Integration of Remote Sensing and Socioeconomic Data

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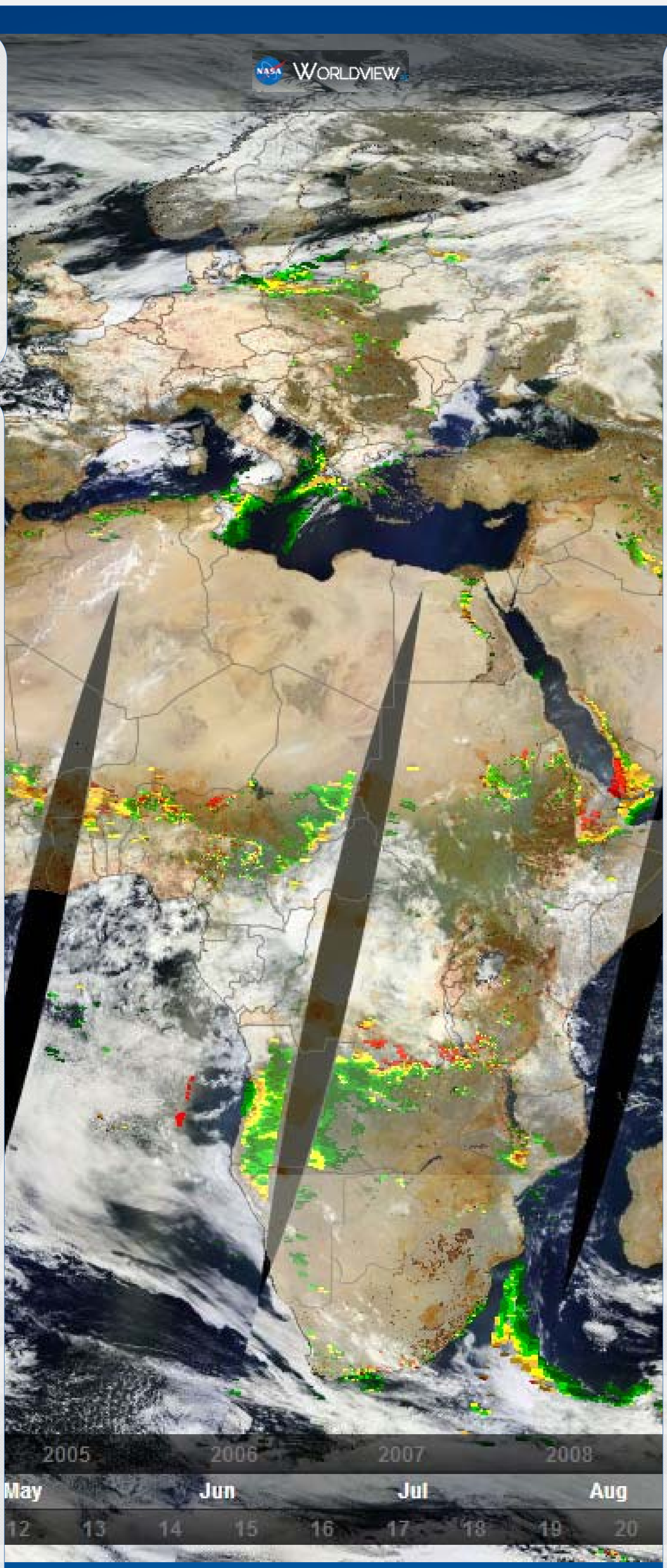
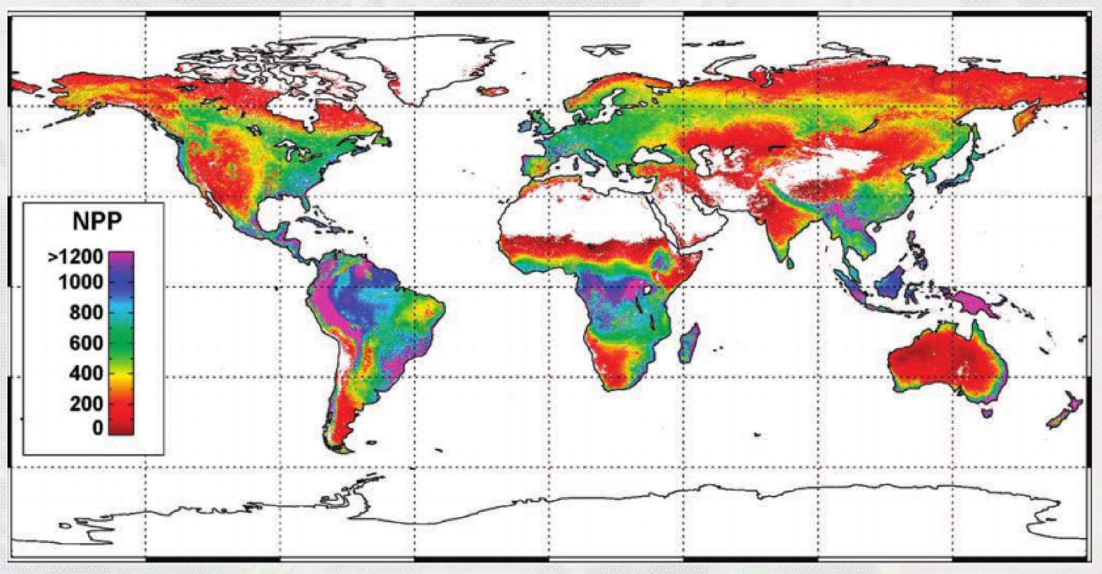


