Policy Relevant Indicators of Air Quality

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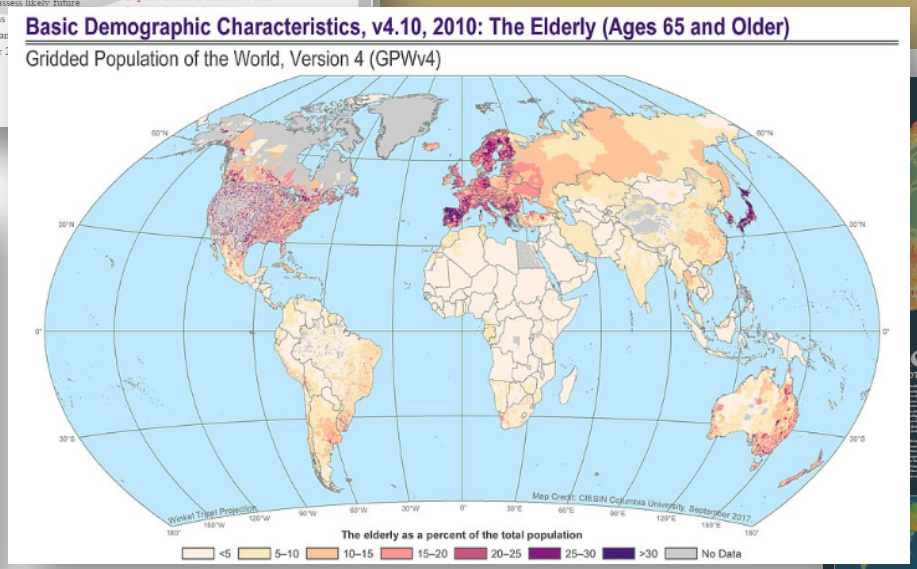
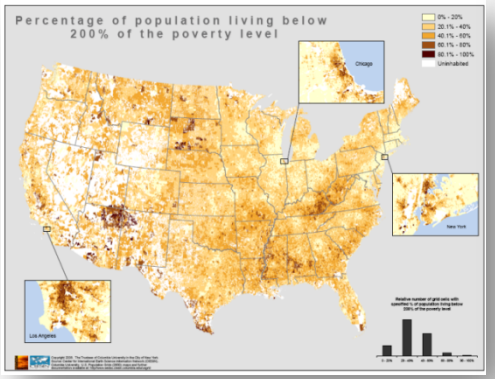
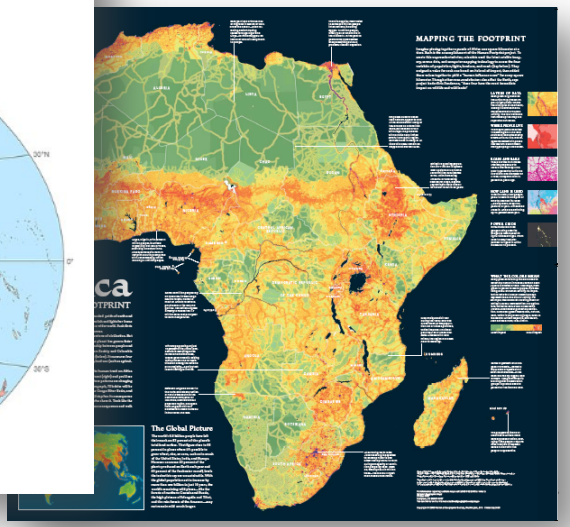
Center for International Earth Science Information Network
Earth Institute | Columbia University

What is SEDAC's purpose?

