**NASA DEVELOP National Program**

**2020 Summer Project Proposal**

**Georgia – Athens**

**Georgia Energy III**

*Reducing Habitat and Solar Site Conflict in Georgia by Developing an Environmental Sensitivity Public Mapping Tool*

**Project Overview**

***Project Synopsis*:** The solar energy market has rapidly developed in Georgia since 2011. Unfortunately, many solar sites overlap with the habitat of the gopher tortoise (*Gopherus polyphemus*) and black bear (*Ursus americanus*) within the state. The Georgia Chapter of The Nature Conservancy (TNC) and the Georgia Department of Natural Resources (GADNR) will benefit from updated conflict maps, an analysis of the progression of solar development since the completion of the first two terms of this project, and a public-facing web application that will allow for a better flow of information between interest groups and solar developers. The team will utilize Landsat 8 OLI, Sentinel-2 MSI, and the NASA POWER dataset to execute this project across the entire state of Georgia and for an in-depth analysis of the fastest-growing solar counties – Taylor, Twiggs, Decatur, and Brook. The partners will benefit from additional information on the land characteristics desired by solar developers and their overlap with the sensitive wildlife habitats of the state.

***Community Concern:*** In November of 2018, ground was broken in Twiggs County, GA for the largest solar plant in the southeast United States. Twiggs County is also home to one of the fastest-growing populations of black bears within middle Georgia. The construction of this new solar plant has altered a significant portion of the black bear habitat within the region, which was already severely threatened by urbanization. Additionally, the endangered gopher tortoise is continuously threatened by solar development in its habitat. While solar development is a positive climate mitigation strategy, these ecosystem impacts could lead to negative and unintended feedbacks for a host of flora and fauna. Increased knowledge of the required habitat for keystone species, like the aforementioned, and the potential overlap of solar sites will assist in the creation of policy and conversations that avoid detrimental cascading effects on the environment.

***Source of Project Idea:*** This project originated in 2017 when the Georgia Chapter of the TNC contacted the Athens, GA, NASA DEVELOP location. In the summer of 2019, the TNC contacted the node again with interests in repeating our previous methods and creating a tool for solar developers and environmentalists alike. Their main interest is in having something that they can update and utilize for years to come, which is not currently possible from the knowledge and products created previously.

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

***Study Location:*** GA

***Study Period:*** July2017 – June 2020

***Advisor:*** Dr. Marguerite Madden (University of Georgia), Laura Mathes (University of Georgia, Office of University Architects for Facilities Planning)

**Partner Overview**

***Partner Organizations:***

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **POC (Name, Position/Title)** | **Partner Type** | **Boundary Org?** |
| **The Nature Conservancy, Georgia Chapter** | Amy Gutierrez, Climate and Lands Coordinator | End User | Yes |
| **Georgia Department of Natural Resources** | Matt Elliott, Assistant Chief, Wildlife Conservation | Collaborator | No |

***End User Overview***

***End User’s Current Decision-Making Process:***The TNC 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), or expert opinion. Stakeholder values are also assessed and considered in the development of project goals and implementation strategies. Project investments are monitored by senior managers to ensure sound financial practices and adequate monitoring of project outputs and outcomes. The TNC 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. The state-wide approach of the project will increase the TNC’s familiarity with the resources available at intermediate scales. Additionally, given the TNC’s focus on natural resources, utilization of observations for interpretation beyond natural habitats will increase their capacity for future analysis with a broader suite of existing Earth observations.

***Collaborator & Boundary Organization Overview***

***Collaborator Support:***

*Georgia Department of Natural Resources* – Mr. Elliott is an expert in herpetofauna, especially the 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. He will be a frequent advisor and consultant on this project. Additionally, the GADNR has access to state-collected data on land use and habitat location, which is updated frequently.

***Dissemination by Boundary Organizations*:**

*The Nature Conservancy, Georgia Chapter* – The TNC has a long history of disseminating data products and decision support tools across its broad range of stakeholders. The creation of a publicly available platform will ensure distribution across a broad range of constituents including military installations, major land-owners, and energy developers. Interested organizations include the GADNR, Southface Institute, the Southeast Regional Partnership for Planning and Sustainability (SERPPAS), the Gopher Tortoise Conservation Initiative partnership, and the Georgia Association of Land Trusts. Southface Institute promotes sustainable development and green building through various mechanisms. As of the summer of 2020, the TNC and Southface are in a contractual agreement to provide knowledge and information to each other. This partnership provides the TNC with the ability to organize seminars to introduce the broader community to the end products created by the DEVELOP team.