Abstract

The NASA Socioeconomic Data and Applications Center was established with a mission to develop data and applications that support the integration of socioeconomic and Earth science data. Many of the core research questions of the "anthropocene" are spatial in nature, and require spatial data integration to provide the answers. This poster examines some of the challenges and opportunities for spatial data integration through recent examples of the integration of remote sensing and socioeconomic data in a number of areas, drawing from SEDAC's own experience and papers by natural science researchers.

Uses of Other SEDAC Data



SEDAC's Human Footprint v2 data are used along with MODIS data in "Global bioenergy capacity as constrained by observed biospheric productivity rates" by Smith et al. in *BioScience* (Vol. 62, No. 10, 2012). The authors partitioned natural landcover types (i.e., forests and rangelands) as either accessible or remote using human footprint index data set, which accounts for accessibility by incorporating information on roads, major rivers, and coastlines.

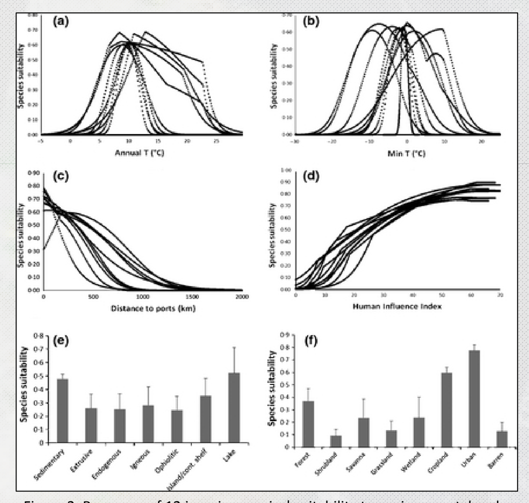
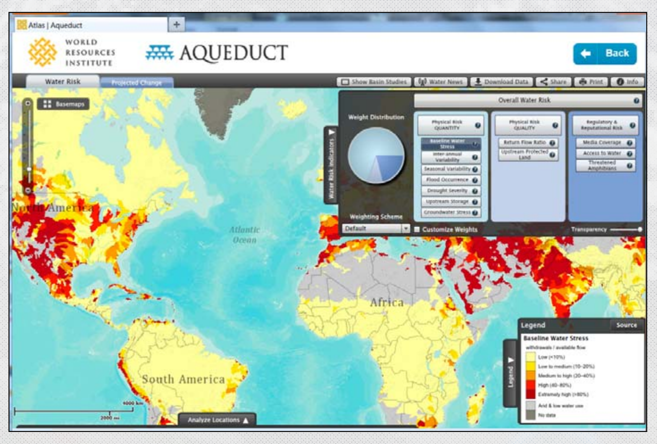
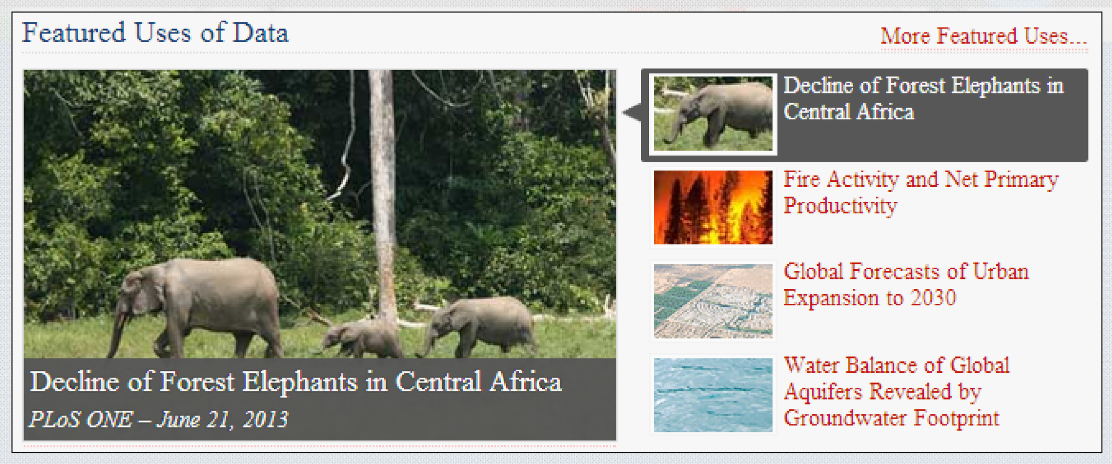


Figure 2. Response of 12 invasive species' suitability to environmental and socio-economic indicators used for modelling. (a) annual average temperature, (b) minimum temperature of coldest month, (c) distance to commercial ports, (d) human influence index, (e) bedrock geology and (f) land cover.

