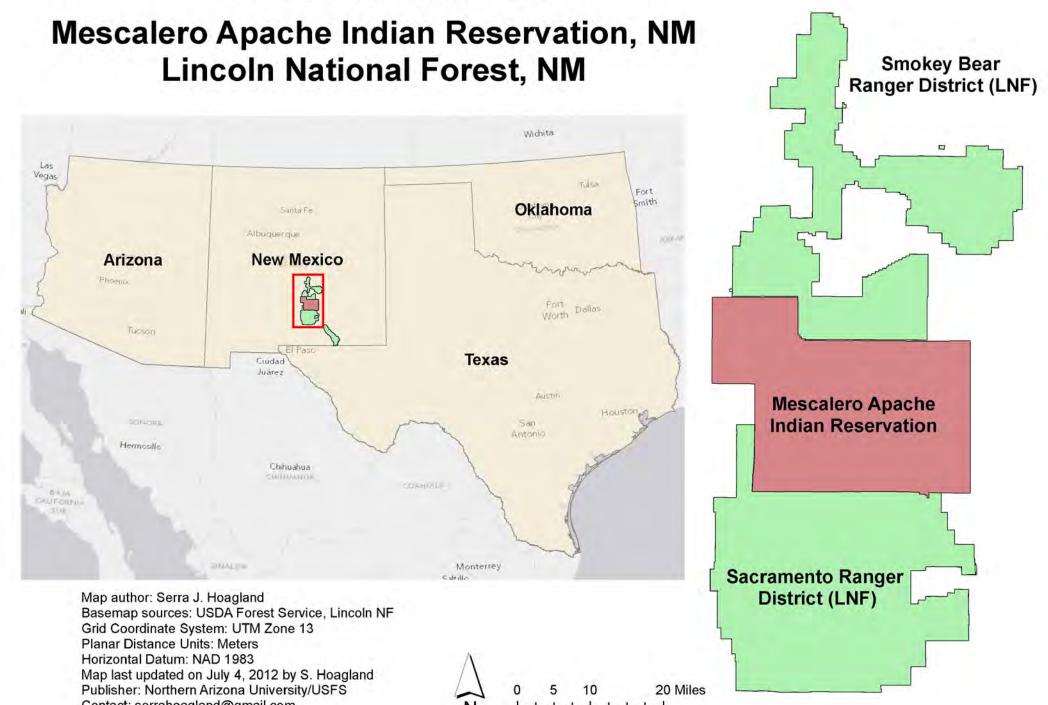# Landscape-scale assessment of Mexican spotted owl nesting habitat using MODIS imagery