***Project Communication & Transition Overview***

***In-Term Communication Plan*:** The team will meet weekly with partners via Google Meet. The project lead will be the main POC for communication with the partners.

***Transition Plan*:** During week 8 of the term, POCs from each partner organization will join the team via video conference to receive a demonstration of the tool and a workshop on creating land use conflict maps. As a part of the workshop, the team will display the Land Use Conflict Identification Strategy (LUCIS) conflict charts and describe the evolution of the mapping capabilities (changes in datasets, scientific methodology, etc.). This will provide partners with a well-rounded picture of what each DEVELOP team completed. After software release, the TNC and the GADNR will share the tool within their respective agencies. Additionally, the THE TNC will assist in finding the best location to host the tool so Georgia solar developers can access and utilize it as needed. In the meantime, Ms. Gutierrez will attend one of Southface’s quarterly meetings to present the work completed by the DEVELOP team, including the evolution of solar potential since the start of the Georgia Energy projects in 2017. Solar developers across the state typically attend the quarterly meeting.

***Letters of Support*:** Deron Davis, Executive Director, The Nature Conservancy – Georgia Chapter; Lisa Bianci-Fossati, Policy Director, Southface Institute

**Earth Observations Overview**

***Earth Observations:***

|  |  |  |
| --- | --- | --- |
| **Platform & Sensor** | **Parameters** | **Use** |
| **Landsat 8 OLI** | Surface reflectance | Landsat 8 OLI will be used to produce land cover maps. The maps will contribute to a layer in the LUCIS model and the tool. |
| **Sentinel-2 MSI** | Surface reflectance | Imagery will assist in mapping utility-scale solar development over time. |

***Ancillary Datasets:***

* NASA Prediction of Worldwide Energy Resources (POWER) – Solar irradiance data that can be easily integrated into ArcGIS platforms
* United States Department of Agriculture (USDA) CropScape – Provide information on land cover type and locations for mapping suitability
* USDA Soil Survey Geographic Database (SSURGO) – Soil type data across the state of Georgia will be used for input in the LUCIS model
* The Nature Conservancy Resilient Land Mapping Tool – This tool will assist in identifying sites marked as likely to sustain native plants, animals, and natural processes in the future
* Georgia Department of Natural Resources Protected Lands Layer – Provide the locations of protected land for a layer in the classifications and tool
* Southface Energy Institute Ground-mounted Solar Array Layer – Solar farm locations will be used in plotting existing locations

***Modeling:***

* Land Use Conflict Identification Strategy (POC: Marguerite Madden, University of Georgia) – Identifying suitable and sensitive land locations for solar development

***Software & Scripting:***

* Esri ArcMap 10.6 – Raster manipulation and analysis, image enhancement
* Esri ArcGIS Online – Web application creation
* Google Earth Engine – Imagery processing
* Python 3.8.1 – Manipulation of POWER dataset

**Decision Support Tool & End Product Overview**

***End Products:***

|  |  |  |  |
| --- | --- | --- | --- |
| **End Product** | **Partner Use** | **Datasets & Analyses** | **Software Release Category** |
| **Solar Site Conflict Bivariate Map Timeseries** | Providing maps of the progression of solar sites since 2017 will assist in visualizing the transformation of the land and the rate of solar expansion. | Landsat 8 OLI and USDA CropScape will be used to create the land cover layer, the POWER dataset will be used for solar potential information. All other ancillary datasets will provide additional layer information to assist in layer production for the LUCIS model and map. | I |
| **2017 vs 2020 Solar Suitability Assessment** | The partners will gain knowledge that assists them in knowing the percent change in land classes, environmental sensitivity, and species habitat. | Landsat 8 OLI and USDA CropScape will be used to create the land cover layer, the POWER dataset will be used for solar potential information. All other ancillary datasets, including solar farm location data, will be used as additional layers of information to assist in layer production for the LUCIS model and map. | I |
| **Land Use Conflict Mapping Guide** | Partners can use this guide to produce additional conflict maps for future species studies. | This guide will be presented during a workshop in week 8. Based on feedback during the workshop, the team will update the document to make it a fully functioning guide for the partners. | N/A |
| **Solar Suitability Web App** | To assist the partner’s conservation goals in Georgia, they will be able to share this app with solar developers. This will enable developers to select land sites that meet their desired characteristics and remain aware of the implications for animal habitats. | Landsat 8 OLI will provide land cover imagery for the tool. Sentinel-2 MSI will assist in plotting solar sites. All other data listed as ancillary will be layers included in the application that users can visualize. | I |

***End User Benefit*:**

The TNC and the GADNR are committed to supporting a renewable energy future to mitigate the predicted impacts of a changing climate. As the pace of solar development has increased, there is increased conflict between the need to generate renewable energy and the need to protect sensitive habitats from incompatible development. The end products of this project will be extremely valuable in helping the TNC in Georgia work with its partners to achieve a more sustainable energy portfolio while protecting sensitive habitats. Making end products public facing will facilitate conversations between developers and conservationists.

