Sprawl

Title: Development Sprawl Impacts on the Terrestrial Carbon Dynamics of the United States

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http addresses: http://dmsp.ngdc.noaa.gov/html/download_sprawl.html
http://dmsp.ngdc.noaa.gov/pres/sprawl_042502/sprawl/title.html

Introduction

- Question: What is the sign and magnitude of development impacts on carbon uptake?
- Goals: 1) To reduce the uncertainty in the terrestrial carbon accounting of the USA. 2) To develop methods that could be applied globally for multiple time periods.
- Approach: Develop a calibrated model of the spatial distribution of constructed materials. Use this with other data sources as input into a carbon model. Make model runs with and without current development and compare the results.

Results

- Most significant results: 1) Constructed related impervious surface area of the USA approaches the size of Ohio. 2) The loss in carbon uptake as a result of the rapid urbanization of the 1990's in the S.E. USA stands at 3.04 Teragrams of carbon per year. 3) Turf and lawns, occupying an estimated surface of 165,000 km^2, rank as the single largest irrigated crop and account for up to 2-5% of the USA carbon uptake.
- Future Directions: Completion of full USA assessment. Project expanded to global via new IDS project.

Conclusions

- Most important conclusions: 1) The national area of constructed development can be estimated with an accuracy of +/- 11%. 2) 1990's development resulted in 0.35% reduction in carbon uptake in the S.E. USA. 3) Turf and lawns form a significant part of the carbon sink for the USA.

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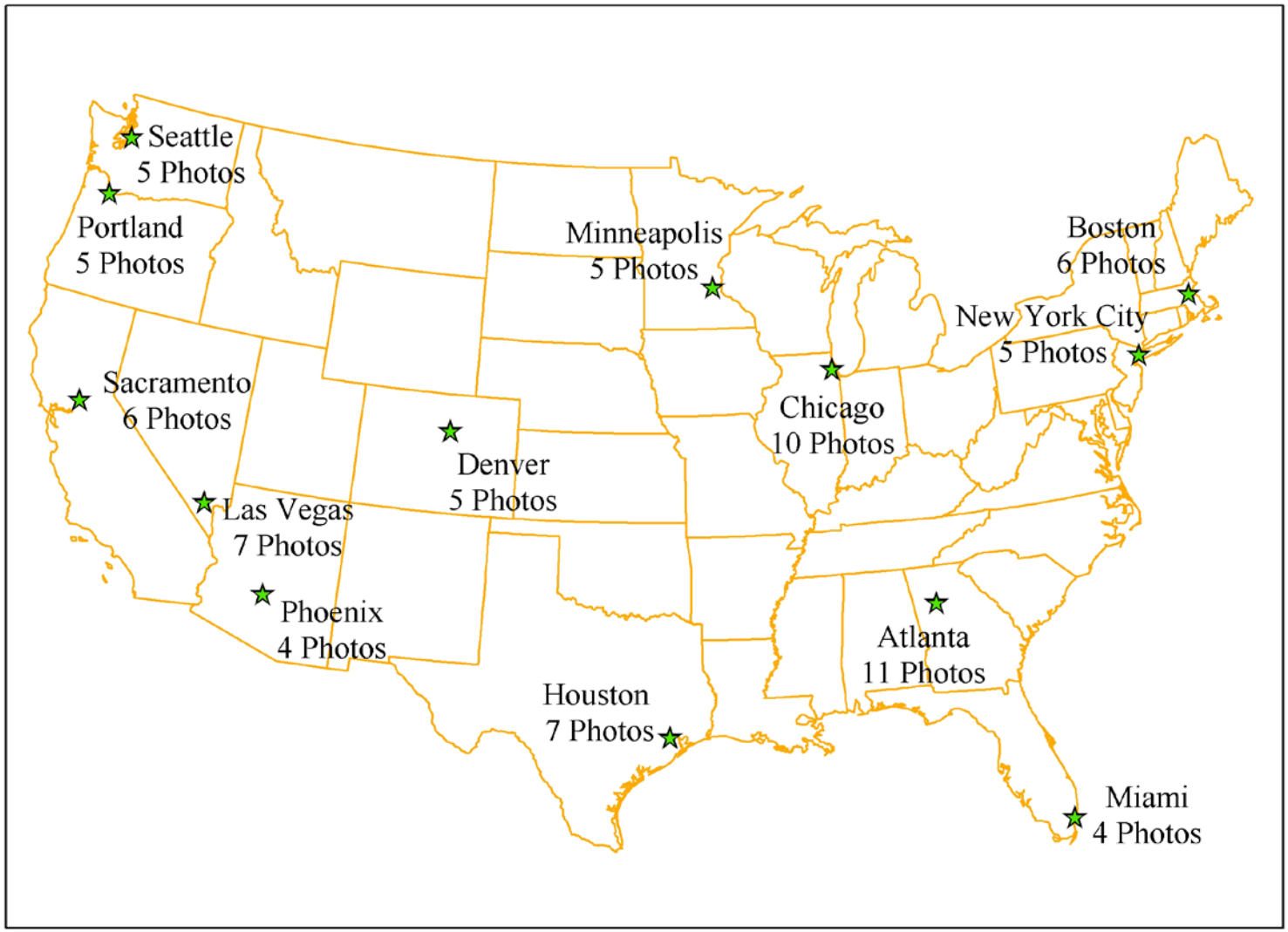
Research Approach / Methods
1 km Grids

