**NASA DEVELOP National Program**

**2017 Summer Project Proposal**

**NASA Marshall Space Flight Center**

**Thailand Cross-Cutting**

*Utilizing Suomi NPP’s Day-Night Band to Assess Energy Consumption in Rural and Urban Areas as an Input for Poverty Analyses*

**Project Overview**

***Project Synopsis*:** The project aims to measure light emissions at night across Thailand to utilize energy consumption in urban and rural areas as an input to poverty indicators. Light emissions will be measured with Suomi National Polar-orbiting Partnership Visible Infrared Imaging Radiometer Suite’s Day/Night Band (Suomi NPP VIIRS DNB). Analyses will include the degree to which electricity decreases outside of a city, distance of lights from major highways and thoroughfares, and seasonality of night lights. This data can be combined with other census demographics to produce enhanced poverty indices to help inform and support poverty reduction and aid efforts.

***Community Concern:*** Poverty in Thailand has been reducing in the past 30 years due to periods of economic growth. Currently 13% of the population is impoverished—however, due to reoccurring droughts, decreases in agricultural prices, and, therefore, an unstable economy can all contribute to rises in poverty over the next few decades. According to the World Bank, 6.7 million people live within 20% above the national poverty line and are at risk of becoming impoverished if the economy slows. Therefore, it is important to determine new methods to identify where the poverty is occurring and what groups of the population are most at risk.

***Source of Project Idea:*** This project idea originated from several talks with the Royal Thai Embassy, NASA SERVIR, and the Asian Disaster Preparedness Center (ADPC). Eric Anderson from NASA SERVIR-Mekong Hub offered the idea, while the Royal Thai Embassy expressed their interest in the project noting that it would produce very helpful products for the region.

***National Application Area(s) Addressed:*** Cross-Cutting

***Study Location:*** Thailand

***Study Period:*** January 2016 – December 2016

***Advisor(s):*** Dr. Jeffrey Luvall (NASA Marshall Space Flight Center), Dr. Robert Griffin (University of Alabama in Huntsville), Eric Anderson (NASA SERVIR Science Coordination Office), Leigh Sinclair (University of Alabama in Huntsville, Information Technology and Systems Center)

**Partner Overview**

***Partner Organization(s):***

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **POC (Name, Position/Title)** | **Partner Type** | **Boundary Org?** |
| Royal Thai Embassy | Gam Bunyakiat Petri, Project Consultant and Policy Analyst  | Collaborator | Yes |
| Asian Disasters Preparedness Center (ADPC) | Peter Cutter, SERVIR-Mekong Science & Data Co-Lead Peeranan Towashiraporn, Chief of Party | End User | Yes |
| NASA SERVIR Science Coordination Office | Eric Anderson, SERVIR-Mekong Science Coordination Lead Kel Markert, SERVIR-Mekong Research Associate | Collaborator | No |

***End-User Overview***

***End-User’s Current Decision-Making Process:***ADPCserves as a liaison to regional organizations throughout the Lower Mekong to build their capacity to keep them informed for further decision making. The final products of this project can serve as a basis for their future research of poverty analysis throughout surrounding Asian countries. From there, decisions can be made as to what areas should receive the most aid for poverty conditions.

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

*Asian Disasters Preparedness Center (ADPC)* – ADPC is already familiar with Earth observations. They respond to end user needs for Earth observations and information dissemination/management systems by increasing their capacity to access and use such tools. Furthermore, this project will expand their knowledge with Suomi NPP VIIRS DNB.

***Collaborator & Boundary Organization Overview***

***Collaborator Support:***

*Royal Thai Embassy* – The Royal Thai Embassy will be communicating with the team to provide information about the state of poverty in Thailand and offer insight as to what facets of the research will helpful for the people of Thailand.

*NASA SERVIR Science Coordination Office* – NASA SERVIR will be involved through their meetings with the team where they will offer their expertise in remote sensing and experience with the Mekong region.

***Dissemination by Boundary Organizations*:**

Officials at the Royal Thai Embassy will serve as the liaison to local organizations and decision makers throughout Thailand. The Royal Thai Embassy will provide these local parties with the derived end-products and results that will improve disaster management practices and the allocation of resources.

ADPC will also serve as a liaison to regional organizations throughout the Lower Mekong.

