**NASA DEVELOP National Program**

****NASA Jet Propulsion Laboratory

*Spring 2017*

**Short Title: Santa Monica Mountains Climate**

**Subtitle:** Using NASA Earth Observations to Determine the Extent of Drought-Related Dieback in Oak Woodlands within the Santa Monica Mountains

**VPS Title:** From Drought to Dieback: Investigating Effects of Drought in the Santa Monica Mountains

**Project Team & Partners**

**Project Team:**

Natalie Queally (Project Lead), nataliequeally@gmail.com

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Nick Rousseau

**Advisors & Mentors:**

Dr. Natasha Stavros (NASA JPL)

Dr. Erika Podest (NASA JPL)

**Partner Organizations:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **POC (Name, Position/Title)** | **Partner Type** | **Boundary Org?** |
| Resource Conservation District of the Santa Monica Mountains | Rosi Dagit, Senior Conservation Biologist  Jen Mongolo, Conservation Biologist | End-User | Yes |
| National Park Service – Santa Monica Mountains National Recreation Area | Irina Irvine, Restoration Ecologist  Marti Witter, Fire Ecologist | Collaborator | No |
| California Department of Parks and Recreation – Los Angeles District | Suzanne Good, Senior Ecologist, CA Department of Parks and Recreation (CDPR)  Jaime King, Ecologist, CDPR  Danielle LeFer, Ecologist, CDPR | Collaborator | No |
| California Department of Forestry and Fire Protection (CAL FIRE) | Kim Corella, Forest Health Specialist/Forester II | Collaborator | No |
| Los Angeles County Department of Forestry and Fire Protection | Jay Lopez, Asst. Chief, LA County Forestry and Fire Protection | Collaborator | No |
| University of California Cooperative Extension | Sabrina Drill, Natural Resources Advisor, Los Angeles and Ventura Counties  Tom Scott, UC Berkeley and UC Riverside | Collaborator | No |

**Project Details**

**Applied Sciences National Applications Addressed:** Climate

**Study Area:** Santa Monica Mountains, CA

**Study Period:** January 2010 – December 2016

**Earth Observations & Parameters:**

Airborne Visible and Infrared Imaging Spectrometer (AVIRIS) – land cover

Uninhabited Aerial Vehicle Synthetic Aperture Radar (UAVSAR) – land cover

**Ancillary Datasets Utilized:**

* Partner *in situ* data – RCD Santa Monica Mountains Oak Drought Study Field data from Trippet Ranch and Topanga Elementary School, used for endmember selection
* Partner *in situ* data – NPS Vegetation Mapping Program for SMMNRA, used for endmember selection and visual assessment of Fraction Alive Cover (FAL) and Radar Vegetation Index (RVI) trends
* Partner *in situ* data – County of Los Angeles Fire Department Fire History Data, used to visually assess FAL and RVI trends
* USDA National Agriculture Imagery Program (NAIP) – 2016 Orthoimagery used for endmember selection
* PRISM climate data – precipitation and temperature parameters used to study spatial dynamics of change in vegetation cover

**Software Utilized:**

* ESRI ArcGIS – raster manipulation and analysis, image enhancement & map creation
* Excelis ENVI – analysis of vegetation, VIPER tools add-on, Incidence angle correction for UAVSAR
* UCSB VIPER tools – multiple endmember spectral mixture analysis (MESMA)
* Google Earth Pro – endmember selection
* R – plot Radar Vegetation Index and Fraction of Alive (FAL) vegetation cover change

**Project Overview**

**80-100 Word Objectives Overview:**

This project will work with the Resource Conservation District of the Santa Monica Mountains to develop a better spatial understanding of how drought has impacted the oak woodlands throughout the Santa Monica Mountains in recent years. A baseline landscape status assessment will be produced to provide direction on ways to map spread of impacts, develop risk assessment strategies for addressing wildfire risk, and identify and prioritize potential management response strategies to make best use of limited resources.

**Abstract:**

The Santa Monica Mountains stretch along the west coast of California between the coastal city of Oxnard and the populous urban hub of Los Angeles. Despite the close urban proximity, the Santa Monica Mountains still retain 80% native vegetation cover, including precious expanses of coastal sage scrub, chaparral, valley grassland, and oak woodland. While 30,000 ha of this land is protected by public and private conservation agencies within the Santa Monica Mountains National Recreation Area (61,000 ha total), the area has still suffered from the recent severe and prolonged drought in California. These effects have been especially detrimental to oak woodlands, which are more susceptible to pest infestations during times of abiotic stress. Because these woodlands are prized for their aesthetic value and ecosystem services, land managers will benefit from finding high-risk areas that will suffer more from drought effects. Current practices to assess changes in vegetation rely mostly on field studies, which are restricted by large scale landscapes, time, and resources. Incorporating remote sensing in the assessment of high-risk areas for drought-related dieback will allow land managers to develop larger scale solutions. The Santa Monica Mountains Climate team at JPL aims to discover the effect of drought on vegetation dieback from 2010 to 2016 using optical data from AVIRIS and radar data from UAVSAR.

**Keywords:**

Remote Sensing, AVIRIS, UAVSAR, oak woodland

**Community Concerns:**

* Oak woodlands are sought by the community for many reasons, including added real estate value, aesthetic appeal, and recreational use
* Oak tree loss also means loss of all its ecosystem services, including carbon sequestration, storm water runoff mitigation, temperature moderation, and soil erosion control
* The oak woodlands provide habitat for some of the 50 plant and animal species considered threatened or endangered under the Endangered Species Act (1973) within the Santa Monica Mountains

**Current Management Practices & Policies**:

At the start of the drought, biologists at the Resource Conservation District (RCD) of the Santa Monica Mountains noticed that the oaks were experiencing canopy loss on the outer reaches of their branches. In order to monitor the progression of this loss, the RCD created survey plots in two locations and used the help of citizen scientists to determine the condition of the oaks within these plots. However, this work is on a relatively small spatial scale and oak monitoring can be expanded using remote sensing.

**Decision Support Tools & Benefits:**

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| --- | --- | --- | --- |
| **End-Product** | **Earth Observations Used** | **Benefit & Impact** | **Software**  **Release** |
| Time series maps of change in Fraction of Alive cover for 2010 – 2016 in study area | AVIRIS used to determine Green Vegetation (GV) : Nonphotosynthetic Vegetation (NPV) : Substrate (S) fractions for 2013 – 2016 | This time series will show change in live vegetation over the drought period. Areas with greatest change will be denoted as high-risk, and therefore targets for land management practices. | N/A |
| Time series maps of change in Radar Vegetation Index for 2010 – 2015 in study area | UAVSAR Radar Vegetation Index (RVI) used to extrapolate AVIRIS data from 2010 - 2012 | This time series will show changes in vegetation by highlighting changes in surface complexity as observed by UAVSAR. Areas with greatest change will be denoted as high-risk, and therefore targets for land management practices. | N/A |