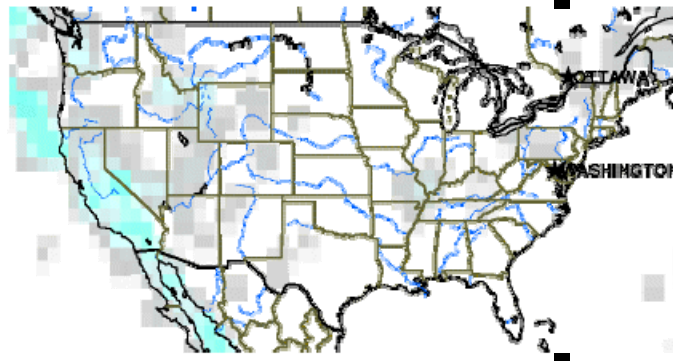
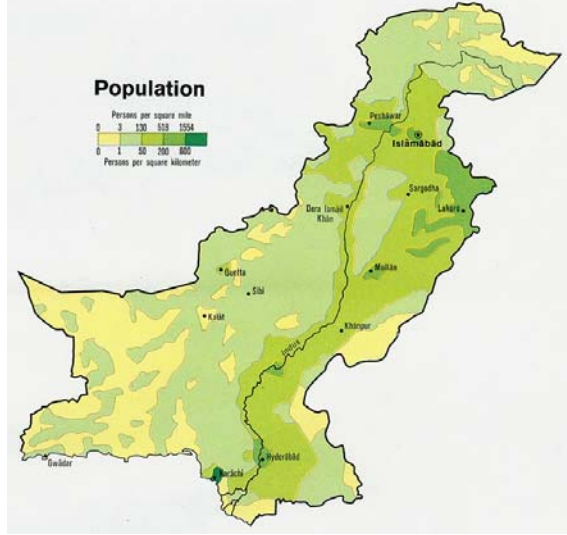
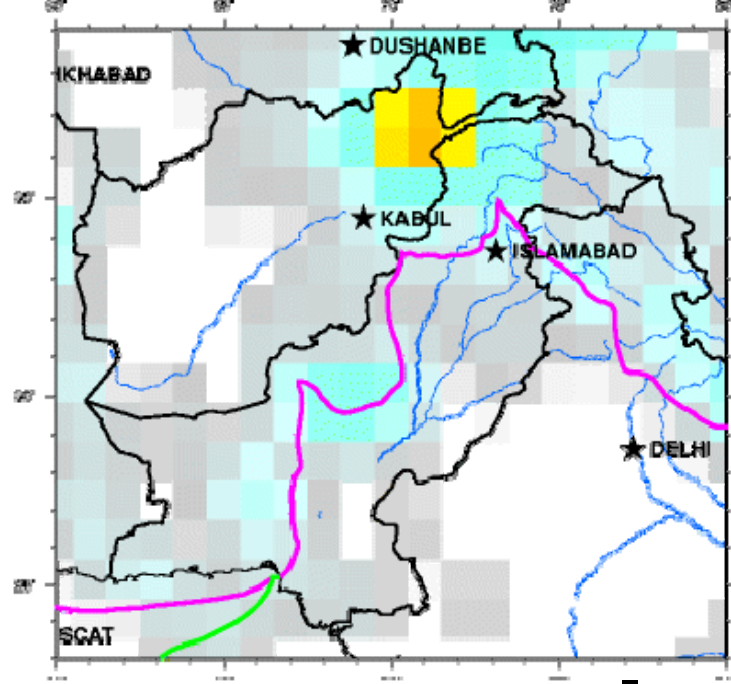
PERCENT IMPERVIOUS



Pakistan Issues

Population 2009: 176,200,000 (6th largest)
 Population growth: 3rd largest

- Natural disasters
- Afghan border region
- Terrorism
- Ethnic conflict
- Sharp rich/poor divide (per capita GDP \$2,400; literacy rate 50%)



Summary of Goals

Build shapefile archive and demographic database, initially to ADM3 level

Use remote sensing methods to update population data,
perhaps to fill in gaps where census data are lacking

Make product accessible online

Questions?

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