- SEDAC data provide the ground level context for NASA's remote sensing data
- Focus on human dimensions of environmental change
- Big emphasis on data integration
- Direct support to scientists, applied and operational users, decision makers, and policy communities
- Strong links to geospatial data community

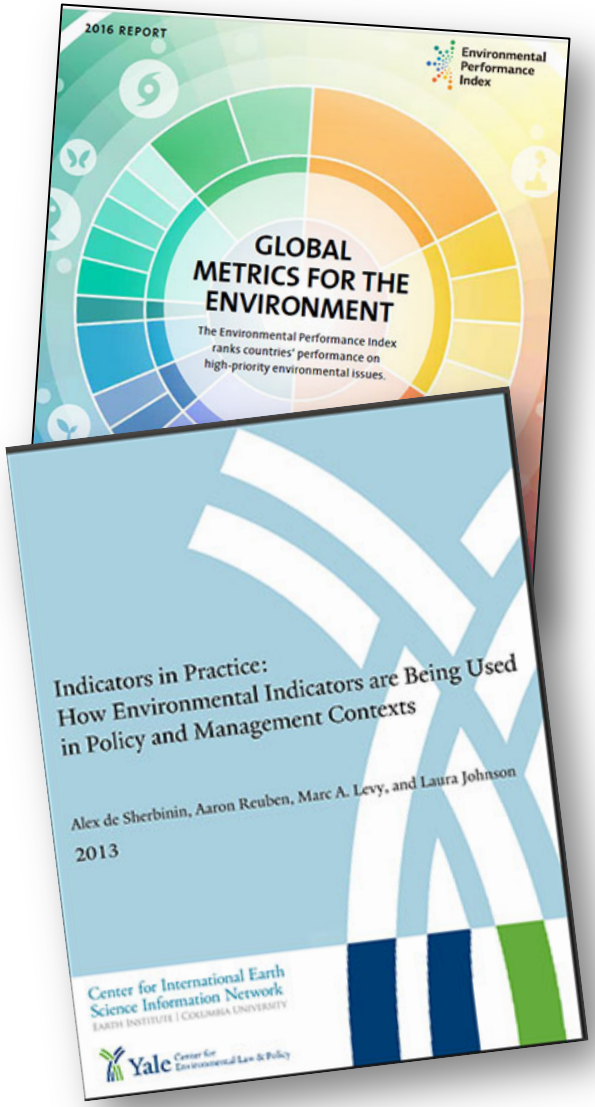






Lessons from the EPI and Indicator Research

- Country comparative indices can set up a *competitive dynamic* among peer groups
- Decision makers are interested in *pressure* and *impact* measures
- Indicators are most successful when they have the following characteristics:
  - *Credible:* high perceived technical quality that is provided by a reputable source
  - *Salient:* relevant technical information provided to decision makers in a timely manner (does the information resonate with the audience?)
  - *Legitimate:* the producers have engaged various actors in indicator design, resulting in "buy-in"



http://ciesin.columbia.edu/binaries/web/global/news/2013/indicatorsinpractice.pdf

The Benefit of Satellite Data for Indicator Development

- Satellite remote sensing data have the potential to fill persistent data gaps in *in situ* monitoring networks
- Satellite data provide wall to wall coverage and consistent time series
- Satellite data are not dependent on the vicissitudes of funding or political situations in countries that are being monitored
- Satellite data can measure environmental conditions and change in hard-to-reach areas

Satellite Derived Indicators

- SEDAC has been exploring how to meet the needs of **high level** policy audiences by providing value added "level 4" remote sensing-derived indicators
  - **Level 0**: raw instrument data; **Level 1**: geo-located and calibrated; **Level 2**: geophysical data product; **Level 3**: Composites of level 2 products; **Level 4**: model-derived data product
- This work builds on:
  - Two decades experience working on country level environmental indictors - the **ESI and EPI**
  - A NASA ROSES* project "Using Satellite Data to Develop Environmental Indicators: An Application of NASA Data Products to Support **High Level Decisions** for National and International Environmental Protection" (2009-2011)

* NASA Research Opportunities in Space and Earth Sciences (ROSES)

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Using satellite data to develop environmental indicators

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Abstract

Environmental indicators are increasingly being used in policy
serious data deficiencies exist for many parameters of interest t
With its global synoptic coverage and the wide range of inst
sensing has the potential to fill a number of these gaps, yet
indicator development has largely remained untested. In th
effort to develop satellite-derived indicators in three majo
coastal eutrophication, and biomass burning. A primary
an advisory group composed of remote sensing scientis

