**NASA DEVELOP National Program**

****The University of Georgia

*Summer 2017*

**Short Title: Georgia Energy**

**Subtitle:** Reducing Conflicts in Siting Solar Power Facilities by Identifying Sensitive Habitats and Wildlife Populations in Areas with High Generation Potential

**VPS Title:** Georgia Forecast: Sunny with a Chance of Energy

**Project Team**

**Project Team:**

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**Advisor:**

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**Project Overview**

**80-100 Word Objectives Overview:**

This project examined the rapid growth of solar energy in Georgia and its impact on environmentally sensitive areas, and raised awareness for future planning efforts. The goals of this project were to investigate land cover change trends, identify sites for solar farm potential, map environmentally sensitive habitats, and integrate these data into a comprehensive suitability analysis. These results created end products that can be used by partners at The Nature Conservancy and the Georgia Department of Natural Resources to facilitate communication with solar site developers and provided the framework for a tool that integrates environmental variables with solar site information.

**Abstract:**

Solar energy is a rapidly growing industry in the state of Georgia. The increasing popularity of solar farms is encouraging 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 OLI in addition to solar insolation data sets from Terra CERES. 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 endangered species habitat layers, with a focus on the 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. This project also developed a case study with higher resolution and supplementary ancillary data in Taylor County, GA. 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:**

Remote sensing, Landsat, Terra CERES, Gopher tortoise, suitability analysis, solar energy, solar farm.

**Partner Organizations:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **POC (Name, Position/Title)** | **Partner Type** | **Boundary Org?** |
| The Nature Conservancy (TNC) | Cassidy Jordan, Conservation Coordinator | End User | Yes |
| Georgia Department of Natural Resources | Matt Elliott, Non-game Conservation Program Manager;‎Jon Ambrose Chief of Nongame Conservation | Collaborator | No |
| US Fish and Wildlife Service, Georgia Ecological Services Field Office | Dr. Michele Elmore, Fish and Wildlife Biologist and Eastern Indigo Snake Lead Biologist; Tamara Johnson, Lead Energy Biologist | Collaborator | No |

**Community Concerns:**

* 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 projects can have significant impacts on sensitive habitats for vulnerable species.
* There is a need for utility developers to consider endangered species habitats and the environmental risks that solar farm development poses for critical wildlife in Georgia.
* Environmental information must be made readily available to state officials involved with siting and permitting these facilities.

**Current Decision-Making Practices & Policies**:

The Nature Conservancy uses a standard framework for decision making and planning for conservation projects referred to as “Conservation by Design”. The framework takes into account science-based information regarding the current status of conservation “targets” which is assessed through on-the-ground surveys, remote sensing (most often from freely-available sources such as NAIP imagery), or expert opinion. Stakeholder values are also assessed and considered in the development of project goals and strategies to be implemented. Project investments are monitored by senior managers to ensure sound financial practices and adequate monitoring of project outputs and outcomes. This project’s contribution will fit into The Nature Conservancy’s framework, but will not replace any current processes on this particular topic.

**Decision Support Tools & Benefits:**

|  |  |  |  |
| --- | --- | --- | --- |
| **End Product** | **Earth Observations Used** | **Partner Benefit & Use** | **Software****Release** |
| Solar Farm Installation Time Lapse | Landsat 8 OLI | This time lapse product will map the rapid growth of the solar energy farm industry in the state of Georgia. Representing this growth will allow users to visualize footprints of solar farms and trends in development, which will inform decision making. | N/A |
| Solar Farm Potential & Conflict Identification Model | Landsat 8 OLI, Terra CERES, Aqua CERES | This model will create a framework for final end products that will be used by TNC 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. | N/A |
| ArcGIS Online Storybook Map  | Landsat 8 OLI, Terra CERES, Aqua CERES | Interactive map created using ArcGIS Online 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 Benefit to End User**:

The Nature Conservancy is committed to supporting a renewable energy future in order to mitigate the predicted impacts of a changing climate. Georgia has a high potential to generate a significant portion of the power used in the state through solar photovoltaic panel installations on rooftops and in undeveloped areas. As the pace of this solar power generating infrastructure has increased over the past several years, the instances of conflict between the need to generate renewable energy and the need to protect sensitive habitats from development have also increased. The Nature Conservancy has a track record of bringing stakeholders to the table to agree on shared outcomes and ways to reduce conflicts among different interests by using the best-available information and generating new information and model results to avoid conflict. The end products of this NASA DEVELOP project will be extremely valuable in helping The Nature Conservancy work with their partners to achieve a more sustainable energy portfolio while protecting sensitive habitats.

**Project Details**

**Applied Sciences National Application Addressed:** Energy

**Study Area:** GA

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

**Earth Observations & Parameters:**

|  |  |  |
| --- | --- | --- |
| **Platform & Sensor** | **Parameter(s)** | **Use** |
| Landsat 8 OLI | Land cover classification | OLI images will be used for land cover classification and identification of large solar sites.  |
| Terra CERES | Cloud cover | The FM1-FM4 products will provide solar radiance data as an indicator for solar farm installation and potential. |
| Aqua CERES | Solar radiance | The FM1-FM4 products will provide solar radiance data as an indicator for solar farm installation and potential. |

**Ancillary Datasets Utilized:**

* UGA Warnell School of Forestry & Natural Resources Modeled Gopher Tortoise Habitat – Gopher tortoise suitability map
* The Nature Conservancy Soils Profile Layer – soil
* The Nature Conservancy Digital Elevation Model – elevation
* The Nature Conservancy Electricity Infrastructure Layer – electricity infrastructure
* Southface Energy Institute Ground-mounted Solar Array Layer – solar farm locations
* Georgia Department of Natural Resources Protected Lands Layer – protected land locations
* USDA gSSURGO – soil
* 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 county roads
* UGA Carl Vinson Institute of Government Parcel Data – land parcels

**Models Utilized:**

* Land Use Conflict Identification Model (LUCIS plus model)

**Software Utilized:**

* Google Earth Engine API – land classification of Landsat 8 imagery
* Esri ArcGIS – raster manipulation and analysis, image enhancement & creation of Landsat 8 OLI and Terra CERES map products

**Project Handoff Package**

**Transition Plan:**

The Georgia Energy team is planning to hold an in-person event at UGA where the NASA DEVELOP participants will display some of their end results and an ArcGIS Online storybook map and present their findings from this term. The presentation will be open to a wider audience for outreach with the project partners at Georgia Department of Natural Resources and The Nature Conservancy. Additionally, the DEVELOP team will meet separately with partners to provide final deliverables and discuss any questions about the project or planning future terms.

*Project Continuation Plan*: The next term will pursue one of two directions (based on partner feedback):

1. refining the variables into the delivered statewide analysis, venturing into a deeper level of detail for additional results, and yielding a similar range of deliverables; or
2. focusing in on a few areas that appear viable for solar farm development (from initial analysis) and exploring additional data layers to consider when siting future development sites: such as zoning, viewshed analysis, utility maps, etc. This direction will yield a similar range of deliverables, but may be developed into tools that can be used by future planning stakeholders.

**Team POC:** Lynn Abdouni, lynn.abdouni@gmail.com

**Handoff Package:**

* Final draft project deliverables
* Project video
* Solar Farm Installation Time Lapse
* Solar Farm Potential & Conflict Identification Model results
* ArcGIS Online Storybook Map