**NASA DEVELOP National Program**

**Georgia – Athens**

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*Project Summary – Fall 2017*

**Georgia Energy II**

*Reducing Conflicts in Siting Solar Power Facilities by Identifying Sensitive Habitats and Wildlife*

*Populations in Areas with High Generation Potential*

**VPS Title:** Looking on the Bright Side: Protecting Sensitive Species and Maximizing Solar Potential

**Project Team**

***Project Team*:**

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***Advisors & Mentors*:**

Dr. Marguerite Madden (University of Georgia, Department of Geography)

***Past or Other Contributors*:**

Lynn Abdouni

Natalia Bhattacharjee

Roger Bledsoe

Christopher Cameron

**Project Overview**

***Project Synopsis*:** This project examined site suitability in Georgia for solar farm development in terms of potential impact on environmentally sensitive areas. Given the rapid expansion of solar energy development in Georgia, there is a need for tools that developers and regulators can use to select development sites that have minimal negative environmental impacts. Results of this project will be used by our partners at The Nature Conservancy and Georgia Department of Natural Resources as they continue communications with solar developers to determine best practices for the development of future utility scale solar farms in Georgia.

***Abstract*:**

Solar energy is a rapidly growing industry in the state of Georgia. The increasing popularity of solar farms has encouraged decision-makers and developers to incorporate a sustainable plan for utility-scale solar developments. However, the construction and siting of solar farms could have a threatening impact on environmentally sensitive habitats and associated species. NASA DEVELOP partnered with The Nature Conservancy and the Georgia Department of Natural Resources to conduct an analysis to inform solar site planning and to communicate with key stakeholders. The team analyzed land cover trends from Landsat 8 Operational Land Imager (OLI), in addition to solar insolation data sets from Terra’s Clouds and the Earth’s Radiant Energy Systems (CERES) sensor. These Earth observations were combined to classify and extract data layers for a solar site suitability and conflict identification model following the Land Use Conflict Identification Strategy (LUCIS). Additionally, the DEVELOP team utilized habitat layers of the endangered gopher tortoise (*Gopherus polyphemus*) primarily due to its role as a keystone species in these sensitive areas. These data were used to generate end products that depict potential conflicts between ideal solar energy sites and endangered species habitats, and prioritize development areas outside of these conflicts. The team examined potential conflicts in Decatur and Taylor counties with additional datasets on existing solar utility infrastructure and parcel data to provide a local-level analysis. The results of this project will be utilized by The Nature Conservancy and Georgia Department of Natural Resources to recommend suitable sites for environmentally conscious solar farm construction.

**Keywords:**

Landsat, remote sensing, gopher tortoise, suitability analysis, solar energy, solar farm, LUCIS, Georgia

***National Application Area Addressed:*** Energy

***Study Location:*** Georgia, GA

***Study Period:*** January 2015 – June 2017

***Community Concern:***

* The rapid pace of utility-scale solar power development in the state of Georgia is now growing at a 30-45% annual rate, raising more opportunities for large-scale solar array installation. Such installations significantly alter the development site and pose a threat for loss in biodiversity and critical habitat.
* Counties, such as Decatur and Taylor, within Georgia have observed a rapid increase in solar farm development. Assessment of the siting of these solar farms and their impact on gopher tortoise habitat is needed for planning future utility-scale solar farms.
* There is a need for solar developers to consider endangered species habitats and environmental risks to sensitive wildlife when planning development sites in Georgia.
* Environmental information must be made readily available to decision makers involved in the planning and permitting of these solar installations.

***Project Objectives:***

* Integrate data on environmental sensitivity and infrastructural site suitability to map most feasible utility-scale solar development sites within Georgia
* Analyze land cover change in selected counties with regards to solar development
* Conduct an in-depth solar site suitability analysis on Decatur and Taylor counties
* Provide decision-makers with data tools to assist in selecting solar development sites

***Previous Term:*** 2017 Summer (Georgia – Athens) - Georgia Energy

**Partner Overview**

***Partner Organizations:***

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **POC (Name, Position/Title)** | **Partner Type** | **Boundary Org?** |
| **The Nature Conservancy, Georgia Chapter** | Cassidy Jordan, Conservation Coordinator | End User | Yes |
| **Georgia Department of Natural Resources** | Matt Elliott, Non-game Conservation Program Manager;  ‎Jon Ambrose, Chief of Non-game Conservation | Collaborator | No |

***Decision Making Practices & Policies***:

The contributions from this project will be used by The Nature Conservancy in their “Conservation by Design” decision making framework that they use for planning conservation projects. Their framework operates by considering both the status of conservation “targets” as well as stakeholder values. The conservation targets of the project are assessed using science-based methods such as on-the ground surveys, remote sensing, or consultation expertise. This information is considered in combination with stakeholder input to develop project goals and strategies that are conducive to optimizing the intersection of environmental conservation and stakeholder goals.