S Online supplementary data available from stacks.i

Keywords: remote sensing, environmental indicator
biomass burning

ERL 2014

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Toward the next generation of air quality monitoring indicators

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HIGHLIGHTS

- Our initiative bridges science and policy to design the next generation of air quality indicators.
- Ozone, mercury, particulate matter, and persistent organic pollutants are considered.
- Cross-cutting themes address knowledge gaps and needed investments in air pollution.
- Regional considerations of air pollution are addressed.
- Recommendations are made for what is needed to develop improved air quality indicators.

Atmospheric Environment 2013

Special Issue Section: Toward the Next Generation of Air Pollutant Monitoring and Indicators. Guest Editors: A. Hsu, H. Hung, N. Pirrone, J. Engel-Cox and K.W. Bowman

Toward the next generation of air quality monitoring indicators
Original research article
Pages 561-570
Angel Hsu, Aaron Reuben, Drew Shindell, Alex de Sherbinin, Marc Levy
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Ozone

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PM

Toward the next generation of air quality monitoring: Persistent organic pollutants
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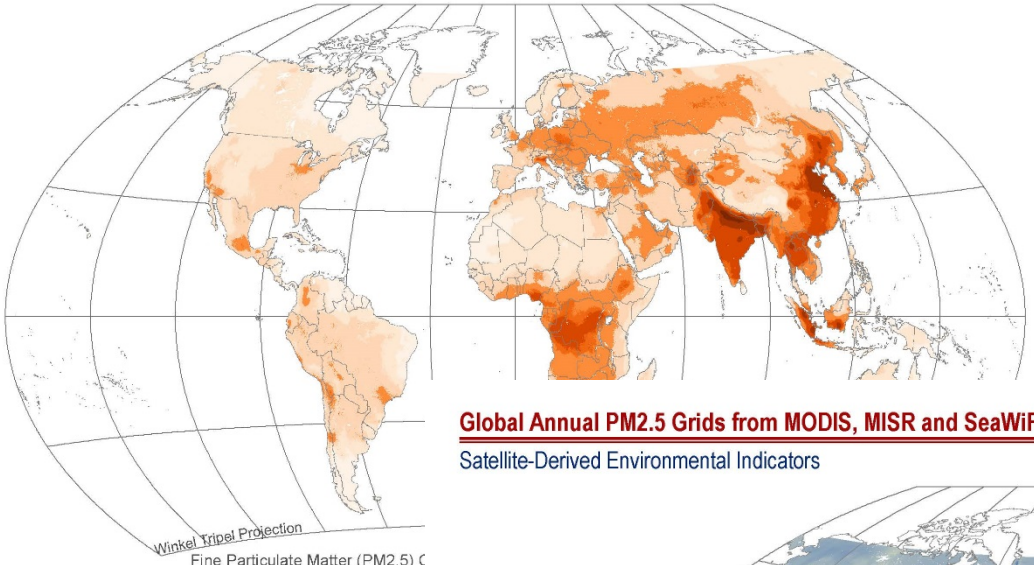
Nicola Pirrone, Wenche Aas, Sergio Cinnirella, Ralf Ebinghaus, ... Elsie M. Sunderland

Mercury

Global Annual PM2.5 Grids from MODIS, MISR and SeaWiFS Aerosol Optical Depth (AOD) with GWR, 2016