SEDAC's Human Footprint v2 data are used along with MODIS and LandScan data in "Socioeconomic factors amplify the invasion potential of 12 high-risk aquatic invasive species in Great Britain and Ireland" by Gallardo and Aldridge in *Journal of Applied Ecology* (Vol. 50, No. 3, 2013).

SEDAC's Global Reservoir and Dam (GRanD v1.1) data are used with runoff data from the NASA GSFC Global Land Data Assimilation System v2 in the Aqueduct Global Water Risk Mapping tool.





The Featured Use section of SEDAC's Web site is regularly updated with other examples of data integration. Visit: http://sedac.ciesin.columbia.edu.

NASA Worldview

NASA Worldview (above background image), a tool for viewing near real-time satellite data, integrates a number of SEDAC socioeconomic data layers to provide context for the satellite data. Here, GPWv3 is combined with MODIS Aerosol Optical Depth. Visit: https://earthdata.nasa.gov/labs/worldview/.

Uses of SEDAC's Gridded Population Data

SEDAC's Gridded Population of the World v3 data are used in conjunction with aerosol optical depth data from MISR and MODIS and the NASA GISS E2-PUCCINI general circulation model in a paper by Marlier et al., on health risks from landscape fire emissions in southeast Asia," in *Nature Climate Change* (Vol. 3, 2013). They combine satellite-derived fire estimates and atmospheric modelling to quantify health effects from fire emissions in southeast Asia from 1997 to 2006.