***Project Communication & Transition Overview***

***In-Term Communication Plan*:** The team lead of the project will set up partner calls during the first week of the term for participants and partners to introduce themselves and discuss any possible updates or desired changes to the project. Communication with the Embassy should always include a DEVELOP NPO representative. Further communication throughout the term will occur on a weekly or biweekly basis via email, teleconference, or, for local partners, and in-person meeting.

***Transition Plan*:** The handoff of project end products for local partners will occur via flash drive during an in-person presentation. For non-local partners, end products will be delivered virtually in conjunction with a teleconference or Google Hangout presentation of the project’s findings. The partners will use this information during their decision making in Thailand. A software release is not anticipated for this project.

**Earth Observations Overview**

***Earth Observations:***

|  |  |  |
| --- | --- | --- |
| **Platform & Sensor** | **Parameter(s)** | **Use** |
| **Suomi NPP VIIRS** | Day/Night Band (DNB) | To identify areas that lack high light emissions as a proxy for poverty occurrence |

***Software & Scripting:***

Esri ArcMap 10.3 – Raster Manipulation/Analysis, Image Enhancement, and Map Creation of Suomi NPP DNB

Google Earth Engine API – raster manipulation, statistical interpretation, map creation

**Decision Support Tool & End Product Overview**

***End Products:***

|  |  |  |  |
| --- | --- | --- | --- |
| **End Product(s)** | **Partner Use** | **Datasets & Analyses** | **Software Release Category** |
| **Night-Time Light Seasonality Time Series** | This time series will show light emissions of different seasons throughout the year. This will be useful for determining the seasonality of energy consumption in Thailand. | Suomi NPP VIIRS DNB will be used to showcase the light emissions at night throughout the different seasons in Thailand. | N/A |
| **Enhanced Poverty Indices** | Factors such as the degree at which light emissions decrease further away from cities or distance of light from highways will aid in the creation of an indices that can be used to identify poverty. These indices will be correlated with poverty and other socioeconomic data to assess its accuracy.  | Suomi NPP VIIRS DNB will be used in conjunction with socioeconomic data to determine a standard for measuring poverty with remotely sensed data. | N/A |
| **Socioeconomic Analysis of Poverty in Thailand** | This analysis will focus on the results from the poverty indices as well as socioeconomic data such as population of females, children, and other at-risk members of Thailand society. This can highlight the type and number of at-risk people in the population that are faced with poverty. This can inspire further research and aid to those certain groups in the population | Results from the Enhanced Poverty Indices and socioeconomic data | N/A |

***End-User Benefit*:** These products are beneficial to the end user by identifying areas where aid should be directed for members of the population that are impoverished. This study offers a less costly and time-intensive survey of poverty in Thailand. These products will also increase partners’ capacity to use remote sensing methods of analyzing socioeconomic issues throughout Southeast Asia.

**Project Timeline & Previous Related Work**

***Project Timeline:*** 1 Term: 2017 Summer

***Multi-Term Objectives:***

* **Term 1:** 2017 Summer (MSFC) – Thailand Cross-Cutting
	+ The overall objective of this project is to use Suomi NPP VIIRS’s DNB to measure light emissions at night as a proxy for poverty in the country. Socioeconomic factors to poverty will be addressed in this analysis along with differences in seasonality of the light emissions. Finally a creation of poverty indices will be formed by analyzing the degrees to which light emissions decrease as one moves further away from landmarks such as cities and highways. This will be beneficial to the project partners because it will save time and money for surveying as well as help in the decision making of where and who to give aid to.

***Related DEVELOP Work:***

2017 Spring (Wise County Clerk’s Office) – Wyoming Cross-Cutting: Utilizing NASA Earth Observations to Detect Changes in Nighttime Sky Brightness in Grand Teton National Park

**Notes & References:**

***Notes*:**

***References:***

Noor, A. M., Alegana, V. A., Gething, P. W., Tatem, A. J., & Snow, R. W. (2008). Using remotely sensed night-time light as a proxy for poverty in Africa*. Population Health Metrics, 6*(1). doi:10.1186/1478-7954-6-5

The World Banl (n.d.). Thailand Overview. *Countries- Thailand* http://www.worldbank.org/en/country/thailand/overview.

United Nations Development Programme (UNDP) (n.d.). About Thailand. *UNDP in Thailand*. http://www.th.undp.org/content/thailand/en/home/countryinfo.html