**NASA DEVELOP National Program**

**** NASA John C. Stennis Space Center

**Summer 2015**

**Mississippi Ecological Forecasting**

**Subtitle:** Using NASA Earth Observations to Locate Potential Habitat for the Dusky Gopher Frog

**VPS Title:** Ponds, Pines, and Precipitation: The search for Dusky Gopher Frog habitat.

**Project Team & Partners**

**Project Team:**

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**Past or Other Contributors:**

Shelby Barrett

**Partner Organizations**

The Nature Conservancy (Collaborator/End-User, POC: Jim Lee, Biologist)

USDA Forest Service: DeSoto Ranger District (Boundary Organization, POC: Ed Moody, Wildlife Biologist)

US Fish and Wildlife Service (Collaborator/End-User, POC: Linda LaClaire, Wildlife Biologist)

US Army Corps of Engineers (Boundary Organization, POC: Danny Hartley, Wildlife Biologist)

**Project Details**

**Applied Sciences National Applications Addressed:**

Ecological Forecasting

**Study Area:** Jackson, Harrison, and Hancock Counties, Mississippi and St. Tammany Parish, Louisiana

**Study Period:** 2005 - Present

**Earth Observations & Parameters**

Landsat 8, OLI - Land Use Land Cover (LULC), Vegetation Indices

Landsat 5, TM – Historical Imagery, Vegetation Indices (NDVI), LULC

Terra, ASTER - Vegetation Indices (NDVI), Water Quality Indices, 30m DEM

Space Shuttle, SRTM – Elevation data and DEMs

**Ancillary Datasets Utilized**

* USGS Gap Analysis Program (GAP)
* USGS LANDFIRE Landcover Dataset – USGS
* USGS EarthExplorer – Elevation ASTER DEM
* LiDAR Elevation Dataset – Bare Earth DEM - WebGIS
* Historical precipitation data – PRISM
* Existing locations and extent of DGF Ponds – USFS, USFWS
* Location of previously surveyed areas for DGF habitat - USFS, USFWS
* High Resolution Aerial and SatelliteData – USGS, EarthData International
* NOAA CSC - Coastal Change Analysis Program (CCAP) Regional Land Cover product, NED

**Models Utilized**

* IDRISI Land Change Modeler for ArcGIS – Clark Labs
* TerrSet Geospatial Monitoring and Modeling Software

**Software Utilized**

ERDAS IMAGINE - Land classification of Landsat imagery

ArcGIS - Raster Manipulation/Analysis, Image Enhancement & Map Creation

R- Statistical Analysis of Accuracy and Percent Error

TerrSet Geospatial Monitoring and Modeling Software

**Project Overview**

**80-100 Word Objectives Overview**

The dusky gopher frog (DGF), *Lithobates sevosus*, is the most endangered species of frog in North America and is listed as one of the top 100 endangered species in the world. The reduction of longleaf pine forests, coupled with the highly specific habitat requirements oftheDGF*,* makes it especially challenging for federal land wildlife managers to maintain existing populations. Threatened by many factors, the DGF is currently at risk of becoming extinct. In response, this project used NASA Earth observations to locate potential habitat for the dusky gopher frog.

**Abstract**

The dusky gopher frog (DGF), *Lithobates sevosus*, is currently found in only four ponds in south Mississippi. This small, wild population is threatened by high risk of inbreeding depression due to genetic isolation, loss of habitat due to land development, wildfire suppression, and runoff from surrounding roadways. Historically, these frogs inhabited longleaf pine ecosystems and utilized burrows from the gopher tortoise (*Gopherus polyphemus),* which is also endangered. In response, this project used NASA Earth observations to locate potential habitat for the DGF. Landsat 8 OLI will be used to calculate vegetation indices and produce updated land cover classifications. ASTER imagery and Landsat 5 will also be used to calculate vegetation indices and water quality indices for the study area. Using this information, partnering organizations will be able to identify and map areas with the ideal land cover, water quality, and elevation characteristics for DGF habitation. NASA Earth Observations will be utilized to identify ponds, canopy cover, proximity to roadways, proximity to developed land, proximity to other bodies of water, appropriate pond hydrology over the course of the year, and emergent and submerged vegetation. NAIP aerial data will be assessed for ability to detect ponds smaller than those detectable at the Landsat scale. This project will augment current decision making practices regarding where relocation and reintroduction ponds for the dusky gopher frog should be established in order to aid in monitoring, protection, and restoration of this critically endangered species.

**Community Concerns**

* The dusky gopher frog (DGF), *Lithobates sevosus*, is the most endangered species of frog in North America and is listed as one of the top 100 endangered species in the world.
* Currently, this species is found to inhabit and breed in only two, genetically isolated ponds in Harrison County, Mississippi.
* Diseases known to frogs, such as chytrid fungus, are also known to cause mortality in the DGF. Should wild DGF populations experience a severe outbreak of chytrid fungus, it has the potential to drive the species to extinction.
* Historically, these frogs inhabited the longleaf pine ecosystems and utilized burrows from the gopher tortoise (*Gopherus polyphemus),* which is also endangered.
* The reduction of longleaf pine forests, coupled with the highly specific habitat requirements of *Lithobates sevosus* and the currently typical forestry management practices, makes it especially challenging to federal land wildlife managers to maintain existing populations and increase the number of viable populations through reintroduction and/or establishment of new populations.

**Current Management Practices & Policies**

On September 10, 2014, the US Fish and Wildlife Service released a draft recovery plan for the dusky gopher frog (DGF) outlining proposed steps and goals to locate existing ponds, stabilize existing populations, and establish new populations by introducing DGF into modified habitats. In this document, the U.S. Fish and Wildlife Service specifically includes goals to incorporate GIS and remote sensing into the DGF recovery plan. This includes obtaining and housing GIS data relevant to DGF conservation, using remote sensing and GIS to locate potential populations and suitable habitat for reintroduction, and locating existing populations that were previously unknown. In the past, all restoration efforts have been limited to field surveys and manual efforts to locate potential DGF habitat.

**Decision Support Tools & Benefits**

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| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| Updated Landcover Classifications | Landsat 8 OLI | Provide end-users with the most current land cover information and extent of cover types.  |
| Vegetation Indices | Landsat 5Landsat 8 OLIASTER Imagery | Provide end-users with current and past health of vegetation surrounding both current and potential gopher frog ponds.  |
| Topographical Map | ASTER DEMsSRTM  | Provide end-users with a clearer understanding of existing topography at current and potential sites in order to best determine if and how sites need to be hydrologically altered in order to best suit DGF habitat specifications. |
| Current Extent of Suitable Habitat Maps | Landsat 5Landsat 8ASTER Imagery | Provide end-users with the most updated highlight areas currently suitable for DGF habitation |
| Suitable Habitat Forecast | Landsat 5Landsat 8ASTER Imagery | Provide end-users with maps highlighting of the location of potential sites for reintroduction. |

**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)