NATIONAL CONSORTIUM FOR REMOTE SENSING EDUCATION, RESEARCH, AND APPLICATIONS

IndianaView
PROJECT FACT SHEET

http://www.indianaview.org

An Exploration of the Spatiotemporal Variations of Nighttime Light Intensity in Indiana

Qihao Weng, Indiana State University (E-Mail: Qihao.Weng@indstate.edu); Yanhua Xie, Indiana State University

Artificial nighttime lights (NTL) emitted from human settlements, industrial activities and economic activities offer the unique ability to monitor human activity from space. While the majority of previous studies focused on the application of NTL data, few efforts have been made to investigate the factors affecting the spatial and temporal variations of NTL intensity at state level.

Therefore, this project aims at identifying the biophysical and socioeconomic factors that control the spatial (across various spatial units) and temporal variations of NTL intensity from 2012 to 2016 in Indiana, including changes in vegetation, impervious surfaces, surface albedo, and socio-economic development. The project was implemented in the following steps. First, the monthly VIIRS NTL composites from April 2012 to April 2016 were collected and potential biophysical and socioeconomic factors were extracted, including monthly and annual normalized difference vegetation index (NDVI), surface albedo, surface imperviousness, population, household income, etc. Then, statistical analyses (i.e., Spearman's correlation, principle component analysis, multi-variable regression) were conducted to analyze the impacts that the factors have changed NTL intensity at multiple spatial scales (i.e., pixel, block, block group, tract, and county levels).

The results showed that NTL changes in Indiana were positively correlated with population and household income variations, impervious surfaces increase, and surface albedo change, and negatively correlated with change in NDVI at all spatial scales. It was also found that these factors explained in combination over 65% of the spatial and temporal NTL variations in Indiana. The conversion from open space and low intensity developed land to moderately and highly developed land was identified as the major source of NTL increase (Figure 1).

Knowledge about the impacts of socioeconomic and biophysical factors on NTL variation facilitates the studies of:

- The impacts of artificial lights on human settlements and urban environment in Indiana; and
- Integration of NTL data and optical images for better socioeconomic applications in Indiana.

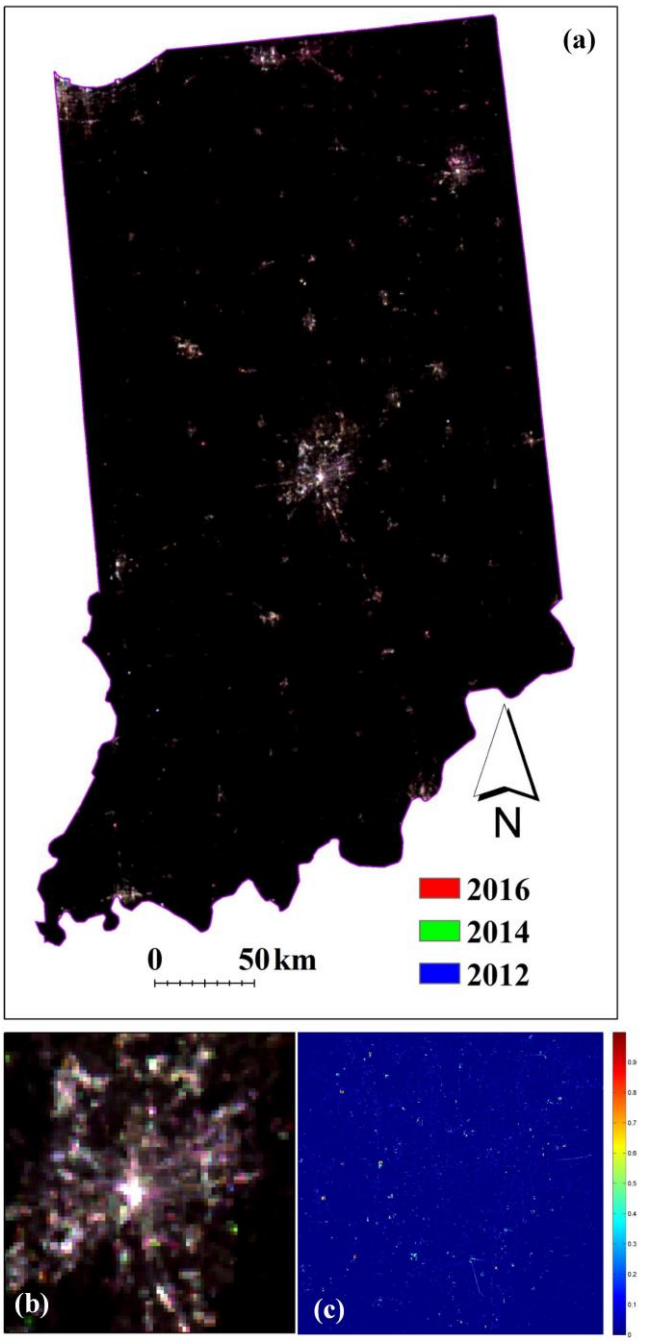

Figure 1. The variation of NTL intensity between 2012 and 2016 for Indiana (a), NTL changes for the Marion County, Indiana (b), and the increase of surface imperviousness from 2011 to 2016 for the Marion County, Indiana (c). Note that the RGB composite in (a) was combined by using NTL intensity in 2016 as red, 2014 as green, and 2012 as blue.