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## INTRODUCTION

Western forests have departed from historical conditions due to decades of fire suppression, timber harvesting, and livestock grazing practices. Current forest conditions and high fuel levels can lead to more frequent and more severe wildfires. Late-successional forests that provide habitat for Mexican spotted owls are susceptible to such wildfires but evolved under lower severity wildfire regimes. A significant amount of owl habitat has been lost throughout the southwest due to recent high-intensity, stand replacing wildfires. Future climate predictions identify longer fire seasons, prolonged drought and fire regimes that are mediated by temperature, which suggest that owl habitat is at risk as temperatures continue to increase. The most recent revision of the Mexican Spotted Owl Recovery Plan recommends strategically placed forest treatments and restoration projects to increase forest resiliency and minimize threats to the owl, yet empirical evidence about Mexican spotted owl's response to forest treatments is limited.
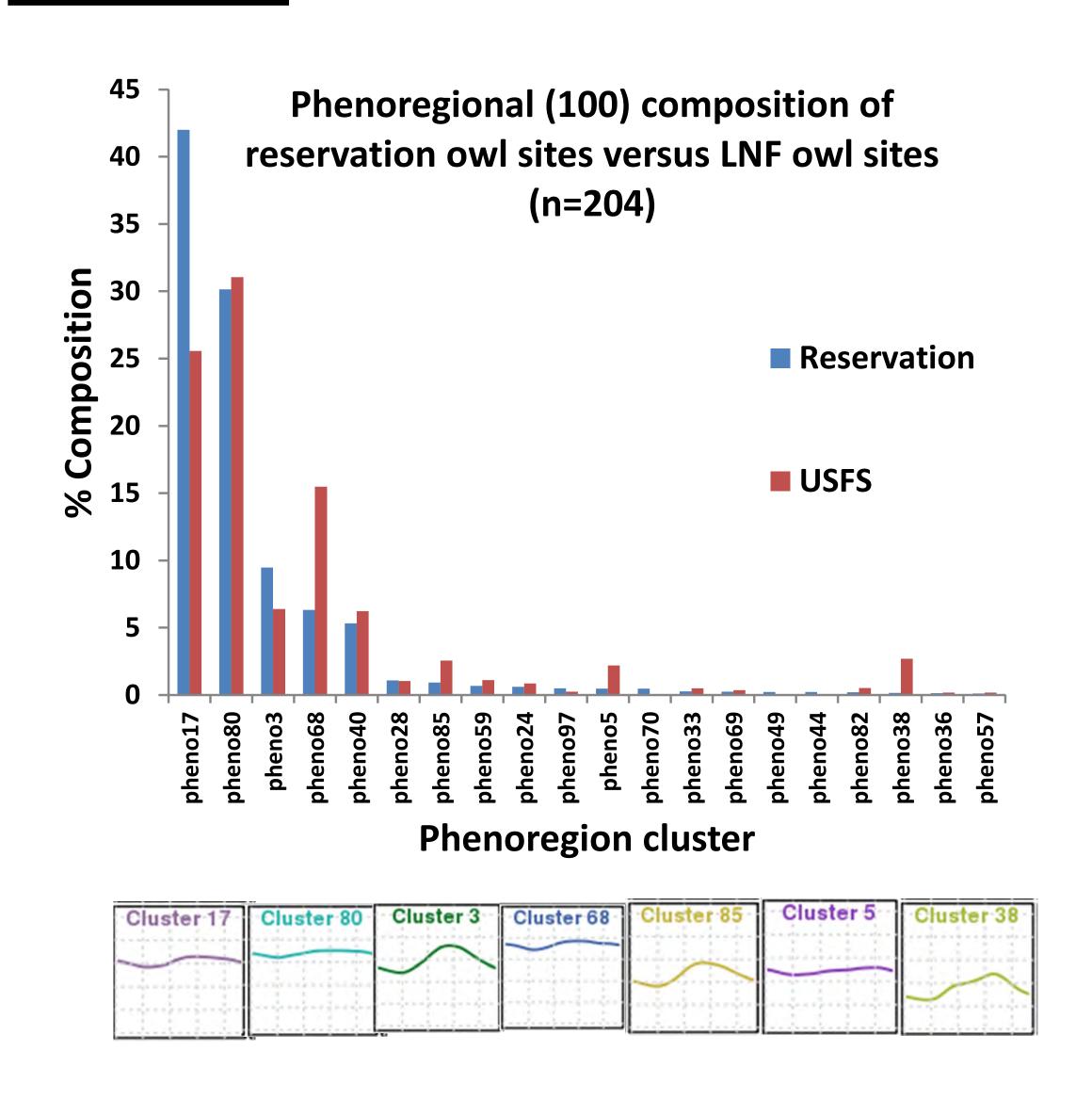
### STUDY AREA

Mescalero Apache Indian Reservation, NM
Lincoln National Forest, NM



Map author: Serra J. Hoagland
Basemap sources: USDA Forest Service, Lincoln NF
Grid Coordinate System: UTM Zone 13
Planar Distance Units: Meters
Horizontal Datum: NAD 1983
Map last updated on July 4, 2012 by S. Hoagland
Publisher: Northern Arizona University/USFS
Contact: serrahoagland@gmail.com



Example of nest tree with nest entrance in a broken top fir (Photo: D. Kauffman).

Example of stand conditions within the nest site on the reservation (Photo: D. Kauffman).

## ABSTRACT

Natural resource management practices by Native American tribes rely on active management to sustain the health and vigor of tribal lands into perpetuity. Despite numerous studies on nesting habitat of Mexican spotted owls (MSO), to our knowledge no one has assessed MSO habitat on tribal lands. Anecdotal evidence suggests that MSO habitat on tribal lands is different due to the use of regulated sustained yield timber management. We conducted a landscape-scale habitat assessment using remotely-sensed Moderate Resolution Spectroradiometer (MODIS) imagery to compare tribal and non-tribal nesting locations of MSO within the Sacramento Mountain range in New Mexico. Tribal information may help inform forest practitioners about the range of forest conditions that MSO will occupy and improve our current understanding about the effects of forest treatments on MSO. We believe this new rapid habitat assessment technique using satellite imagery could be a novel approach to monitoring MSO nesting habitat.
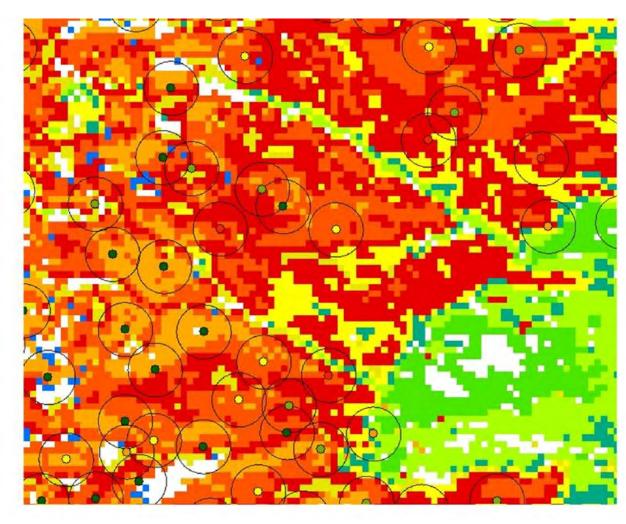
## METHODS

