**NASA DEVELOP National Program**

University of Georgia

**Fall 2014**

**Colombia Ecological Forecasting II**

*Utilizing NASA Earth Observations to Enhance the Conservation of Colombia’s Most Endangered Primate, the Cotton-top Tamarin (Saguinus oedipus)*

**Team Lead:** Caren Remillard, carenremillard@gmail.com

**Team Members:**

Mohamed Amin

Erick Braun

Ning Chen

Hillary Essig

Peter Hawman

Tunan Hu

**Advisors & Mentors:**

Dr. Marguerite Madden (University of Georgia)

Dr. Thomas Jordan (University of Georgia)

Dr. Nathan Nibbelink (University of Georgia)

Daniel Mesa (University of North Georgia)

Steve Padgett-Vasquez (University of Georgia)

**Past or Other Contributors:**

Nikos Kavoori

Suravi Shrestha

Zennure Ucar

Xiaohe Yu

**Applied Sciences National Applications Addressed:**

Ecological Forecasting

**Study Area:** Northwest Colombia, Departments of Atlántico, Bolívar, and Sucre

**Study Period:** February-March 2014

**Partners/Collaborators**

Disney’s Animal Kingdom: Dr. Anne Savage

Proyecto Tití: Dr. Anne Savage

Fundación Proyecto Tití: Rosamira Guillen

**80-100 Word Blurb**

The Cotton-top tamarin*,* a New World primate endemic to the forests of Northwest Colombia, is listed as critically endangered by the International Union for Conservation of Nature (IUCN) with roughly 6,000 individuals remaining. Their habitat continues to be threatened by various human activities such as agriculture and urbanization. The project’s partner organization, Proyecto Tití, aims to conserve this endangered species through field research, public awareness, and community outreach. The DEVELOP team integrated NASA Earth observations with field data to forecast future conditions, identify additional suitable habitat, and focus reforestation and conservation efforts.

**Community Concerns**

* Proyecto Tití is committed to protecting the Cotton-top tamarin (*Saguinus oedipus*), one of the most threatened primates in the world. This species is listed as critically endangered by the International Union for Conservation of Nature (IUCN) Red List, with roughly 6,000 individuals remaining in the wild.
* Colombia is among the top ten countries to suffer significant loss of forested habitat with a 0.5% annual rate of destruction and the status of their forest habitat has been designated as critically endangered throughout a significant portion of Colombia.
* Study by Miller et al. (2004) documented a 31% decrease in forested habitat between the years 1990 and 2000 within the tamarins’ historic distribution. This decrease was due to conversion of tropical forest habitat to agricultural uses and urban development, extraction of forest resources for firewood and lumber, and logging on both private and protected areas.
* Rate of habitat destruction continues at an unprecedented rate in Colombia and the creation of small isolated forest remnants is prevalent throughout much of the distribution of the Cotton-top tamarin.
* Cotton-top tamarins have a localized distribution within northwest Colombia (departments of Antioquia, Atlántico, Bolívar, Chocó, Cordoba, and Sucre) making them highly vulnerable to the effects of habitat destruction.

**Current Management Practices & Policies**

Founded in 1985, Proyecto Titi is a conservation program that dedicates itself to promote public awareness of the plight of the Cotton-top tamarin through a variety of initiatives involving numerous individuals and organizations.This conservation program also seeks sustainable alternatives to generate income for local communities that live near forests in need of protection (Proyecto Tití, 2014). Proyecto Tití performs field studies to monitor tamarin populations and behavior. In 2004, a land cover classification map was created using Landsat 4, 5 and 7 imagery covering the historic range of the Cotton-top tamarin (Miller et al, 2004). Unfortunately, misclassification of forests overestimated the areas identified as suitable for Cotton-top tamarins.

Currently, there are two national parks and one protected reserve within the historic range of the Cotton-top tamarin. Paramillo National Park was established in 1977 by the national government. It is managed by Parques Nacionales Naturales de Colombia (the governmental agency responsible for regulating and protecting national parks). The park is closed to the public and is only accessible to students and scientists who hold a special permit. Los Colorados was established that same year by the national government as a wildlife sanctuary. It is managed by Parques Nacionales Naturales de Colombia and is open to the public. Paramillo National Park, Sanctuary Los Colorados, and the protected reserve called Montes de Maria Reserve have lost 42%, 71%, and 70% of their forested areas, respectively, since their protected status was instituted (Miller et al., 2004).