Satellite-Derived Environmental Indicators

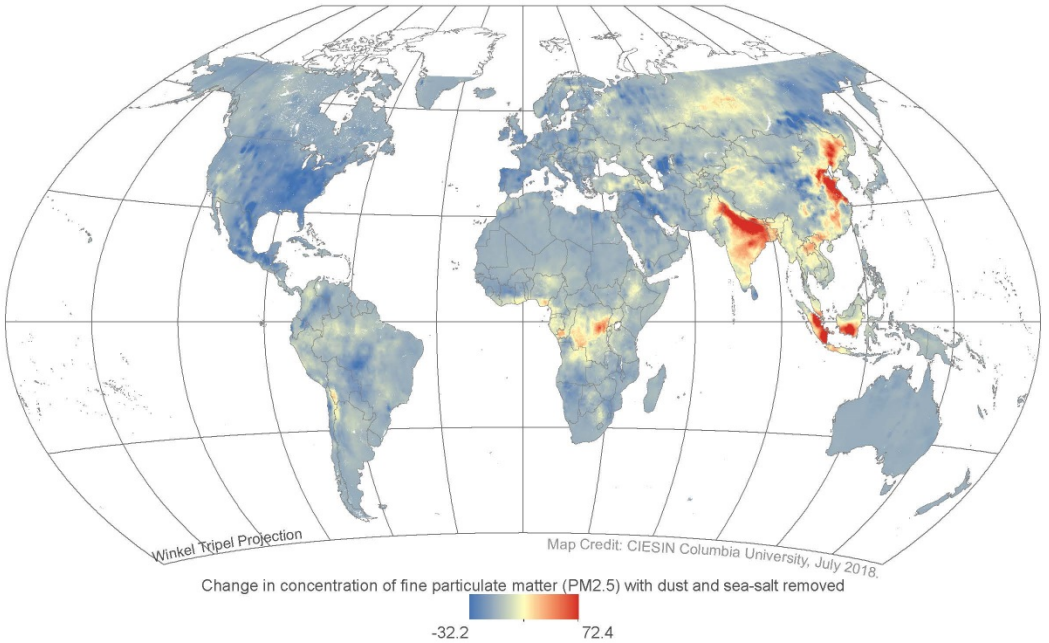


The Global Annual PM2.5 Grids from MODIS, MISR and SeaWiFS
(micrograms per cubic meter) of ground-level fine particulate matte
satellite instruments including NASA's Moderate Resolution Imagin
Viewing Wide Field-of-View Sensor (SeaWiFS). The GEOS-Chem
PM2.5 concentration. Geographically Weighted Regression (GWR)
bias per grid cell in the initial satellite-derived values. The spatial re
particulate matter, with dust and sea-salt removed in the year 2016

Source: van Donkelaar et al. 2018 , available at SEDAC: http://sedac.ciesin.columbia.edu/data/set/sdei-global-annual-gwr-pm2-5-modis-misr-seawifs-aod