During the spring and summer of 2020, the TNC is working directly with Southface to assess the needs of solar developers and the potential for those needs to align or misalign with environmentally friendly practices. While having this partnership and direct conversations with solar developers, The Nature Conservation and Georgia Department of Natural Resources would like to finalize the Georgia Energy projects with a long-lasting public-facing tool.

**Project Timeline & Previous Related Work**

***Project Timeline:*** 3 terms: 2017 Summer to 2020 Summer

***Multi-Term Objectives:***

* **Term 1:** 2017 Summer (GA) – Georgia Energy
  + The team analyzed land cover trends from Landsat 8 OLI and solar insolation datasets from Terra CERES. These Earth observations were combined to classify and extract data layers for solar site suitability and the conflict identification model. Additionally, the DEVELOP team utilized endangered species habitat layers and focused on the gopher tortoise primarily due to its role as a keystone species in these sensitive areas. These data were used to generate end products that depicted potential conflicts between ideal solar energy sites and endangered species habitats and prioritize development areas outside of these conflicts across the entire state of Georgia.
* **Term 2:** 2017 Fall (GA) – Georgia Energy II
  + This project continued to use Landsat 8 OLI and Terra CERES. They classified and extracted data layers for a solar site suitability and conflict identification following the LUCIS model. Additionally, the DEVELOP team utilized habitat layers of the gopher tortoise 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. The team examined potential conflicts in the counties with the most solar development, Decatur and Taylor to provide a local-level analysis.
* **Term 3 (Proposed Term):** 2020 Summer (GA) – Georgia Energy III
  + This term will create LUCIS map products to assess the accuracy of and changes from the 2017 products and create a user-friendly ArcGIS Webmap that will assist solar developers in visualizing their desired or existing locations for solar energy while gaining information about the potential environmental harm the development could cause. The team will present the work and give a demonstration of creating LUCIS products during the handoff meeting. The map products will span the entirety of Georgia with an emphasis on the counties of Taylor, Twiggs, Decatur, and Brook.

***Previous Terms:***

2017 Fall (GA) – Georgia Energy II: Reducing Conflicts in Siting Solar Power Facilities by Identifying Sensitive Habitats and Wildlife Populations in Areas with High Generation Potential

2017 Summer (GA) – Georgia Energy: Reducing Conflicts in Siting Solar Power Facilities by Identifying Sensitive Habitats and Wildlife Populations in Areas with High Generation Potential

***Related DEVELOP Work:***

2018 Summer (MSFC) – New Mexico Energy: Identifying Optimal Site Locations for Wind Energy Farms Considering Ecological and Social Impacts

2019 Summer (JPL) – Douglas County Energy: Identifying Areas with High Solar Power Potential in Kansas via NASA Earth Observations and LiDAR

**Notes & References:**

***Notes*:** On May 13, 2020, Southface Institute and the TNC hosted a webinar for solar developers in the state of Georgia. There were 13 attendees who learned about the previous DEVELOP projects and were told about the upcoming term. Following the webinar, the developers were sent a link to a web survey that inquires information about how the select solar sites in reference to land types and proximity from infrastructure. These survey responses will allow the team to build accurate and useable layers in the tool.

***References:***

Balkcom, G., Bond, B., Day, K., Frazier, S., Hammond, A., Larson, D., …Zellner, D. (2018). *Strategic management plan for Black Bears in Georgia (2018-2027)*. Georgia Department of Natural Resources Wildlife Resources Division. <https://georgiawildlife.com/sites/default/files/wrd/pdf/regulations/BearPlanDraftOct2018.pdf>

Bond, B., Hammond, A., Nelms, G. (n.d.). *Georgia Black Bear project report and status update: Population parameters and harvest characteristics*. U.S. Fish and Wildlife Service.

GA Solar Georgia Solar Energy Association. (n.d.). *Georgia solar policy and laws*. <https://www.gasolar.org/georgia-solar-policy-and-laws>

Origis Energy. (n.d.). *Groundbreaking event for Twiggs County solar | GA solar 4 in Georgia*. <https://www.origisenergy.com/groundbreaking-event-for-twiggs-county-solar-ga-solar-4-in-georgia/>