**Abstract**

The Cotton-top tamarin (*Saguinus oedipus*), a New World primate endemic to the forests of Northwest Colombia, is listed as critically endangered by the International Union for Conservation of Nature (IUCN). Approximately 6,000 individuals remain. The majority of the forest within the tamarin’s range has been cleared for agriculture or ranching. To address the plight of the cotton-top tamarin, NASA DEVELOP partnered with Disney’s Animal Kingdom and Proyecto Tití, a conservation program that makes the preservation of natural resources feasible for local communities in Colombia through education, field work, and community outreach. This project utilized data collected by the Operational Land Imager (OLI) onboard Landsat 8 and the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) onboard Terra to examine suitable tamarin habitat and identify practical areas in which to implement reforestation and conservation efforts. The team developed a multi-input model called the Cotton-top Tamarin Suitable Forest Model (CTSFM). The CTSFM integrated landscape metric calculations, slope, field data, and proximity to selected features with a land use land cover classification map constructed during a previous DEVELOP project. The results will assist Disney’s Animal Kingdom and Proyecto Tití in purchasing and protecting land with the most potential for forest connectivity. This will ultimately provide a more continuous habitat for the Cotton-top tamarins and sympatric species.

**Decision Support Tools**

* Cotton-top Tamarin Suitable Forest Model (CTSFM) - A weighted overlay model that produces spatial representation of suitable forest patches with potential for connectivity, taking multiple inputs such as proximity to selected features, forest patch area, and landscape metric calculations as weighting factors
* Historic Range Connectivity Assessment - A series of maps displaying suitable forest patches with potential for connectivity in the Colombian departments of Atlántico, Bolivar, and Sucre within the historic range of the Cotton-top tamarin

**Benefit to End-User:**

* Enhance on-going efforts and assist local resource managers in prioritizing critical habitats at risk
* Better understanding of the current distribution of suitable habitat and its potential for connectivity, which will aid in future conservation policy and reforestation initiatives
* Efficiently identify priority areas for conservation and restoration in the departments of Atlántico, Bolívar, and Sucre

**Earth Observations & Parameters**

* Landsat 8, OLI and TIRS - Land cover and vegetation indices
* Terra, ASTER – Digital Elevation Model

**Future Applicable NASA Missions**

N/a

**Models Utilized**

Tom Prebyl, Warnell School of Forestry and Natural Resources at UGA, Edge Density Python Script

Fall 2014 Colombia Ecological Forecasting Team, Cotton-top Tamarin Suitable Forest Model (CTSFM)

**Ancillary Datasets Utilized**

Proyecto Tití Field Surveys, *in situ* measurements, GPS points - census transects with tamarin sightings and vegetation types

**Software Utilized**

* ArcGIS - Raster Manipulation/Analysis, Image Enhancement & Map Creation of Landsat OLI and Terra ASTER DEM

**References**

Fedigan, L., & Jack, K. (2000). Neotropical Primates in a Regenerating Costa Rican Dry Forest: A comparison of Howler and Capuchin Population Patterns. *International Journal of Primatology,* *22*(5), 689-713.

Fetene, A., Yeshitela, K., & Desta, H. (2012). Approaches to Conservation and Sustainable Use of Biodiversity- A Review. *Nature and Science,* *10*(12), 51-62.

Hickey, J., Carroll, J., & Nibbelink, N. (2012). Applying Landscape Metrics to Characterize Potential Habitat of Bonobos (Pan paniscus) in the Maringa-Lopori-Wamba Landscape, Democratic Republic of Congo.*International Journal of Primatology,* *33*, 381-400. doi: 10.1007/s10764-012-9581-8

Holzmueller, E., Gaskins, M., & Mangun, J. (2011). A GIS Approach to Prioritizing Habitat for Restoration Using Neotropical Migrant Songbird Criteria. *Experimental Management,* *33*(48), 150-157. doi: 10.1007/s00267-011-9660-1

Jantz, S., Hansen, M., Nackoney, J., Pintea, L., & Potapov, P. (2014). Monitoring and Forecasting Chimpanzee Habitat Health in Africa to Inform Conservation Actions, Strategies, and Measure Success. *Experimental Management,* *33*.

Llewellyn, D., Shaffer, G., Craig, N., Creasman, L., Pashley, D., Swan, M., & Brown, C. (1996). A Decision-Support System for Prioritizing Restoration Sites on the Mississippi River Alluvial Plain. *Conservation Biology,* *10*(5).

Miller, L., Savage, A., Giraldo, H. (2004). Quantifying Remaining Forested Habitat Within the Historic Distribution of the Cotton-top Tamarin (Saguinus oedipus) in Colombia: Implications for Long-Term Conservation. American Journal of Primatology 64: 451–457.

Proyecto Tití: Conserving the Cotton-top Tamarin in Colombia. (2014). Retrieved June 5, 2014, from<http://proyectotiti.com/Default.htm>

Rosenberg, D., Noon, B.,& Meslow, E.,(1997). Biological Corridors: Form, Function, and Efficacy.*BioScience,* *47*(10).

Tischendorf, L., & Fahrig, L. (2000). How should we measure landscape connectivity? *Landscape Ecology,* *15*, 633-641.

Turner, I. (1996). Species loss in fragments of tropical rain forest: A review of the evidence. *Journal of Applied Ecology,* *33*, 200-209.

Zeller, K., Rabinowitz, A., Salom-Perez, R., & Quigley, H. (2013). The Jaguar Corridor Initiative: A Range-Wide Conservation Strategy. *In: Molecular Population Genetics...,* 200-209.