Sustainability at Auburn University: Assessing Rooftop Solar Energy Potential with Remote Sensing and GIS

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Achieving sustainability has become an important goal for many people, companies, and institutions in the United States. One of the most effective ways for a company to achieve sustainability is to decrease their carbon footprint with the implementation of renewable energy. As an institution that is committed to sustainability and investing in the future by mitigating the effects of climate change, Auburn University is an ideal case study. In an estimation from the Auburn University Office of Sustainability, the total campus currently consumes about 190,000,000 kWh annually. In comparison, the current campus solar arrays account for only 0.0047% of this power. Auburn has grown substantially since 2017, increasing in enrollment, total buildings on campus, and electricity use. As the university grows, its carbon footprint and energy demand has and will continue to grow.

This study assessed rooftop solar potential, which is the estimated amount of solar electric energy that could be produced if all suitable buildings on campus had rooftop photovoltaic (PV) systems installed. Auburn's current energy provider is Alabama Power, which sources most electricity from fossil fuels. The study, completed entirely with publicly available data, follows a processing workflow shown in (Figure 1). To estimate the rooftop solar potential of Auburn University, a digital surface model (DSM) was derived from a point cloud of light detection and ranging (LiDAR) data by the United States Geological Survey (USGS) 3D Elevation Program in 2017, and visual assessment of National Agriculture Imagery Program (NAIP) orthophotos. The points from the aerial LiDAR sensor represent the elevation of objects along the surface of the earth. From these data, the slope, aspect, and total solar potential of the study area were calculated with individual pixels of a gridded raster. Using building footprint polygons to represent campus buildings, different structures on campus were ranked in suitability for rooftop solar arrays. The criteria for "suitable buildings" in this case was non-north-facing rooftops with a slope less than or equal to 47 degrees, with a solar potential that is less than or equal to 609kWh/m². North-facing rooftops, buildings with high slopes, and buildings too small (<10 m²) to produce significant solar energy were removed from the campus-wide estimate.

With these criteria, there are an estimated 323 buildings of the 443 in the study area that were found to be suitable for rooftop solar arrays. The estimated solar potential of Auburn University is 27,068,555 kWh/m². In the year the data were collected (2017), the proposed solar arrays would have met up to 21.07% of annual building electricity requirements, and about 14.43% of total campus electricity required for all operations. At a residential pricing with Alabama Power, the initial installation would cost approximately $62,032,105.21, with an additional annual electric fee of $1,802,765.76. The workflow used in this study is easily adaptable to other universities that would want to complete similar assessments.

Statement of Research Advisor

In terms of contribution, Victoria performed research exceptionally. She completed research goals outlined in the initial report, specifically conducted a literature review, seamlessly integrated suggestions, and recommendations, further developed and implemented methods, interpreted findings, and developed a manuscript that will be finalized for submission soon.
—Lana L. Narine, Forestry and Wildlife Sciences

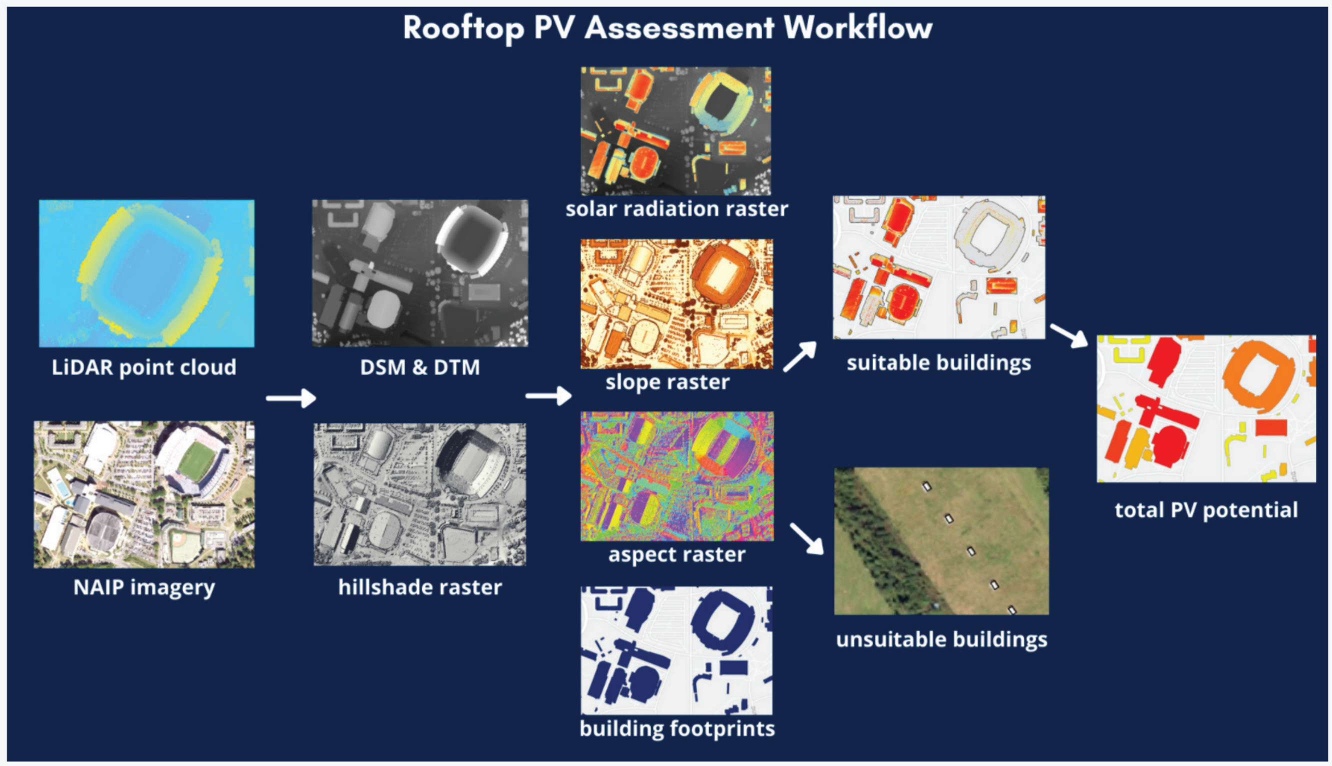

Figure 1. Workflow from Light Detection and Ranging (LiDAR) data and National Agricultural Imagery Program (NAIP) to Digital Surface Model (DSM) and Digital Terrain Model (DTM) to the final total Photovoltaic (PV) potential by building.