***Project Benefit to End User***:

The state of Georgia has a high potential to generate a significant portion of its power through solar photovoltaic panel installations. As the pace of solar power development has increased over the recent years, there is a growing need to optimize the environmental sustainability of these infrastructural installations through comprehensively informed development decisions. The Nature Conservancy is committed to supporting renewable energy and has a track record of bringing stakeholders to the table. This inclusive approach enhances collaboration among different interests by using the best-available data and generating new information and model results to avoid conflict. In addition to end products of the first term, the final deliverables from this term will be valuable in helping The Nature Conservancy work with their partners to achieve a more sustainable energy portfolio while protecting sensitive habitats.

**Earth Observations & End Products Overview**

***Earth Observations:***

|  |  |  |
| --- | --- | --- |
| **Platform & Sensor** | **Parameters** | **Use** |
| **Landsat 8 OLI** | Land cover classification | Landsat OLI images were used for land cover classification and identification of large solar sites. Further, they were used to examine land cover trends for Decatur and Taylor counties. |
| **Terra CERES** | Cloud cover | The FM1-FM4 products provided solar radiance data as an indicator for solar farm installation and potential. |

***Ancillary Datasets:***

UGA Warnell School of Forestry & Natural Resources Modeled Gopher Tortoise Habitat – Gopher tortoise suitability map

The Nature Conservancy Ventyx Data - electricity infrastructure, solar energy study areas, transmission lines

Southface Energy Institute Ground-mounted Solar Array Layer – solar farm locations

Georgia Department of Natural Resources Protected Lands Layer – protected land locations

USDA SSURGO – soil type

USDA CropScape – land cover

Georgia Clearing House Roads Layer – road locations

FEMA Floodplain layer – floodplain locations

UGA Carl Vinson Institute of Government Digital Elevation Model – elevation

UGA Carl Vinson Institute of Government County Roads – Taylor and Decatur county roads

UGA Carl Vinson Institute of Government Parcel Data – land parcels

National Weather Service SVRGIS – hail, tornado and wind database (1950-2016)

***Modeling:***

Land Use Conflict Identification Model (LUCIS plus model) (POC: Dr. Marguerite Madden, University of Georgia, Department of Geography)

***Software & Scripting:***

Esri ArcGIS 10.2 – raster manipulation and analysis, image enhancement map; creation of Landsat 8 OLI and Terra CERES map products

***End Products:***

|  |  |  |  |
| --- | --- | --- | --- |
| **End Products** | **Earth Observations Used** | **Partner Benefit & Use** | **Software Release Category** |
| **Solar Farm Conflict Potential Identification Model and Bivariate Map** | Landsat 8 OLI, Terra CERES | This model will create a framework for end products that will be used by The Nature Conservancy to create a web-based portal that enables partners, private individuals, and solar industry developers to make better decisions about siting solar facilities in a manner that will reduce impacts on sensitive habitats. Additionally, county-level analyses will be beneficial in showing the impact of solar development at a local level. | N/A |
| **Solar Growth in Georgia Outreach Materials** | Landsat 8 OLI, Terra CERES | Outreach material will be provided to partners in the form of a tri-fold brochure, one-page infographic, and flyer. The information will be used to inform the public of solar power management strategies in the state of Georgia. | N/A |
| **ArcGIS Online Story Map** | Landsat 8 OLI, Terra CERES | An interactive map created using ArcGIS Online will be used to communicate this project’s results and serve as a community outreach tool for project partners at The Nature Conservancy and Georgia Department of Natural Resources. | N/A |

**Project Handoff Package**

**Transition Plan:**

The Georgia Energy II team is planning to host an event at UGA where the team members will present their findings to the project partners, NASA DEVELOP participants, as well as a wider audience for outreach. After the presentation, the team will meet separately with the project partners and science advisors. The team will provide the partners with a package that includes all the deliverables from this term, an updated version of the ArcGIS Online Story Map from the past term and discuss any questions about the project or planning further for future terms.

**Team POC:** Suravi Shrestha, suravi.stha@gmail.com

**Partner POC**: Cassidy Jordan, cassidy.jordan@tnc.org

**Handoff Package:**

* Final draft project deliverables
* Project video
* Updated Solar Farm Potential & Conflict Identification Model results
* Bivariate Map
* ArcGIS Online Story Map

**References:**

Hernandez, R.R. et al. (2014) “Environmental impacts of utility-scale solar energy.” *Renewable and Sustainable Energy Reviews, 29*, 766-779. https://doi.org/10.1016/j.rser.2013.08.041.

Watson, J.W., Hudson, M.D. (2015). “Regional Scale wind farm and solar farm suitability assessment using GIS-assisted multi-criteria evaluation.” *Landscape and Urban Planning, 138*, 20-31. https://doi.org/10.1016/j.landurbplan.2015.02.001.