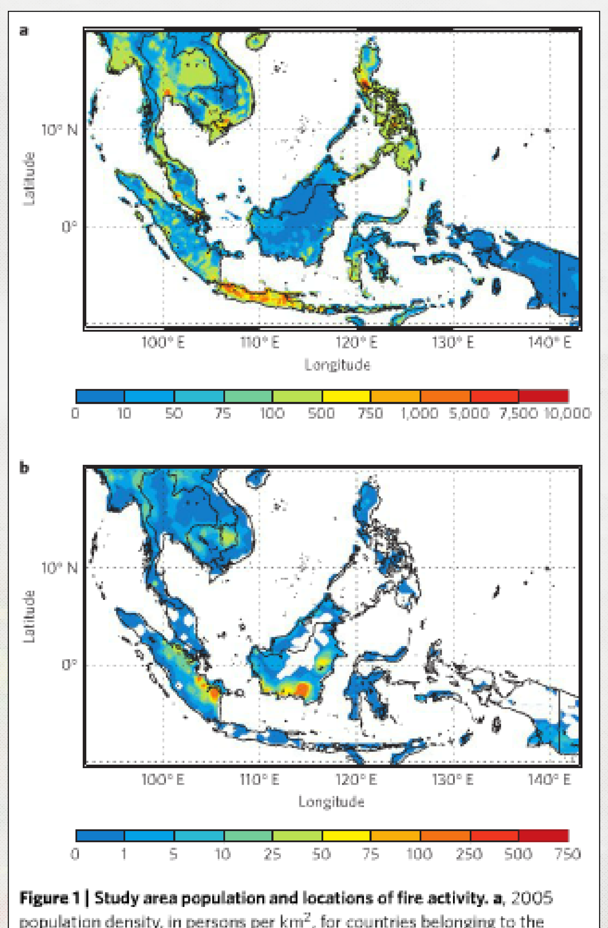
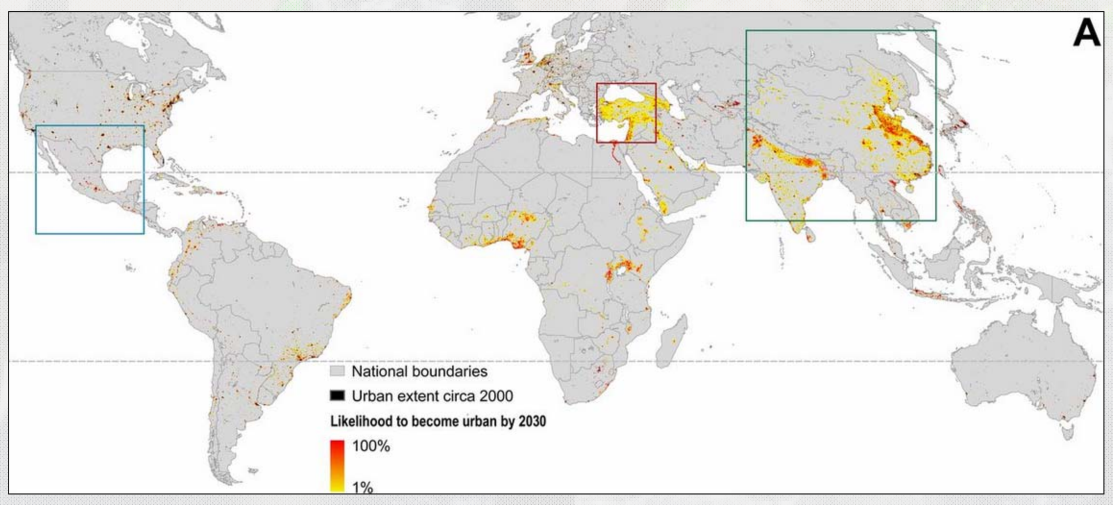
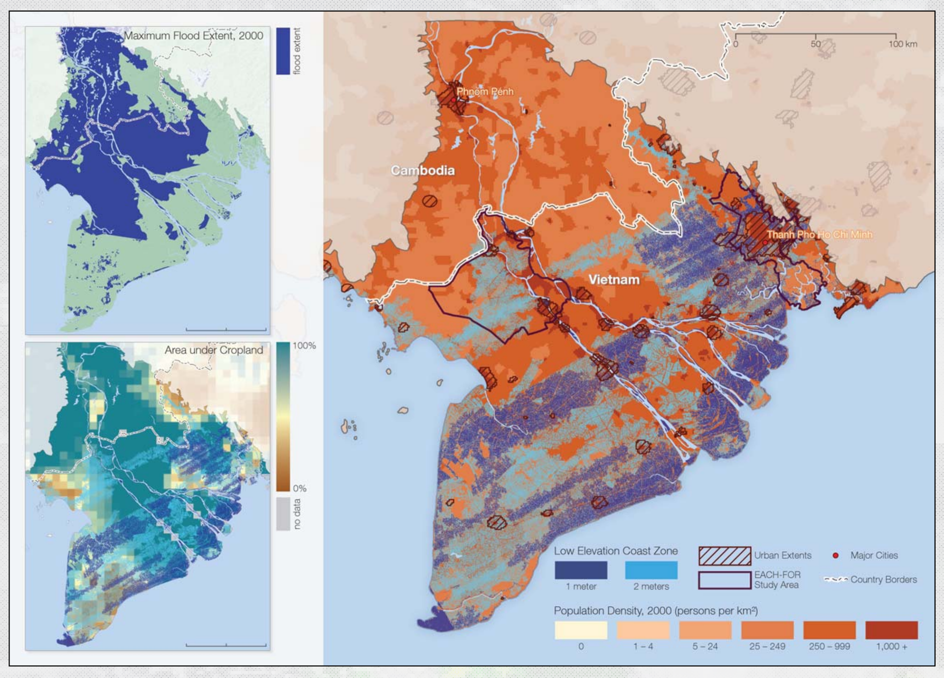