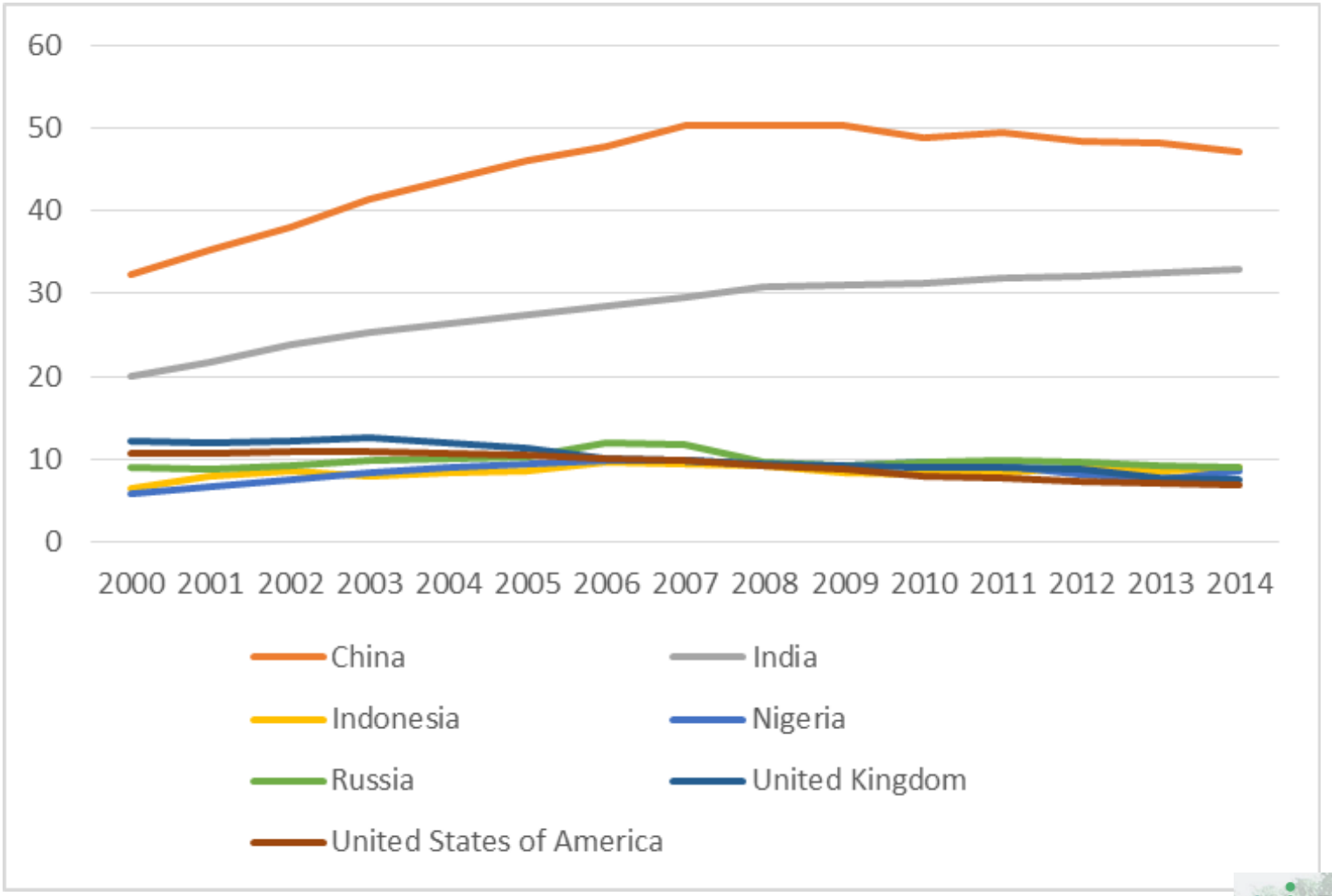
Global Annual PM2.5 Grids from MODIS, MISR and SeaWiFS Aerosol Optical Depth (AOD) with GWR: Change from 2000 to 2016

Satellite-Derived Environmental Indicators



The Global Annual PM2.5 Grids from MODIS, MISR and SeaWiFS Aerosol Optical Depth (AOD) with GWR, 1998–2016 consist of annual concentrations (micrograms per cubic meter) of ground-level fine particulate matter (PM2.5), with dust and sea-salt removed. This data set combines AOD retrievals from multiple satellite instruments including NASA's Moderate Resolution Imaging Spectroradiometer (MODIS), Multi-angle Imaging SpectroRadiometer (MISR), and the Sea-Viewing Wide Field-of-View Sensor (SeaWiFS). The GEOS-Chem chemical transport model is used to relate this total column measure of aerosol to near-surface PM2.5 concentration. Geographically Weighted Regression (GWR) is used with global ground-based measurements to predict and adjust for the residual PM2.5 bias per grid cell in the initial satellite-derived values. The spatial resolution of the data is 0.01 degrees. This map represents the change in concentration of ground-level fine particulate matter, with dust and sea-salt removed from the year 2000 to 2016.

