**NASA DEVELOP National Program**

****NASA Marshall Space Flight Center

**Summer 2015**

**Short Title: Texas and Arizona Ecological Forecasting**

**Subtitle:** Utilizing NASA Earth Observations to Monitor and Manage Ocelot Habitat Loss

**VPS Title:** There’s Not a Lot of Ocelots

**Project Team & Partners**

**Project Team:**

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**Advisors & Mentors:**

Dr. Jeffrey Luvall (NASA at NSSTC)

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**Partner Organizations**

Pittsburg Zoo & PPG Aquarium, Collaborator/Boundary Organization, POC: Ken Kaemmerer

Pittsburg Zoo & PPG Aquarium, Collaborator/Boundary Organization, POC: Dr. Joseph Gaspard

Caesar Kleberg Wildlife Research Institute at Texas A&M University – Kingsville, Collaborator/End-User/Boundary Organization, POC: Michael Tewes and Humberto Perotto

The Denver Zoo, Collaborator/End-User, POC: Nanette Bragin

South Texas Refuge Complex, Collaborator/End-User, POC: Mitch Sternberg

Texas Department of Transportation, Collaborator/End-User, POC: Dr. John Young, Jr.

Secretaria de Medio Ambiente y Rescusos Naturales (SEMARNAT), Collaborator/Boundary Organization/End-User, POC: Dr. Arturo Caso

East Wildlife Foundation, Collaborator/End-User, POC: Dr. Tyler Campbell

**Project Details**

**Applied Sciences National Applications Addressed:**

Ecological Forecasting

**Study Area:** TX and AZ

**Study Period:** 1996 to 2014, January to March

**Earth Observations & Parameters**

Landsat 8, Operational Land Imager (OLI) - Land Cover

Landsat 7, Enhanced Thematic Mapper Plus (ETM+) - Land Cover

Landsat 5, Thematic Mapper (TM) - Land Cover

Terra, MODIS - Surface Reflectance

Aqua, MODIS - Surface Reflectance

**Ancillary Datasets Utilized**

* US FWS U.S. Counties for Ocelot Species - Believed occurrences of ocelot
* Texas A&M University Current Ocelot Habitat Data - Ocelot habitat locations
* Texas Transportation Department Texas Road GIS Data - Road locations
* USGS Web Soil Survey Data - Texas soil data

**Models Utilized**

* Princeton University, Maximum Entropy Distribution Model (Maxent)

**Software Utilized**

ArcGIS 10.2.1 - Raster Manipulation/Analysis, land cover classification of Landsat imagery, Normalized Difference in Vegetation Index (NDVI) of Landsat, Terra, and Aqua MODIS imagery.

ENVI Classic - Data processing of Landsat, geo-referencing of Terra and Aqua MODIS imagery, land cover classification of Landsat imagery.

R - Execution of MaxEnt

Soil Data Viewer 6.2 - Access to soil databases

**Project Overview**

**80-100 Word Objectives Overview**

The goal of this project was to use remote sensing technologies to study ocelot habitats in southern portions of Texas and Arizona. In recent years, urban and agricultural growth has reduced the ocelot habitat in the United States. Additionally, road development has had a significant impact on ocelot populations by forming barriers to dispersal and increasing vehicular collisions. It is important to track these trends in order to reduce their impacts on ocelot habitat and prevent further habitat loss, as well as find ways to minimize conflicts between humans and ocelots.

**Abstract**

Although the ocelot (*Leopardus pardalis*) is located throughout Central America, portions of South America, and the United States, the species is currently listed as endangered with less than 100 remaining in the United States. This cat requires a minimum home range of 6.5 square kilometers, which prevents deadly interactions with humans on roadways. Many conservation efforts have been attempted, such as translocation and restoring native vegetation. Landsat 8 Operational Land Imager (OLI), Landsat 7 Enhanced Thematic Mapper Plus (ETM+), and Landsat 5 Thematic Mapper (TM) imagery were used to create supervised land cover classifications for 1996, 2005, and 2014 during January through March where land use and cover were assessed over time. Surface reflectance imager from Terra and Aqua Moderate Resolution Imaging Spectroradiometer (MODIS) were then used to derive Normalized Difference in Vegetation Index (NDVI). The NDVI was used to verify the results from the derived land cover classification layer. The derived land cover classification was then used with in situ data in the Princeton Maximum Entropy model which determined the suitable ocelot habitat. The proximity risk map was then created using multiband buffer zones over the locations of suitable ocelot habitat by determining the proximity to roads and urban areas. The use of GIS and remote sensing will greatly aid the project partner’s decision making process in directing conservation efforts.

**Community Concerns**

* The ocelot (*Leopardus pardalis*) has been listed on the United States Endangered Species List since 1981, with less than a hundred individuals in the U.S.
* Ocelots are largely restricted to the south of Texas and in the Sky Islands region of Arizona, in areas of closed canopy dense thornscrub.
* Grigioni & Mrykalo (2004) stated that 16 counties in southern Texas that represent the majority of ocelot habitat are among the fastest growing counties in Texas. Cameron and Hidalgo counties, where the majority of ocelots in the United States are found, are expected to see a human population increase of 83% and 130% by 2050 respectively according to the Texas Office of the State Demographer.
* According to Simpson *et al.* (2010), 95% of ocelot habitat has been destroyed as a result of human encroachment and land alteration of the ocelot historical range. Combined with hunting, isolation as a result of highways and urban sprawl, and conversion to farmland, remaining ocelot populations face severe population pressures.
* Remaining populations remain small and isolated. These ocelots face inbreeding depression, reduced reproductive success, and increasing competition from other small predators.
* Large populations of ocelots live on privately-owned lands, and partnerships with stakeholders are vital to preserving remaining populations.

**Current Management Practices & Policies**

Currently, conservation efforts by researchers at Caesar Kleberg Wildlife Institute at Texas A&M University - Kingsville and South Texas Refuge Complex include a variety of practices, such as the use of camera trappings, radiotelemetry, translocation of Mexican ocelots, and the restoration of native vegetation in the area. These management practices can be costly and time-consuming for the project’s partners and each technique has its limitations. Trapping and collaring ocelots is an invasive method which causes the animal undue stress. Additionally, previously trapped ocelots avoid traps in the future, further increasing the difficulty of future research. While camera trapping is a non-invasive practice, accurate assessments of population density for ocelots is difficult as trap placement bias, small sample size, and repeated captures of the same individuals; skewing the data.

**Decision Support Tools & Benefits**

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| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| Habitat Percent Cover Map | Landsat 8 OLI, Landsat 7 ETM+, Landsat 5 TM | This product will narrow the focus of the decision making process to specific locations for vegetation restoration  |
| Habitat Probability Map | Landsat 8 OLI, Terra MODIS, Aqua MODIS | This product will aid the decision making process in future translocation of ocelots |
| Proximity Risk Map | Landsat 8 OLI, Terra MODIS, Aqua MODIS | This product will help the decision making process for current and future road networks |

**Project Imagery**

**[Insert image here]**

**Caption:** [Insert Caption Here. Max of 25 words.] Image Credit: [Insert project short title] Team.

**Image:** File Name (Please submit your image as a separate .jpeg as well as inserting it in this document)