- Aggregated 30 meter land cover from Landsat TM (MRLC) from the early 1990's. Classes found most useful include 21 , 22, and 23 (low density residential, high density residential, and commercial / transportation).
- Radiance calibrated nighttime lights from the DMSP-OLS (2001)
- Aggregated road density processed from the U.S. Census Bureau TIGER (2000)
- DOE Landscan population density data (2000)

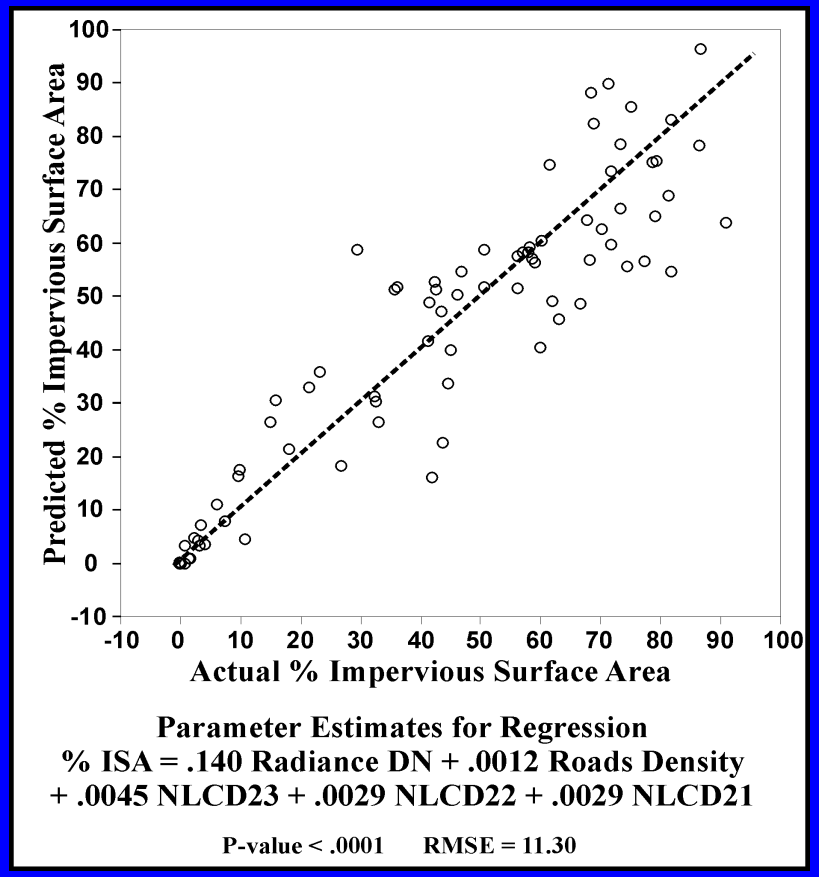
Research Approach / Methods (continued)

- For calibration, the percent cover of impervious surface was measured being measured with gridded point counts made on 1 km tiles of high resolution aerial photograpahy (1998-00) acquired along transects crossing major metropolitan areas in each region of the country. Each photo tile covers a 1Km Albers Equal Area grid cell.

