**NASA DEVELOP National Program**

****NASA Goddard Space Flight Center/NASA Marshall Space Flight Center/Wise County

**Summer 2015**

**Short Title: Alto Orinoco Health & Air Quality**

**Subtitle:** Utilizing NASA Earth Observations to Locate Yanomami Villages in the Alto Orinoco Municipality for Targeted Eradication of River Blindness Disease

**VPS Title:**

1. Eradicating Disease with the Help of NASA Earth Observations
2. It Takes a Village: Eradicating Onchocerciasis using Remote Sensing

(Input on which title name should be selected would be greatly appreciated)

**Project Team & Partners**

**Project Team:**

Goddard Space Flight Center

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**Partner Organizations**

The Carter Center, End-User

POC: Dr. Frank Richards, Director of River Blindness Elimination Program

University of Minnesota, Collaborator

POC: Claire Porter, Remote Sensing Scientist for Polar Geospatial Center

SERVIR, Collaborator

POC: Dan Irwin, Earth Scientist for NASA

**Project Details**

**Applied Sciences National Applications Addressed:**

Health and Air Quality

Ecological Forecasting

**Study Area:**

Alto Orinoco Municipality

Northern Brazil

Southern Venezuela

**Study Period:**

GSFC and WC: June 2013 - April 2015

MSFC: January 2011 – Present, November to February & May to August

**Earth Observations & Parameters**

Landsat 8, OLI and TIRS - Cloud-Free Composite of Study Area and Normalized Difference Vegetation Index (NDVI)

Terra, ASTER - Land Cover and Digital Elevation Model

SRTM - Digital Elevation Model

VIIRS - Night Lights

WorldView-1,2,3, Land Cover

IKONOS, Land Cover

GeoEye-1,2, Land Cover

QuickBird, Land Cover

**Ancillary Datasets Utilized**

* ISRIC SoilGrids 1km- Soil Properties

**Models Utilized**

* University of Minnesota Digital Globe Mosaic Model

**Software Utilized**

ENVI 5.1 and ENVI Classic – Image Analysis using Vegetation Indices and Match-filter Technique

ESRI ArcGIS 10.2.1 and 10.3 - Raster Manipulation and Analysis of ASTER DEM and Landsat Data, Land Cover Classification of Landsat Imagery, and Map Creation

**Project Overview**

**80-100 Word Objectives Overview**

Onchocerciasis - also known as river blindness – is a neglected tropical eye and skin disease that is present among the indigenous and nomadic Yanomami tribes within the Alto Orinoco municipality of Venezuela. This study aimed to use NASA Earth observations and DigitalGlobe data to identify remote villages in densely forested areas. Mapping villages will allow The Carter Center to pinpoint locations for initial disbursement of medical treatment, as well as returning to locations for follow-up treatments.

**Abstract**

Onchocerciasis is a treatable disease caused by the vector-borne parasite *Onchocerca volvulus. O. volvulus* is transmitted through bites of infected black flies from the genus *Simulium*. Once inside the human host, *O. volvulus* migrate to the skin, various organs, and eyes, causing debilitating itching and rashes, disfigurement, visual impairment, and complete blindness. The Alto Orinoco municipality of Venezuela is the last remaining area for active transmission of Onchocerciasis in the Americas. The Yanomami tribes occupy this area in secluded rainforest villages and migrate frequently due to shifting cultivation, flooding, and food shortages. This presented a unique set of challenges to health workers in distributing regular treatments, collecting data, and locating groups of nomadic people whose survival depends on relocating regularly and living in isolation. The NASA DEVELOP teams analyzed data from NASA’s Landsat 8 Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS) and Terra Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) to map suspected locations of the Yanomami villages from 2011 to 2015. Spectral analysis, cloud masking, soil properties, and WorldView 3 high-resolution comparisons were also utilized to produce the end-user products. Ultimately, this project assisted The Carter Center River Blindness Elimination Program in targeting its efforts to eliminate Onchocerciasis in the Americas by the end of 2015.

**Community Concerns**

* Onchocerciasis is classified as one of 17 debilitating Neglected Tropical Diseases (NTD) that the World Health Organization (WHO) and The Carter Center are working to eradicate.
* The WHO estimates more than 1 billion people (1/6th of the world’s population) are currently affected by at least one crippling NTD.
* Globally, there are an estimated 120 million people at risk of Onchocerciasis.
* In the Yanomami Territory region of Brazil and Venezuela, there are approximately 20,500 people in need of treatment for Onchocerciasis.
* By supporting the Carter Center’s Onchocerciasis Elimination Program, this project will help identify at-risk populations in the Venezuelan Amazon.
* Onchocerciasis is the second leading cause of blindness due to infection, second only to Trachoma.
* The majority of cases occur in developing countries among the world’s poorest communities. This is, in part, due to lack of access to adequate health care and treatment.
* The crippling effects of this disease reinforce the cycle of poverty by dramatically impacting a person's quality of life, ability to work, and ability to visually learn survival skills and cultural practices.
* Other countries, including Colombia, Mexico, and Guatemala, have previously eliminated Onchocerciasis.  The Yanomami reside in poorly accessible regions of the Amazon where transmission rates remain high.

**Current Management Practices & Policies**

Currently, The Carter Center’s Onchocerciasis Elimination Program for the Americas (OEPA) has been working with the Ministries of Health in Latin America and the 2013 World Health Organization mandate CD52/INF4 towards the elimination of Onchocerciasis (River Blindness) in the Americas by the end of 2015. The targeted Yanomami territories have presented significant difficulties in distribution of effective treatment due to their remote physical locations, rigid political boundaries, and limited research options. In the past, village identification has been performed by costly helicopter field surveys that were ineffective in predicting the migrations of the villages. More recently, The Carter Center purchased high resolution data and partnered with the University of South Florida in an attempt to use remote sensing methods for village identification.  The Carter Center operates primarily by training local health workers to deliver treatments, conduct population censuses and collect data; they are seeking assistance in identifying remote, nomadic villages to expand operations and achieve a threshold of treatment that will assure disease eradication.

**Decision Support Tools & Benefits**

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| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| Yanomami Village Location Map | Landsat 8 OLI/TIRS  WorldView-1,2,3  IKONOS  GeoEye-1,2  QuickBird | Provides End-Users with accurate locations of targeted villages for efficient planning of disease eradication missions. |
| Yanomami Suitability Map | Landsat 8 OLI/TIRS | Helps identify suitable habitable locations of Yanomami villages. |
| Land Cover Change Detection | Terra ASTER | Shows the migratory patterns of the Yanomami. |
| “Forest vs Non-Forest” Classification Map | Landsat 8 OLI/TIRS Cloud-Free Composite | The “Forest vs Non-Forest” Classification Map provides The Carter Center with vegetation and soil properties of the study area. |

**Project Imagery**

**[Insert image here]** To be added later.

**Caption:**

**Image:**