**NASA DEVELOP National Program**

**2017 Fall Project Proposal**

**Georgia - Athens**

**Georgia Energy II**

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

**Project Overview**

***Project Synopsis*:** The goals of this project are to examine the rapid growth of solar energy in the state of Georgia, identify its potential impact on environmentally sensitive areas, and provide information to raise awareness for future planning efforts. This project will work with partners at The Nature Conservancy and the Georgia Department of Natural Resources to produce end-products that facilitate communication with solar developers and provide the framework for a tool that integrates environmental variables with solar site information. The results of this project will be used to support permitting decisions and incorporated into outreach materials for solar energy developers across Georgia.

***Community Concern:*** Utility-scale solar power development in the United States is growing at an annual rate of 30-45%, with Georgia in the top five states for most solar capacity added in 2016. While this is good news from the standpoint of mitigating the effects of a changing climate, large-scale solar arrays (or solar farms) can have significant impacts on sensitive habitats for vulnerable species such as the gopher tortoise (*Gopherus polyphemus*). In order to avoid siting new solar farms where these impacts would be most damaging, information about sensitive wildlife habitats and protected areas needs to be made readily available to state officials involved with siting and permitting these facilities.

***Source of Project Idea:*** The Nature Conservancy has been aware of this issue for several years and has collaborated with the GA Department of Natural Resources, US Fish and Wildlife Service and Southern Company on potential solutions. This project’s concept is modeled after similar work done by other chapters of The Nature Conservancy, namely Kansas.

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

***Study Location:*** GA

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

***Advisor:*** Dr. Marguerite Madden (University of Georgia)

**Partner Overview**

***Partner Organizations:***

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **POC (Name, Position/Title)** | **Partner Type** | **Boundary Org?** |
| The Nature Conservancy | 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 |

***End User Overview***

***End User’s Current Decision-Making Process:***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 are 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 implementation strategy. Project investments are monitored by senior managers to ensure sound financial practices and adequate monitoring of project outputs and outcomes. 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 when possible.

***End User’s Capacity to Use NASA Earth Observations:***

*The Nature Conservancy, Georgia Chapter* – The organization has significant familiarity with NASA Earth observations and uses them to visualize and characterize natural habitats at local, regional, and global scales. This project will increase The Nature Conservancy’s familiarity with CERES data and allow them to continue using it to support their work on this topic.

***Collaborator & Boundary Organization Overview***

***Collaborator Support:***

*Georgia Department of Natural Resources* – Mr. Elliott is an expert in herpetofauna, especially gopher tortoise, indigo snake, and other species associated with habitats at risk from solar siting in Georgia. He also has significant expertise in spatial analysis and habitat delineation, and will be a frequent advisor and consultant on this project through an existing relationship with The Nature Conservancy and the other project collaborators.

*US Fish and Wildlife Service, Georgia Ecological Services Field Office* – Dr. Elmore is a former employee of The Nature Conservancy who now serves as the Lead Biologist for the Eastern Indigo Snake program within the Georgia Ecological Services Field Office at Fort Benning. Therefore, she is familiar with both The Nature Conservancy’s and the Fish and Wildlife Service’s operations, priorities, and decision-making process in addition to being an expert in solar energy. She will be a frequent advisor and consultant on this project.Ms. Johnson is the lead energy biologist in the Georgia Ecological Services Field Office. She has coordinated with state and industry partners on wind, solar, and hydropower projects for the past six years, and has helped develop and implement best management practices for solar projects that are being utilized by the Fish and Wildlife Service throughout the Southeast.

***Dissemination by Boundary Organizations*:**

*The Nature Conservancy, Georgia Chapter* – The Nature Conservancy has a long history of disseminating data products and decision support tools through its many communications channels. The Georgia Chapter intends to develop a web-based portal through which the broader community can access and use the data products and decision-support tools to select sites for solar power generating facilities throughout the state. Staff will also organize in-person or web-based seminars to introduce partners and the broader community to the existence of these data and tools. The primary targets of outreach will include members of the energy generation community in Georgia, major land-owners, including military installations, and agencies with regulatory authority over land use decisions in the state.

***Project Communication & Transition Overview***

***In-Term Communication Plan*:** The Georgia Chapter of the Nature Conservancy will hold at least one partner meeting prior to the initiation of the NASA DEVELOP term to collaborate on the data inputs, outputs, and prioritization of model factors. During the term, The Nature Conservancy contact, Cassidy Jordan, will meet weekly via Skype with the NASA DEVELOP team to discuss any aspects of the project, including data needs, modeling approaches, output formats, and delivery of final products for dissemination to the partners.

***Transition Plan*:** The team will present their results to the Georgia Department of Natural Resources and The Nature Conservancy during an in-person event at the end of term. The Nature Conservancy intends to incorporate the final results of this project into an online map (started in the summer term). Software release is not anticipated at this time.