80 Photos From 13 Transects

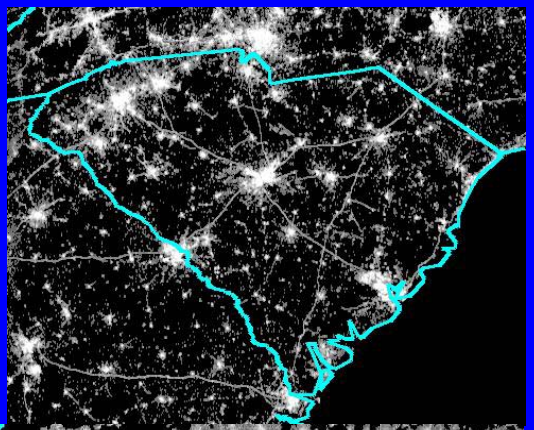


Regression Results

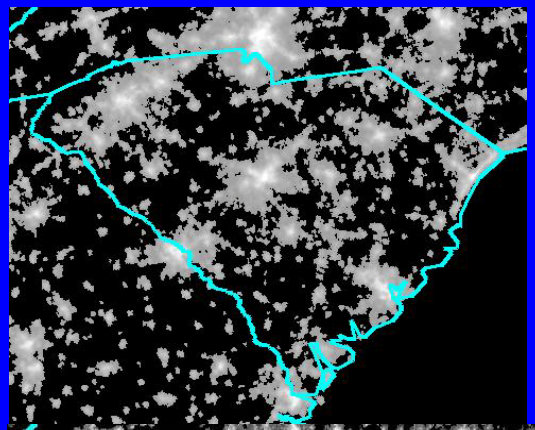


%ISA From Four Models

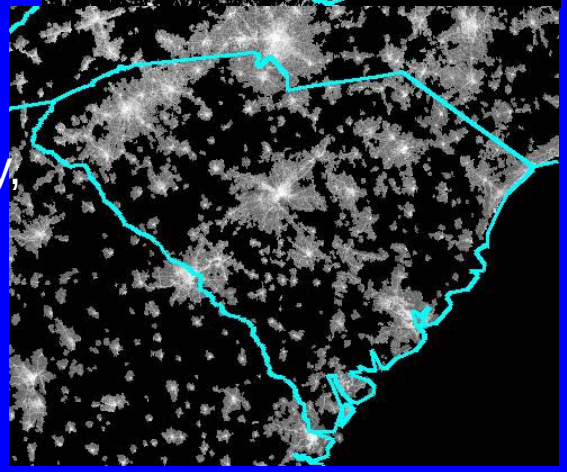
MRLC
21,22,23



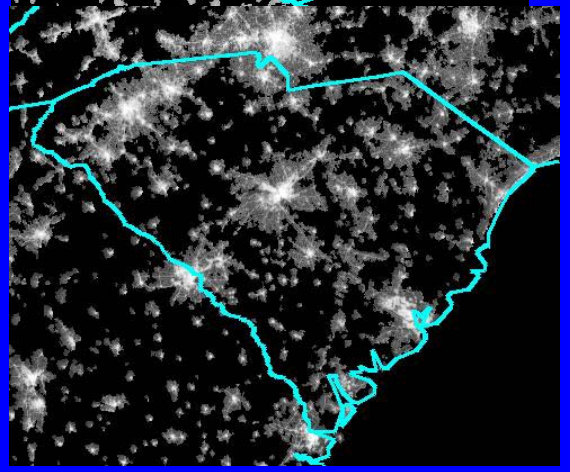
DMSP
Radiance



Radiance,
Road Density,
MRLC
21,22,23



Radiance &
Road Density



Conclusion To Date

- ISA can be modeled regionally to globally at 1 km resolution.
- DMSP radiance, road density plus Landsat urban land cover gave the best results.
- Effort required to generate continental scale Landsat land cover results in long delays and high cost. Other sources of land cover should be considered (e.g. Landsat, MODIS).
- Level of effort for Landsat land cover for ISA estimation could be reduced by focus on areas with DMSP lights.