**NASA DEVELOP National Program**

****BLM at Idaho State University GIS TReC

*Spring 2017*

**Short Title: Intermountain West Ecological Forecasting**

**Subtitle:** Using NASA Earth Observations to Identify Current Habitat Areas and Forecast Habitat Suitability for the Yellow-Billed Cuckoo in Semiarid Environments.

**VPS Title:** A Bird’s Eye View: Using Satellite Imagery to Identify Yellow-billed Cuckoo Habitats

**Project Team & Partners**

**Project Team:**

Arina Mardoukhi (Project lead), mardarin@isu.edu

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**Advisors & Mentors:**

Keith Weber, Lead Science Advisor (GIS Training and Research Center at Idaho State University)

Charles Peterson (Biology Department, Idaho State University)

Mark Carroll (NASA Goddard Space Flight Center)

**Partner Organizations:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **POC (Name, Position/Title)** | **Partner Type** | **Boundary Org?** |

|  |  |  |  |
| --- | --- | --- | --- |
| US Fish and Wildlife Service - Eastern Idaho Field Office | Evan Ohr, Fish and Wildlife Biologist | End-User | No |
| US Fish and Wildlife Service - Wyoming Ecological Services Field Office | Patricia Sweanor, Energy Program Coordinator | End-User | No |
| US Fish and Wildlife Service - Utah Ecological Services Field Office | Amy Defreese, Ecologist | End-User | No |
| Idaho Department of Fish and Game – Southeast Regional Office | Scott Bergen, Principal Wildlife Research Biologist  Becky Abel, Regional Wildlife Biologist | End-User | No |
| NASA RECOVER Science Team | Keith Weber, GIS Director | Collaborator | No |

**Project Details**

**Applied Sciences National Applications Addressed:** Ecological Forecasting, Water Resources

**Study Area**:Intermountain West (ID, WY, UT)

**Study Period:** 2003 – 2016 (May – August); Forecasting to 2030

**Earth Observations & Parameters:**

Landsat 5, Thematic Mapper (TM) – spectral classification

Landsat 8, Operational Land Imager (OLI) – spectral classification

Shuttle Radar Topography Mission (SRTM) - elevation

**Ancillary Datasets Utilized:**

* USGS National Land Cover Dataset (NLCD) – land cover
* USGS National Elevation Dataset (NED) – elevation data

**Models Utilized:**

* TerrSet Land Change Modeler (LCM)

**Software Utilized:**

* ESRI ArcGIS – raster manipulation and analysis
* TerrSet - forecasting land change

**Project Overview**

**80-100 Word Objectives Overview:**

Personnel at the USFWS Eastern Idaho Field Office, the USFWS Ecological Services Field Offices in Utah and Wyoming, and the Idaho Department of Fish and Game Southeastern Regional Office need current information on suitable habitat for the threatened Western Yellow-Billed Cuckoo (YBC). Current approaches for determining habitat areas for YBC are time consuming and cost prohibitive. To improve efficiencies in field monitoring for this species, and to predict the future habitat extents due to changing environmental conditions, the NASA DEVELOP team in Idaho created a model using NASA Earth Observations to predict YBC habitat suitability.

**Abstract:**

Observations of the threatened western yellow-billed cuckoo (YBC) are rare in Idaho, Wyoming, and Utah. This species can act as an indicator for the overall health of an ecosystem, therefore understanding their habitat is critical to planning and improving land management and ecosystem conservation practices. These secretive birds spend only a few months of the year in breeding locations throughout the intermountain west from May to August. Partner organizations tasked with monitoring this species, such as the US Fish and Wildlife Service (USFWS) and the Idaho Department of Fish and Game (IDFG) find that observations can be difficult even through solicited survey methods. The team utilized NASA Earth observations, Landsat 5 TM and Landsat 8 OLI, to create current habitat suitability maps in order to help prioritize surveys in areas that are more likely to contain YBC. In addition, the team sought to understand the cause of the decline of the YBC areas across the Intermountain West by looking at how suitable habitat has changed over time through loss and degradation. The team also utilized Terrset LCM to forecast the change in habitat to the year 2030 in order to allow partner organizations to better plan for future monitoring and conservation efforts.

**Keywords:**

Landsat, NDVI, remote sensing, conservation, habitat, yellow-billed cuckoo

**Community Concerns:**

* The western yellow-billed cuckoo population has been in decline and was listed as threatened under the Endangered Species Act on November 3rd, 2014.
* The decline of this once-prevalent species acts as an indicator that riparian health is deteriorating, and indicates a need for future habitat conservation efforts.
* Predictions of the spatial and temporal extents of these habitats can help with yellow-billed cuckoo land management.

**Current Management Practices & Policies**:

Currently end-users, the USFWS and the IDFG, have increased habitat monitoring for the western yellow-billed cuckoo (YBC) in response to its threatened listing under the Endangered Species Act (ESA). These agencies rely upon field monitoring surveys to document locations of YBC nesting areas. The USFWS does not utilize NASA Earth observations in any capacity for monitoring and conservation decision support, although they are familiar with spatial data. The IDFG is familiar with GIS software and has utilized satellite remote sensing data in the past, but not for habitat suitability mapping. Their current reliance on unfocused field surveys increases costs and can lead to inefficient conservation efforts for the YBC.

**Decision Support Tools & Benefits:**

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| --- | --- | --- | --- |
| **End-Product** | **Earth Observations Used** | **Benefit & Impact** | **Software Release** |
| 2016 Habitat Suitability Map | Landsat 5 TM, Landsat 8 OLI , and Shuttle Radar Topography Mission | The partner will be able to use this to better discern the extent of suitable habitat for the yellow-billed cuckoo and to identify areas that require more monitoring. | N/A |
| Forecasted Habitat Map | Landsat 5 TM, Landsat 8 OLI, and Shuttle Radar Topography Mission | The partner can use this product to evaluate areas that need more or less focused attention by seeing where habitat is predicted to change the most. | N/A |
| Habitat Change Maps | Landsat 5 TM, Landsat 8 OLI, and Shuttle Radar Topography Mission | The partner will be able to use this to assess areas where suitable habitat has been declining or increasing helping to determine where restoration efforts have been effective. | N/A |
| Habitat Suitability Model and Tutorial | Landsat 8 OLI | The partner will be able to use this model to replicate the suitability mapping method in other study areas. | N/A |