Modeling optimal and marginal habitat in a non-equilibrium system for a threatened California endemic

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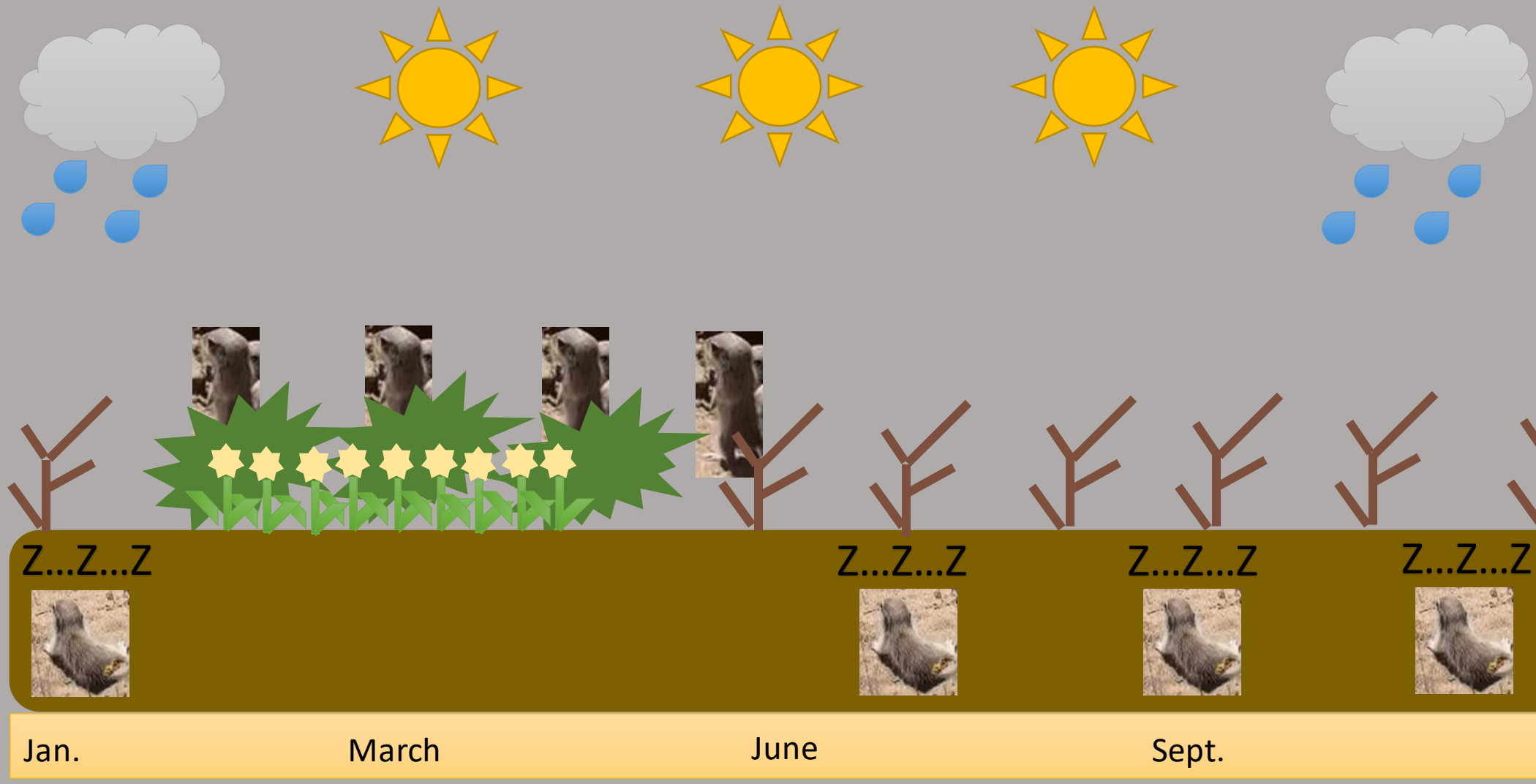
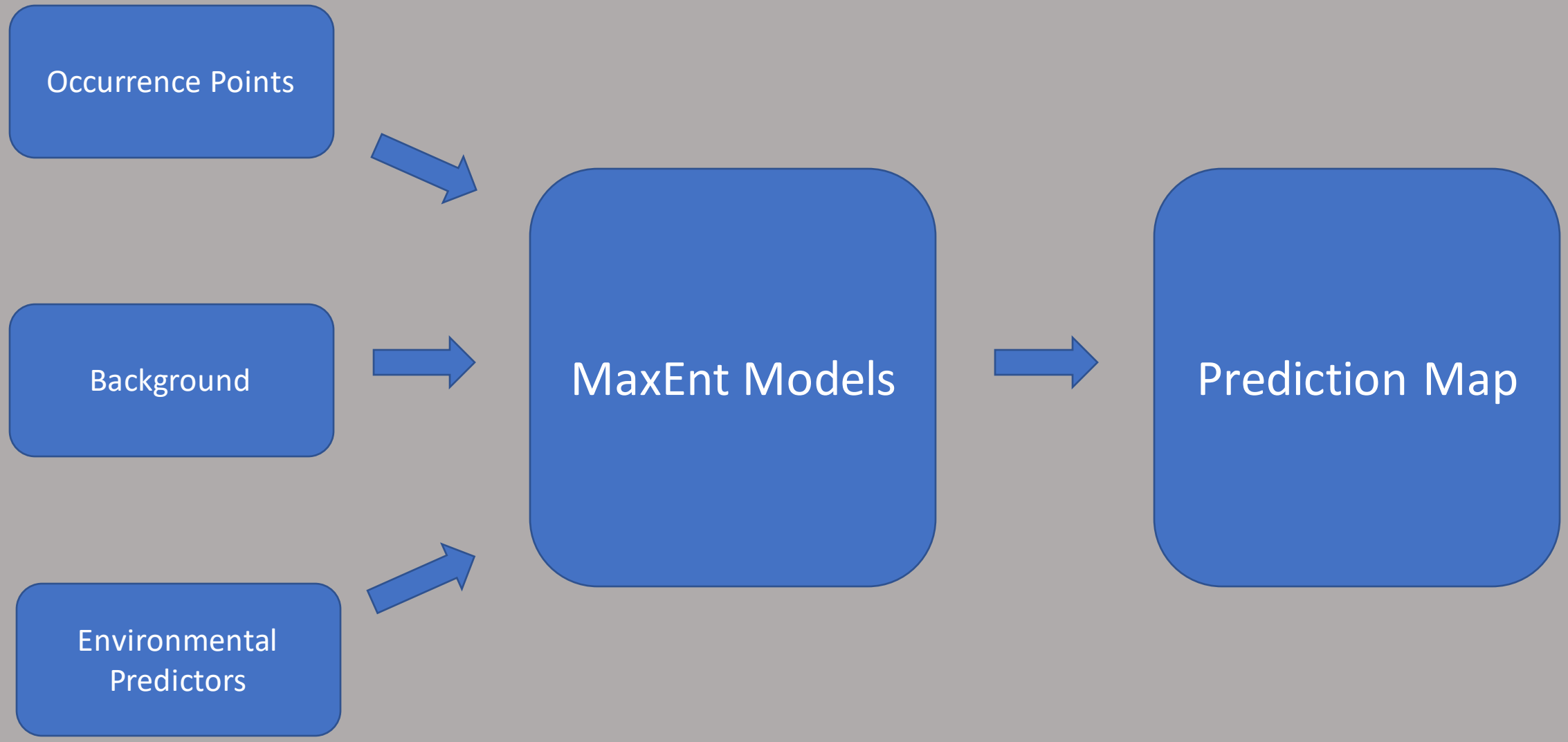
A Year in the Life of an MGS