***Letters of Support*:** Deron Davis, Executive State Director, The Nature Conservancy, Georgia Chapter

**Earth Observations Overview**

***Earth Observations:***

|  |  |  |
| --- | --- | --- |
| **Platform & Sensor** | **Parameter(s)** | **Use** |
| **Landsat 8 OLI** | Land cover | 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:***

FEMA Floodplain layer – floodplain locations

Georgia GIS Clearing House Roads Layer – road locations

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

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

The Nature Conservancy Soils Profile Layer – soil type

The Nature Conservancy Digital Elevation Model – elevation

The Nature Conservancy Electricity Infrastructure Layer – electricity infrastructure

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

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

USDA gSSURGO – soil type

USDA CropScape – land cover

***Modeling:***

Land Use Conflict Identification Model (LUCIS plus model) (POC: Rosanna Rivero, University of Georgia)

***Software & Scripting:***

Esri ArcGIS – raster manipulation and analysis, image enhancement, map creation

Exelis ENVI 5.0 – image processing and classification

**Decision Support Tool & End Product Overview**

***End Products:***

|  |  |  |  |
| --- | --- | --- | --- |
| **End Product(s)** | **Partner Use** | **Datasets & Analyses** | **Software Release Category** |
| Solar Farm Installation Time Lapse | 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. | Landsat 8 OLI data will be used to help identify the locations of large-scale solar facilities in the state of Georgia and land cover conditions around these sites.  | N/A |
| Solar Farm Potential & Conflict Identification Model | 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. | Landsat 8 OLI, Terra CERES, and Aqua CERES data will be used along with other ancillary datasets to map the potential areas of conflict between solar facility development and environmentally sensitive habitats. | N/A |
| ArcGIS Online Storybook Map  | 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. | Landsat 8 OLI, Terra CERES, Aqua CERES, and other ancillary datasets will be integrated into an online map showing the recent trends in solar utility development across Georgia and the importance of considering environmental factors when siting these facilities.  | N/A |

***End User Benefit*:** The Nature Conservancy and the Georgia Department of Natural Resources are committed to supporting a renewable energy future to mitigate the predicted impacts of a changing climate. As the pace of the 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 incompatible development have also increased. The end products of this NASA DEVELOP project will be extremely valuable in helping The Nature Conservancy in Georgia work with their partners to achieve a more sustainable energy portfolio while protecting sensitive habitats.

**Project Timeline & Previous Related Work**

***Project Timeline:*** 2 Terms: 2017 Summer to 2017 Fall

***Multi-Term Objectives:***

* **Term 1:** 2017 Summer (GA) – Georgia Energy
	+ This term of the project will focus on creating the radiation and insolation time series and the land cover time series. These products will serve as inputs for the solar siting suitability analysis. The team will provide partners with the time series at the end of the term to establish a framework of the upcoming suitability analysis.
* **Term 2 (Proposed Term):** 2017 Fall (GA) – Georgia Energy II
	+ The second term of the project will refine the previous results and analysis by incorporating solar utility infrastructure data. Additionally, the team will conduct case studies on selected counties in Georgia to examine finer-scale solar siting criteria. This term will produce updated maps that will be used to create an online storybook map and additional outreach materials for project partners. During this term, the team will have increased communication with partners regarding the final end products and meet with solar energy stakeholders to provide additional insight for their analysis.

***Previous Terms:***

2017 Summer (GA) – Georgia Energy

***Related DEVELOP Work:***

2016 Spring (GA) – Atlanta Water Resources: Identifying Key Urban Areas to Reduce Stormwater Runoff in Metropolitan Atlanta to Maximize Conservation Efforts (Term I)

2016 Summer (GA) – Atlanta Water Resources: Identifying Key Urban Areas to Reduce Stormwater Runoff in Metropolitan Atlanta to Maximize Conservation Efforts (Term II)

2016 Fall (GA) – Atlanta Water Resources: Identifying Key Urban Areas to Reduce Stormwater Runoff in Metropolitan Atlanta to Maximize Conservation Efforts (Term III)

**Notes & References:**

***References:***

Berkeley Law. (Accessed January 2017). Mapping Lands to Avoid Conflict for Solar PV in the San Joaquin Valley. Retrieved from https://www.law.berkeley.edu/research/clee/research/climate/solar-pv-in-the-sjv/

Chapman, D. (2015, September 18). Clean energy in Georgia comes with some nasty side effects. The Atlanta Journal Constitution. Retrieved from http://www.myajc.com/news/state--regional-govt--politics/clean-energy-georgia-comes-with-some-nasty-side-effects/d0PvKFIS2IxAb307Wk0AaP/

Fuhr, M. & Hawk, K. (2016, September 20). Where Does Your Wind Energy Come From and Is It Really ‘Green”? Retrieved from http://blog.nature.org/conservancy/2016/09/20/where does-your-wind-energy-come-from-and-is-it-really-green/

Mirshak, M. (2015, May 16). Georgia solar industry growth threatening state’s gopher tortoise population. The Augusta Chronicle. Retrieved from http://chronicle.augusta.com/news/metro/2015-05-16/Georgia-solar-industry-growth-threatening-states-gopher-tortoise-population?v=1431822002

The Nature Conservancy. (Accessed January 2017). Wind Energy and Wildlife: Site it Right. Retrieved from http://www.nature.org/ourinitiatives/regions/northamerica/areas/greatplains/conservation-priorities/eco-friendly-energy.xml

The Nature Conservancy. (Accessed January 2017). [Interactive map and web application]. Central Plains Low-Risk Wind. Retrieved from http://tnc.maps.arcgis.com/apps/webappviewer/ index.html?id=789aa65256b744ad9ccd54fb90130ba8