**NASA DEVELOP National Program**

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NASA Langley Research Center

**Spring 2016**

**Short Title: Southern Rockies Ecological Forecasting II**

**Subtitle:** Tracking Mule Deer for Wildlife Corridors between Seasonal Habitats in the Southern Rockies

**VPS Title:** Oh Deer! Where are the Mule Deer Going?

**Project Team & Partners**

**Project Team:**

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**Advisors & Mentors:**

Dr. Kenton Ross (NASA DEVELOP National Science Advisor)

**Past or Other Contributors:**

Ross Reahard (Project Lead)

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**Partner Organizations:**

Southern Rockies LCC (End-User), POC: John Rice

Western Association of Fish and Wildlife Agencies (WAFWA) Mule Deer Working Group (End-User) POC: Jim Heffelfinger

**Project Details**

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

**Study Area:** Southern Rocky Mountains (ID, WY, UT, CO, AZ, NM)

**Study Period:** 01/2011 – 12/2015

**Earth Observations & Parameters:**

Aqua, MODIS – Spectral vegetation indices and phenology products

Terra, MODIS – Global elevation datasets, spectral vegetation indices, phenology products

Landsat 5 and 8, TM and OLI – Spectral vegetation, land cover classifications

**Ancillary Datasets Utilized:**

* USGS National Land Cover Dataset (NLCD) - land cover
* NASA ForWarn system - Vegetation phenology
* NASA Digital Elevation Model (DEM) - digital elevation model
* SRLCC GPS data - collar data from mule deer

**Models Utilized:**

* Lifemapper Species Distribution Modeling (LmSDM)

**Software Utilized:**

ERDAS IMAGINE - land classification of Landsat imagery

ArcGIS - raster manipulation/analysis, image enhancement & map creation

**Project Overview**

**80-100 Word Objectives Overview:**

Mule deer (Odocoileus hemionus) are considered a keystone species and a symbol of the west therefore, their disappearance would be detrimental to the Southern Rockies. Wyoming has seen a 36% decrease in mule deer population from 1991-2012. The goal is to create migratory corridors to maintain the current population because fragmented habitats have aided in the decrease of mule deer throughout the region. The final mapping products will examine mule deer migration to help identify ideal conservation areas.

**Abstract:**

Mule deer are migratory animals that are capable of traveling as far as a few hundred miles from their summer to winter habitats. Mule deer are both economically and ecologically important to the Southern Rockies, thus their corridors need to be conserved. Declining mule deer populations caused by anthropogenic features have created a need for mapping mule deer habitats. NASA DEVELOP provided map production for the aid in the conservation of mule deer and their habitats in support of Southern Rockies Landscape Conservation Cooperative (SRLCC) and the Western Association of Fish and Wildlife Agencies (WAFWA) Mule Deer Working Group. The scope of the project was in the southern Rocky Mountains in Idaho, Wyoming, Utah, Colorado, Arizona, and New Mexico from 2011 to 2015. The objective of this project was to develop an increased understanding of why the mule deer numbers are declining by utilizing NASA Earth observation satellites. Aqua and Terra Moderate Resolution Imaging Spectroradiometer (MODIS) data were primarily used to evaluate vegetation phenology and Normalized Difference Vegetation Index (NDVI) to see how they influence migratory patterns. Terra ASTER data were utilized to create a Digital Elevation Model (DEM) to aid in determining suitable habitats. Landsat 5 TM and 8 OLI were utilized to determine current and historical land use, land cover, patch size, and winter to summer connectivity corridors. Additionally, GPS collar data was provided by the mule deer working group and the Southern Ute Indian Tribe. These factors were incorporated into a species distribution model and mule deer range maps. Finally, a methodology and tutorial for the use of the Lifemapper Species Distribution Modeler was created.

**Community Concerns:**

* Mule deer numbers are declining in the Southern Rocky Mountains. They are economically and ecologically important to the Southern Rockies because of the revenue of hunting licences and species diversity for the ecosystem that they are part of.

**Current Management Practices & Policies**:

Currently, land managers are attempting to track where mule deer migrate in order to conserve land and create corridors. These land managers are limited in their research because they are unable to identify the extent to which human involvement has played a role in the mule deer’s migratory patterns. John Rice has established a need for a landscape-scale solution that will allow for the development of a predictive habitat for the restoration and conservation of these mule deer habitats.

**Decision Support Tools & Benefits:**

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| --- | --- | --- |
| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| Mule Deer Range Maps | Landsat 5 TM & 8 OLI Terra ASTER (DEM)Aqua/Terra MODIS | An accurate Mule Deer Range Map of current and historical migration patterns will aid our partners in establishing conservation areas and connectivity corridors for mule deer  |

**Project Imagery**

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**Caption:** The Southern Rockies Ecological Forecasting II looked at several layers to find ideal locations for mule deer corridors. Layers shown here from the top down are MODIS Vegetation Phenology, a DEM from Aster, precipitation and surface temperature from ForWarn Image Credit: SREFII Team.

**Software Release Requirements**

What category do the tools your project is creating fall within? No software development involved