Figure 1 | Study area population and locations of fire activity. a, 2005 population density, in persons per km², for countries belonging to the ASEAN. Data from CIESIN GPWv3 (ref. 29) at 0.25° resolution. **b,** 1997–2006 mean fire emissions, in g C m⁻² per month at 0.5° resolution, from the GFED3 (ref. 8).



SEDAC's Global Rural-Urban Mapping Project (GRUMP v1) urban extents data and Country-level downscaled GDP Projection data are used with MODIS urban extent estimates in the paper, "Global forecasts of urban expansion to 2030 and direct impacts on biodiversity and carbon pools," by Seto et al. in the *Proceedings of the National Academy of Sciences* (Vol. 109, No. 40, October 2, 2012). The figure above shows that there is significant variation in the amount and likelihood of urban expansion. Much of the forecasted urban expansion is likely to occur in eastern China.



SEDAC's data have been integrated in a series of reports on climate change and potential impacts on migration produced by CARE, United Nations University, and CIESIN, including *In Search of Shelter* (2009) and *Where the Rain Falls* (2012). The main map depicts SRTM-derived 1m and 2m elevation bands overlaid on GRUMPv1 population grids and urban extents in the Mekong Delta. Half the delta's population would be inundated by a 2m sea level rise. The upper left inset map shows the area flooded in the year 2000 from MODIS, and the map below it shows the distribution of agricultural lands. Half of the land would be inundated by a 2m sea level rise.

Data Integration for Indicator Development

Air quality matters for human health, and many parts of Asia have particularly bad air quality. Using an model developed by researchers at Dalhousie University, a team from Battelle and CIESIN developed annual global grids of $PM_{2.5}$ based on MODIS Aerosol Optical Depth (AOD) data from 2000 to 2010. The grid values were then population weighted using SEDAC's GRUMP v.1 population grid in order to produce. population-weighted exposure maps for administrative areas, such as China's provinces (Figure 2). The data show that $PM_{2.5}$ levels in China are well above the WHO guidelines for annual average $PM_{2.5}$ exposure of 10 micro-grams per cubic meter (μg/m3).