Habitat was characterized around owl sites using MODIS images. The resolution of MODIS images is 231 m, resulting in each pixel containing approximately 13 acres. We used a 1km buffer radius around the owl nest sites which approximates the area of a Protected Activity Center and Mexican spotted owls will forage within this area during the breeding season. This resulted in approximately 57 MODIS pixels per owl site. If multiple nest sites were defined we used the most recent nest location as the center. If the nest tree has not been identified, we either 1) used juvenile roost locations found prior to August 1 as the center or 2) defined an ecologically sound center point based off all previous roost locations, topography, vegetation and tree density. Within each 1km radius owl breeding site I described the landscape in terms of phenoregions. Phenoregions are areas that are geospatially clumped according to their MODIS signatures, which reflects Normalized Difference Vegetation Index (NDVI – see image) and indicates plant phenology. Pixels are analyzed and clumped with other pixels that have similar signatures to create each phenoregion.

## RESULTS



Phenoregional (100) composition of reservation owl sites versus LNF owl sites (n=204)



Collecting Mexican spotted owl occupancy and reproduction data on the Mescalero Apache Indian Reservation, NM.
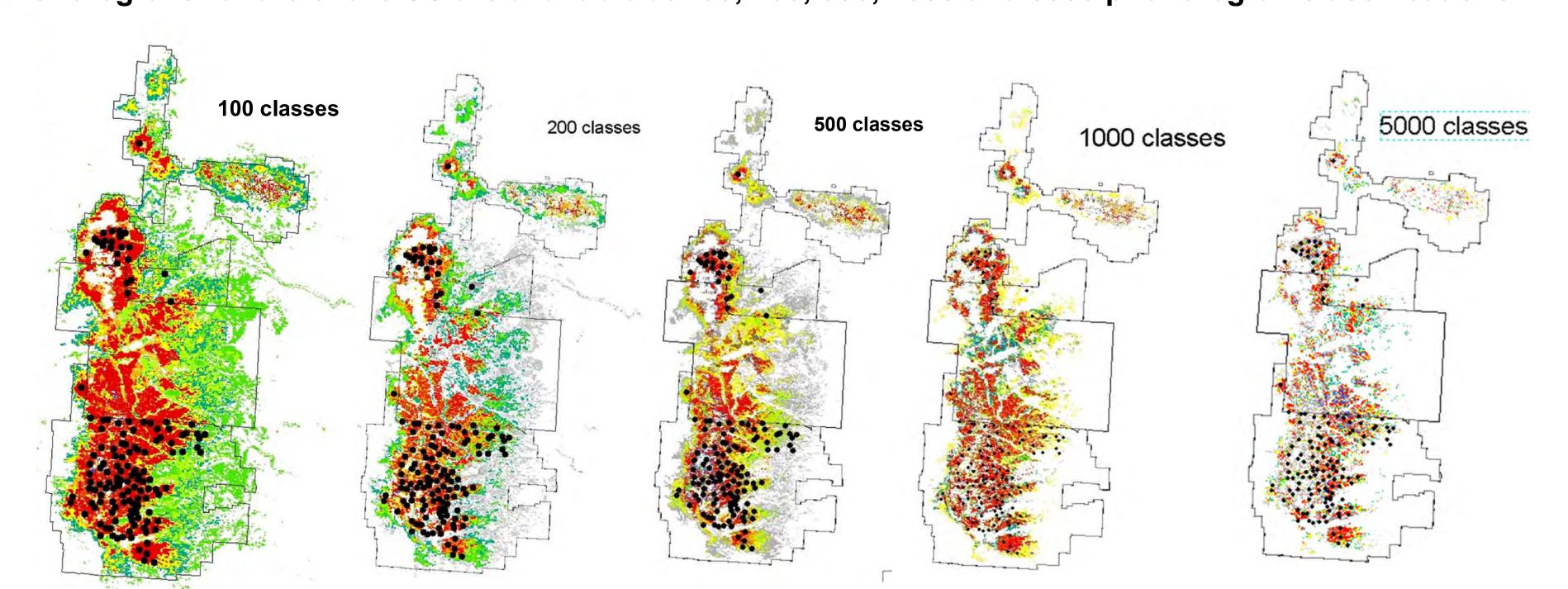