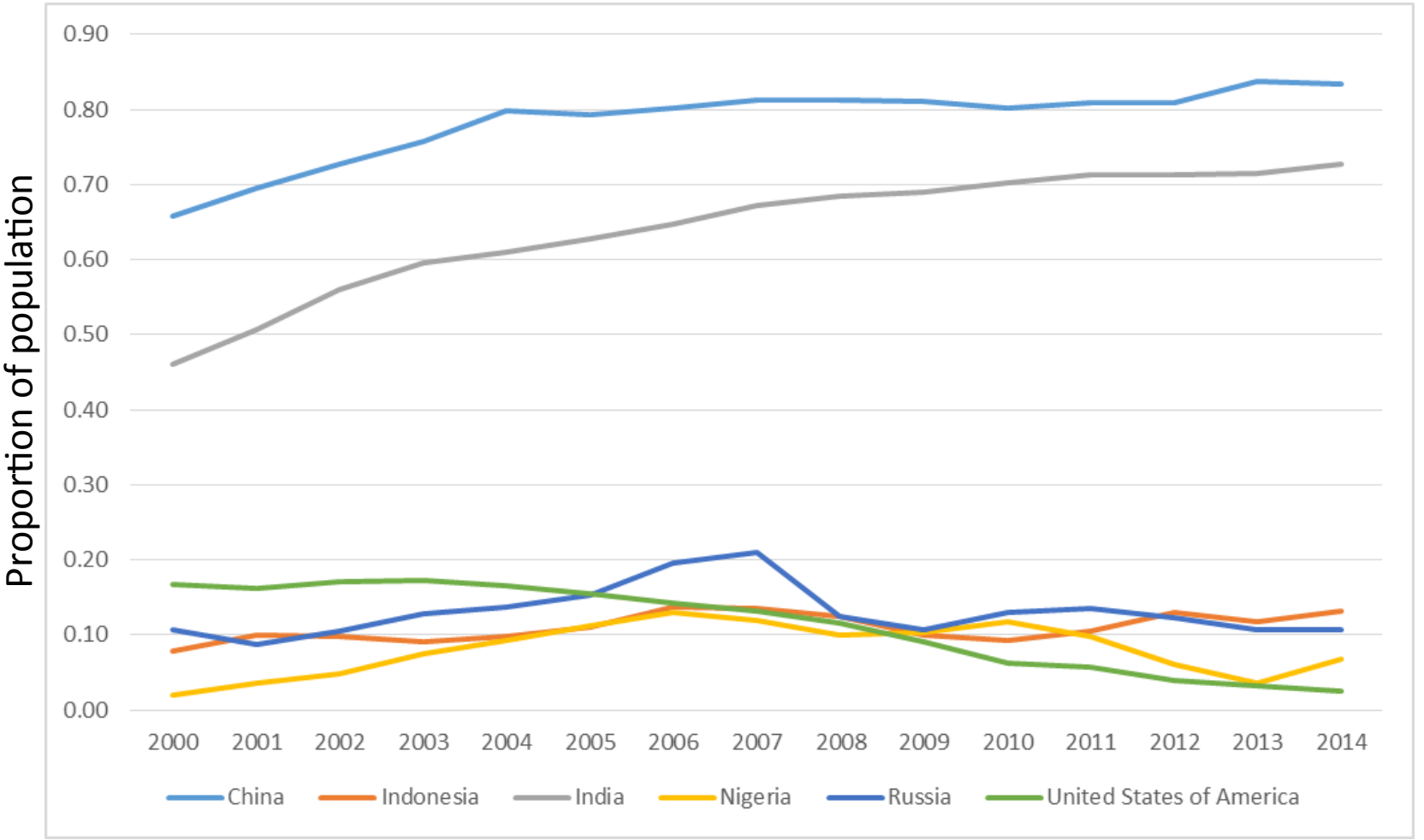
Trend in Average Annual PM2.5 Concentrations



Source: 2016 EPI, http://sedac.ciesin.columbia.edu/data/set/epi-environmental-performance-index-2016

Environmental Performance Index

Trends in Proportion of Population Exposed to PM2.5 in Exceedance of 25 ug/m^3



Source: 2016 EPI, http://sedac.ciesin.columbia.edu/data/set/epi-environmental-performance-index-2016

Environmental Performance Index

Air Pollution

The Economist

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Pollution in China

Man-made and visible fr

Feb 1st 2012, 7:19 by The Economist online

"PM2.5" seems an odd and wonky term for th
precisely what has happened in China in rec
particles in the atmosphere—those less thar
into people's lungs; far deeper than that ra
authorities have revealed measurements or
online revolt broke out. Such was the publ
PM2.5 data are now being published for B