Figure 2. Average Exposure to $PM_{2.5}$ (2008-2010)

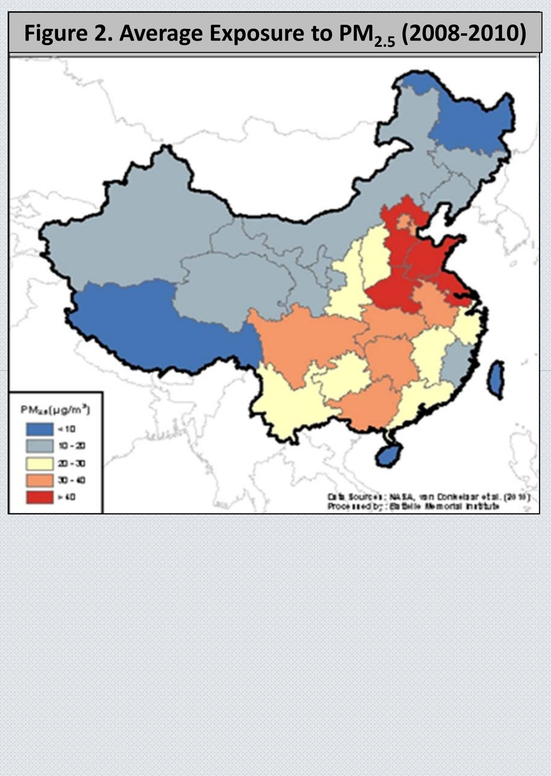
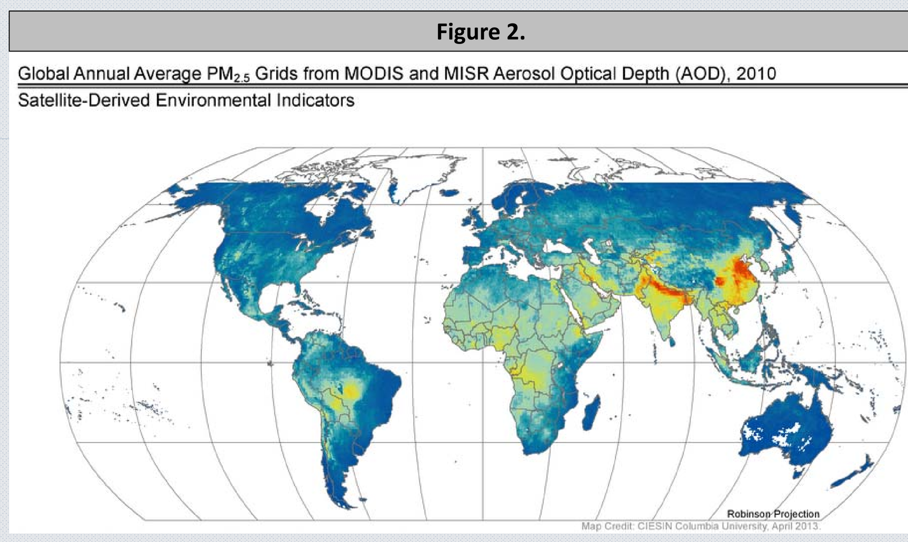


Figure 2.

Global Annual Average $PM_{2.5}$ Grids from MODIS and MISR Aerosol Optical Depth (AOD), 2010

Satellite-Derived Environmental Indicators



This work was funded by the NASA Earth Science Division, Applied Sciences Program.

The gridded $PM_{2.5}$ data behind this study are now being disseminated by SEDAC as the Global Annual Average PM2.5 Grids from MODIS and MISR Aerosol Optical Depth (AOD), v1 (2001-2010) data set (Figure 2)

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