Global Constructed Impervious Surface Area (ISA) Density Product

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Objectives

To create a global one-km resolution map of percent impervious surface area (ISA). Impervious surfaces include roads and buildings. These surfaces increase runoff of precipitation, altering hydrology by moving water quickly into drainages and displace vegetation, fragmenting vegetation cover and reducing transpiration. Because impervious surfaces absorb sunlight but are unable to transpire, they may lead to development of urban heat islands.

Approach

Direct measurement of ISA density would require high spatial resolution imagery (~ one meter), limiting the spatial extent for which a product could be generated. Considering that most continental scale modeling would require aggragation to a kilometer scale - we focused on using kilometer scale grids covering all of North America to estimate the percent cover of ISA. The two grids are the 2004 Landscan population count from the U.S. Department of Energy and radiance calibrated nighttime lights (2000-2001) from the Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS). Both grids were available at 30 arc second resolution and were reprojected to a one kilometer Albers equal area grid. The calibration for estimating the fractional cover of ISA was developed using the USGS MRLC ISA data, which was aggregated to the same 1km Albers equal area grid. A linear regression was applied to define an empirical relationship for estimating the percent cover of impervious surface based on the brightness of lights and population density.

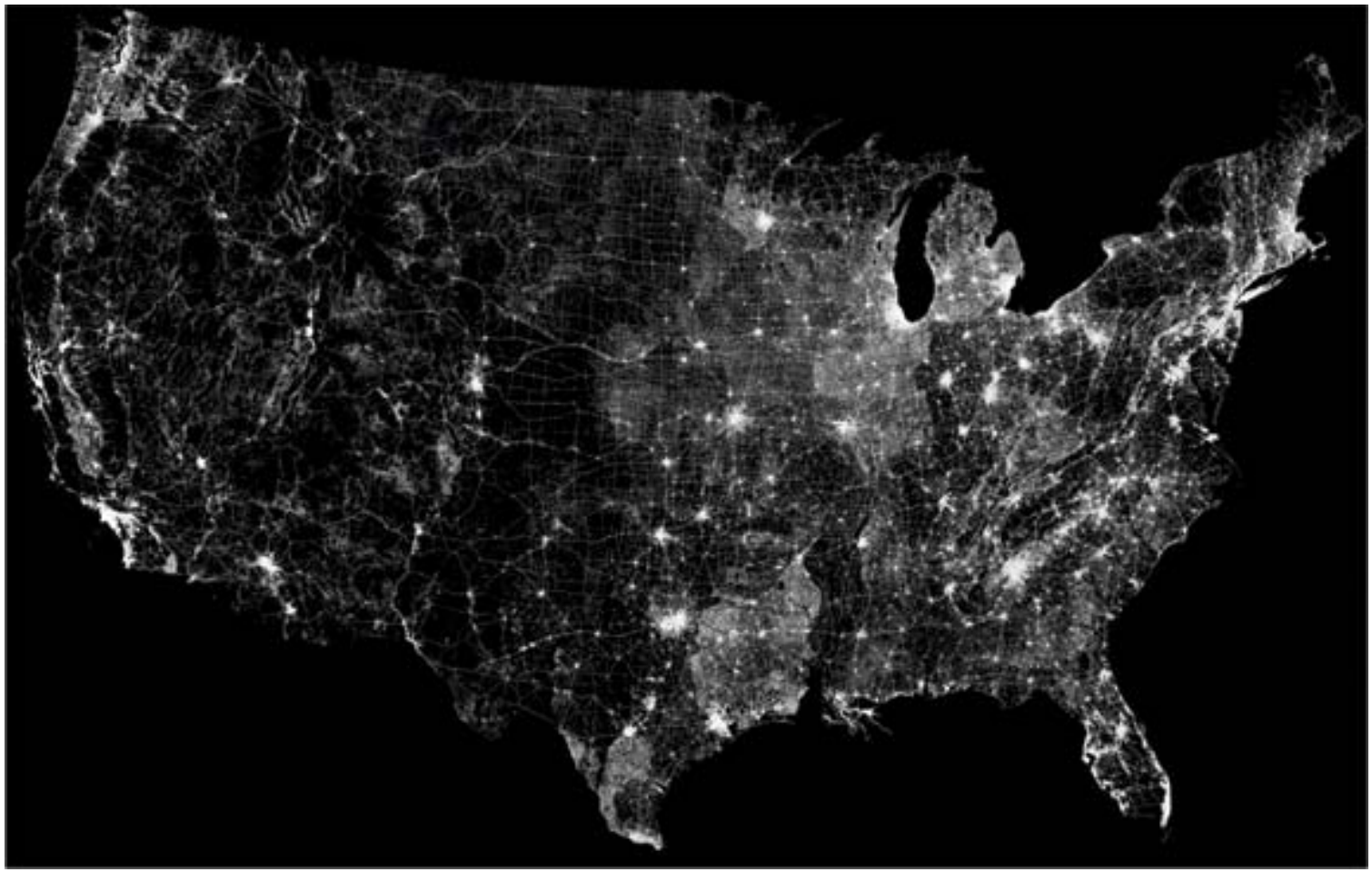
Results

Radiance calibrated lights and population were determined to be good predictors of percent ISA. This combination resulted in the highest R2 and the most consistent results when applied to the whole US. The result was:

%ISA = (0.0747403*Radiance + 0.0046079*Landscan)

R2 = 0.6897

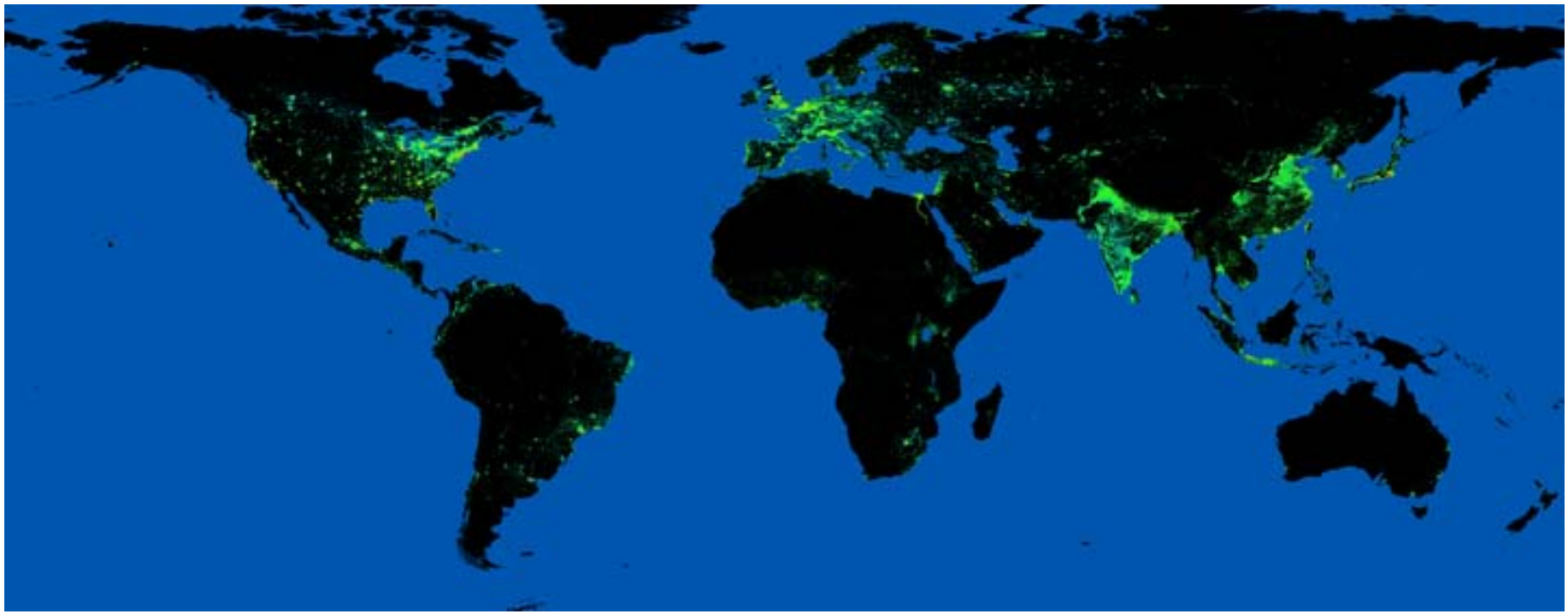
USGS MRLC ISA



DMSP OLS Radiance Calibrated Lights

Landscan Population

Global ISA Product



Global ISA Product