RCH

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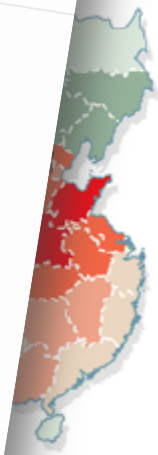
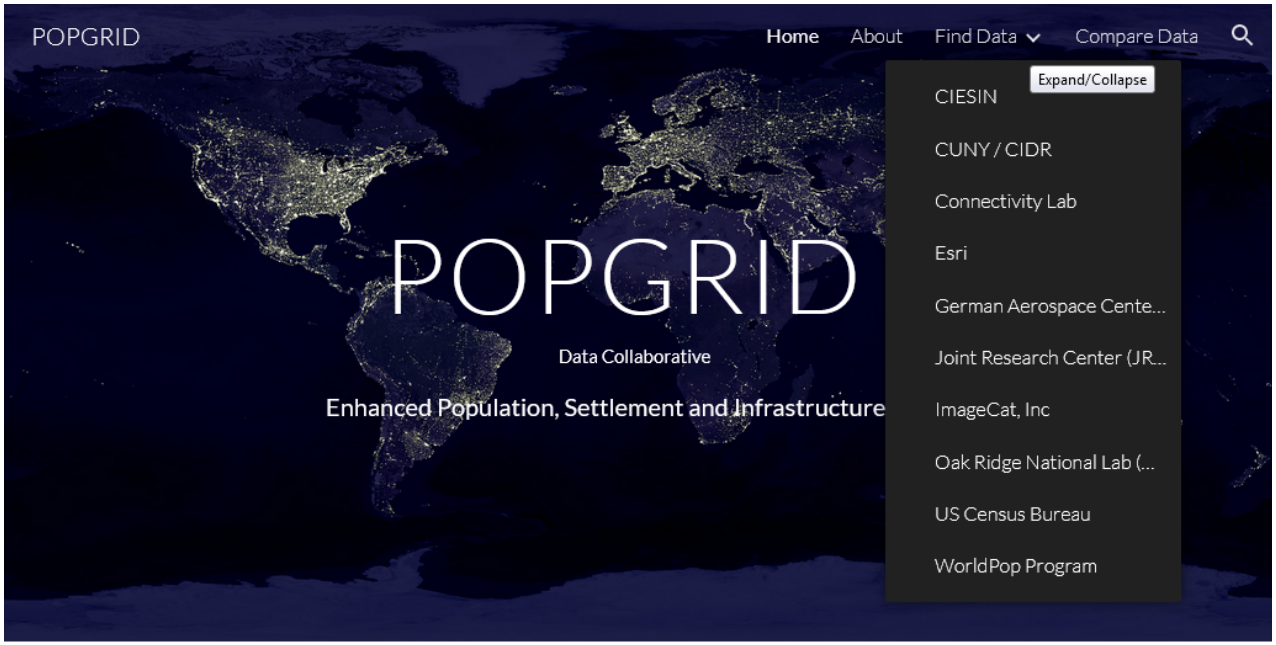
By GARDINER HARRIS JAN. 25, 2014



POPGRID – Population and Settlement Layer Intercomparison

- Information on available datasets provided by POPGRID participants
- Access to consistent metadata and documentation
- Comparison tools
- Access to user support (via SEDAC)



Spatially accurate and up-to-date population and settlement data are widely used in planning and decision making in both the public and private sectors to improve the effectiveness and efficiency of decisions, monitor impacts, and identify those who might otherwise be left behind. Understanding where people live and work, and the type and condition of their housing and other infrastructure, is critical in times of disaster, enabling emergency responders to reach those most in need more quickly with appropriate assistance. Such data can help improve access to public and private services, increase the sustainability of natural resources, and facilitate progress towards meeting the internationally accepted Sustainable Development Goals (SDGs).

www.popgrid.org

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