Example showing phenoregion classes (100) that composed >1% within all (n=204) 1km owl buffers. Warm colors denote high compositional proportion, cool colors denote less compositional proportion.
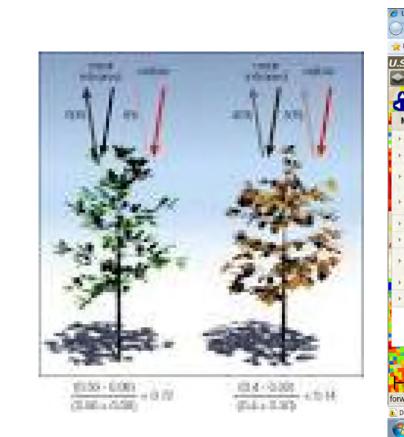
### MSO habitat suitability with increasing thematic resolution

Phenoregions for the entire US are available at 100, 200, 500, 1000 and 5000 phenoregion classifications.



100 classes   200 classes   500 classes   1000 classes   5000 classes
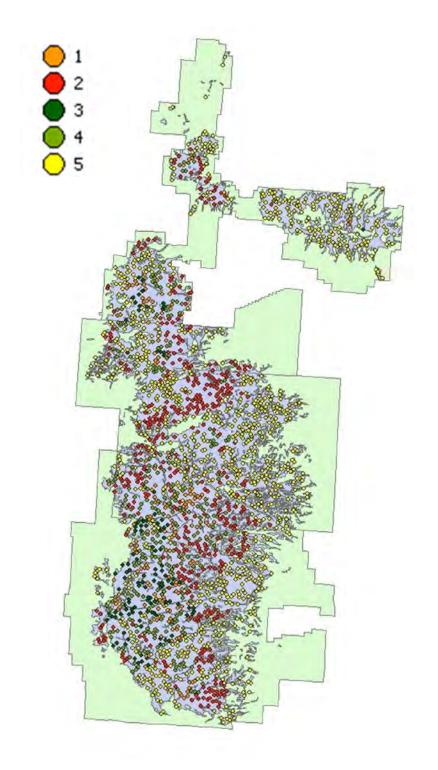
## NDVI & PHENOREGIONS

What are phenoregions? Phenoregions are phenologically and climatically self-similar clusters of pixels and are essentially regions with similar NDVI (Normalized Difference Vegetation Index) annual profiles. NDVI can be thought as the "green-ness" of an area.
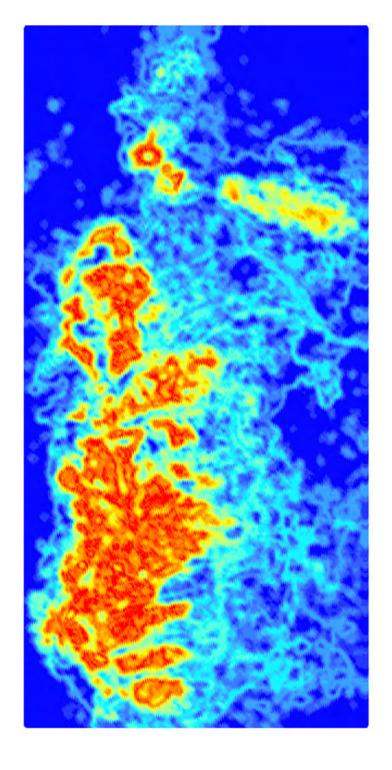


## DISCUSSION & FUTURE WORK

Phenoregional compositions differed between owl and random points, suggesting that the owls are selecting particular areas within the landscape for their nest sites. Furthermore, phenoregional compositions of owl sites on the reservation were significantly different from owl sites on the National Forest. This difference may be indicative of the active management done within owl sites on the reservation. Future work will cluster owl sites based on their phenoregional composition. Preliminary results indicate that there are 5 distinct cluster types that owls prefer. Two thousand random points placed in suitable forest types have been clustered and are shown below. Additional analyses will compare occupancy and reproduction rates between treated and untreated sites to see how Mexican spotted owls may respond.



## ACKNOWLEDGEMENTS