**NASA DEVELOP National Program**

****Langley Research Center

**Spring 2016**

**Short Title: El Salvador Ecological Forecasting II**

**Subtitle:** Utilizing NASA Earth Observations to Predict Deforestation and Degradation in El Salvador

**VPS Title:** El Salvador’s Changing Landscape: Getting to the Ground Truth

**Project Team & Partners**

**Project Team:**

Britta Dosch (Project Lead), britta.c.dosch@nasa.gov

Rebekke Muench

Amy Wolfe

Jacob Patrick

Garrett Kidd

Labreshia Mims

**Advisors & Mentors:**

Dr. Kenton Ross (NASA DEVELOP National Program)

**Past Contributors:**

Jordan Ped

Courtney Duquette

Clarence Kimbrell

Susannah Miller

Stephen Zimmerman

**Partner Organizations:**

Ministerio de Medio Ambiente y Recursos Naturales (MARN) (End-User), POC: Giovanni Molina

The Earth Institute, Columbia University, Agroforestry for Biodiversity and Ecosystem Services (ABES) Project (Collaborator), POC: Dr. Sean Smukler & Sean Kearney; Boundary Organization

USAID (Collaborator), POC: Jason Landrum (Boundary Organization)

**Project Details**

**Applied Sciences National Applications Addressed:** Ecological Forecasting, Agriculture

**Study Area:** La Mancomunidad La Montañona, Chalatenango, El Salvador

**Study Period:** December 1986 – January 2016; 2030

**Earth Observations & Parameters:**

Landsat 4/ 5 (TM) & 8 (OLI/TIRS) - Land Use/Cover; Vegetation

RapidEye Constellation, Jena-Optronik - Land Use/Cover; Vegetation

QuickBird, BGIS 2000 - Land Use/Cover; Vegetation

**Ancillary Datasets Utilized:**

* ABES Field Surveys - Land cover
* Hansen et al. Global Forest Cover Dataset - Land Cover
* NASA Shuttle Radar Topography Mission (SRTM) - Land use/cover; Vegetation

**Models Utilized:**

* ClarkLab’s TerrSet Land Change Modeler

**Software Utilized:**

Google Earth Engine - Land classification of Landsat imagery

ArcGIS - Raster manipulation/analysis, image enhancement, and map creation

Multispec– Land cover classifications

Python - Programming language, land classifications, image manipulation

TerrSet- Land change modeler, forecasting

**Project Overview**

**80-100 Word Objectives Overview:**

To develop a methodology for monitoring and forecasting ecological change in La Mancomunidad La Montañona region in El Salvador. El Ministerio de Medio Ambiente y Recursos Naturales (MARN) and other end-users will use this methodology to anticipate locations at risk of deforestation, allowing them to determine where to focus land use management and future REDD+ strategies at a national level.

**Abstract:**

Tropical forests are vital ecosystems because of their rich biodiversity and carbon sequestration abilities. Unfortunately, due to a number of factors, these forests are threatened by deforestation and degradation and are in need of comprehensive management strategies. The conservation of forests is not only vital for biodiversity but also for the ecosystem services they provide to the surrounding communities. The micro-region of La Mancomunidad La Montañona in Chalatenango, El Salvador is a hilly area with a population dependent upon subsistence and livestock farming, often utilizing slash and burn agricultural techniques. Using NASA Earth observations in collaboration with Ministerio de Medio Ambiente y Recursos Naturales (MARN), the Earth Institute of Columbia University, and Agroforestry for Biodiversity and Ecosystem Services (ABES) Project, a methodology was developed for stakeholders and policy makers to monitor long-term changes in forest cover and to predict significant changes in woody forest biomass. A baseline time series showing forest cover and land use land cover (LULC) from December 1986 to January 2015 was used to forecast forest cover change through the year 2030. These predictions will allow stakeholders to identify at-risk regions to focus forest conservation efforts and management strategies.

**Community Concerns:**

* Tropical forests are recognized as essential carbon sinks, vital to maintaining the global carbon budget, and are home to 80% of the world’s terrestrial biodiversity.
* El Salvador is the second most deforested country in Latin America, having lost almost 85% of its forest cover since the 1960’s. It also has the highest population density in Central America. These two factors make forests especially susceptible to deforestation and forest degradation.
* The pine oak forest in La Mancomunidad La Montañona, with both cultural and ecological importance, is threatened by encroachment by the surrounding agricultural and pastoral activities.
* Subsistence farmers rely on forests to provide soil stability, prevent mudslides, and reduce nutrient loss. Today, over half of El Salvador is deemed as unsuitable for cultivation due to severe soil erosion.
* The communities of La Montañona, San Salvador, and other regions downstream, rely on the pine oak forests to maintain local stream and river quality.

**Current Management Practices & Policies**:

El Salvador has few strict environmental policies currently in place. Although the government has designated protected forested areas, forestry laws often go unenforced due to lack of management and funds. There has, however, been a recent push to develop and implement new laws and regulations that would help benefit the environment, especially the forests that have suffered over the last few decades. The Ministry of the Environment and Natural Resources (MARN) is working with the Earth Institute at Columbia University’s ABES Project to determine the best ways to regulate effective payment for ecosystem services (PES) programs and to implement Reducing Emission from Deforestation and Forest Degradation (REDD+) guidelines. Efforts include establishing a national forest inventory and identifying priority areas for conservation efforts.

**Decision Support Tools & Benefits:**

|  |  |  |
| --- | --- | --- |
| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| Forecasted Land Change Map for 2030 | Landsat 4/ 5 (TM) & 8 (OLI), RapidEye Constellation, QuickBird | Allow partners to anticipate and mitigate potential locations at risk for deforestation and incorporate this into REDD+ strategies |
| Land Use, Land Cover (LULC) maps | Landsat 4/ 5 (TM) & 8 (OLI), RapidEye Constellation, QuickBird | Provide insight into past and current land cover changes. |

**Project Imagery**

**Caption:**

**Image:**

**Software Release Requirements**

N/A

**Software Title:** N/A

**Software Abbreviation:** N/A

**Technical Point of Contact:** N/A

**Brief Description of the Software** N/A

**Type of Code:** N/A

**Will the software include any embedded computer databases?** N/A

**Does the software use or call any open software or libraries?** N/A

**List the software or libraries used, under what license they were obtained, and the URL for the license in the table below:**

|  |  |  |
| --- | --- | --- |
| **Name** | **License** | **License URL** |
| N/A | N/A | N/A |

**Full Software Description and Plan**

**Introduction/Objective:**

N/A

**Applications and Scope:**

N/A

**Capabilities:**

N/A

**Interfaces:**

N/A

**Assumptions, limitations, & Errors:**

N/A

**Testing:**

N/A