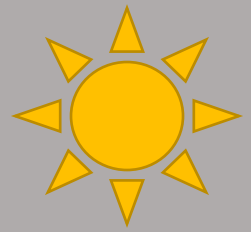
MaxEnt Models



Occurrence Points

2015

2016



2017

Dry

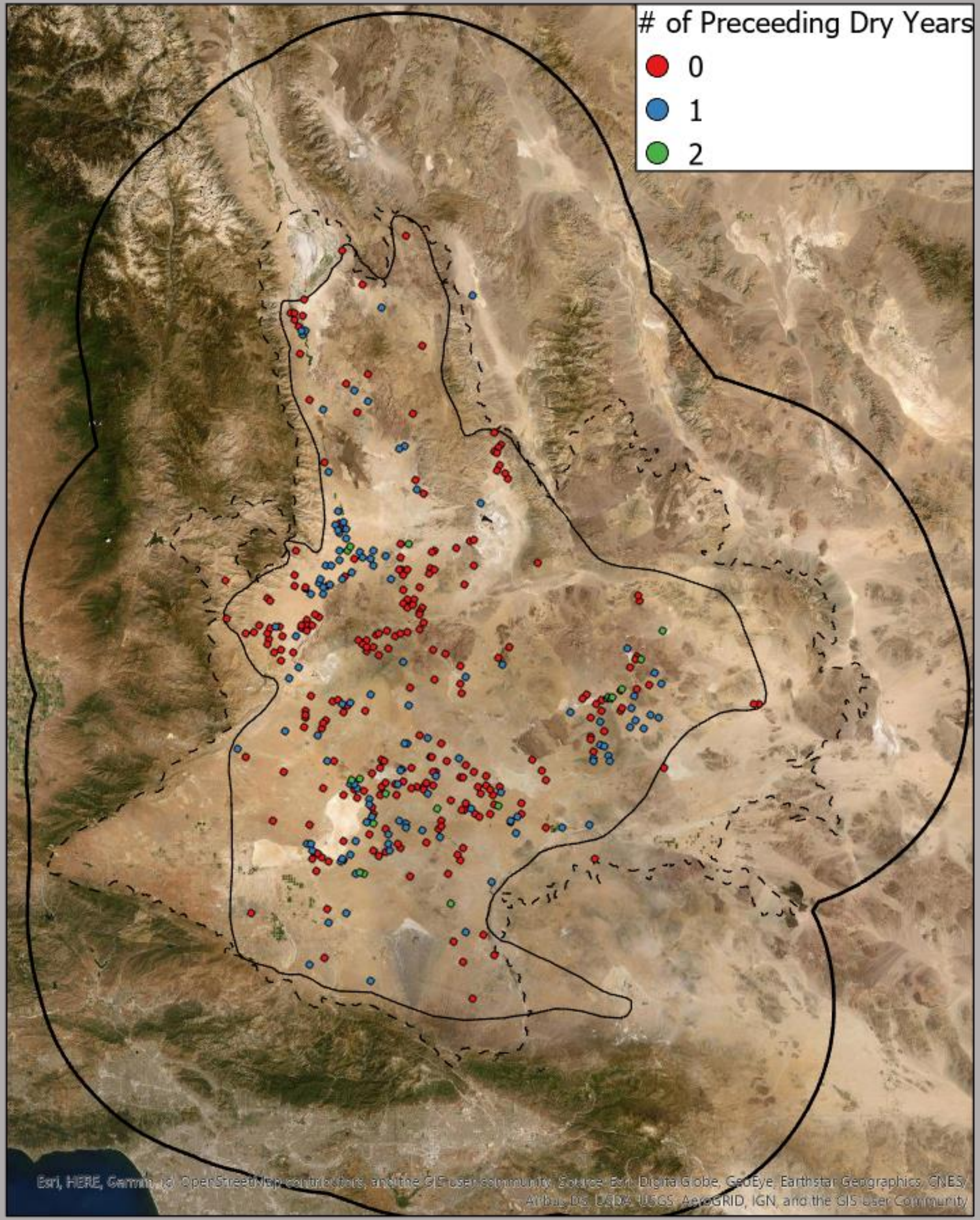
2016

2017

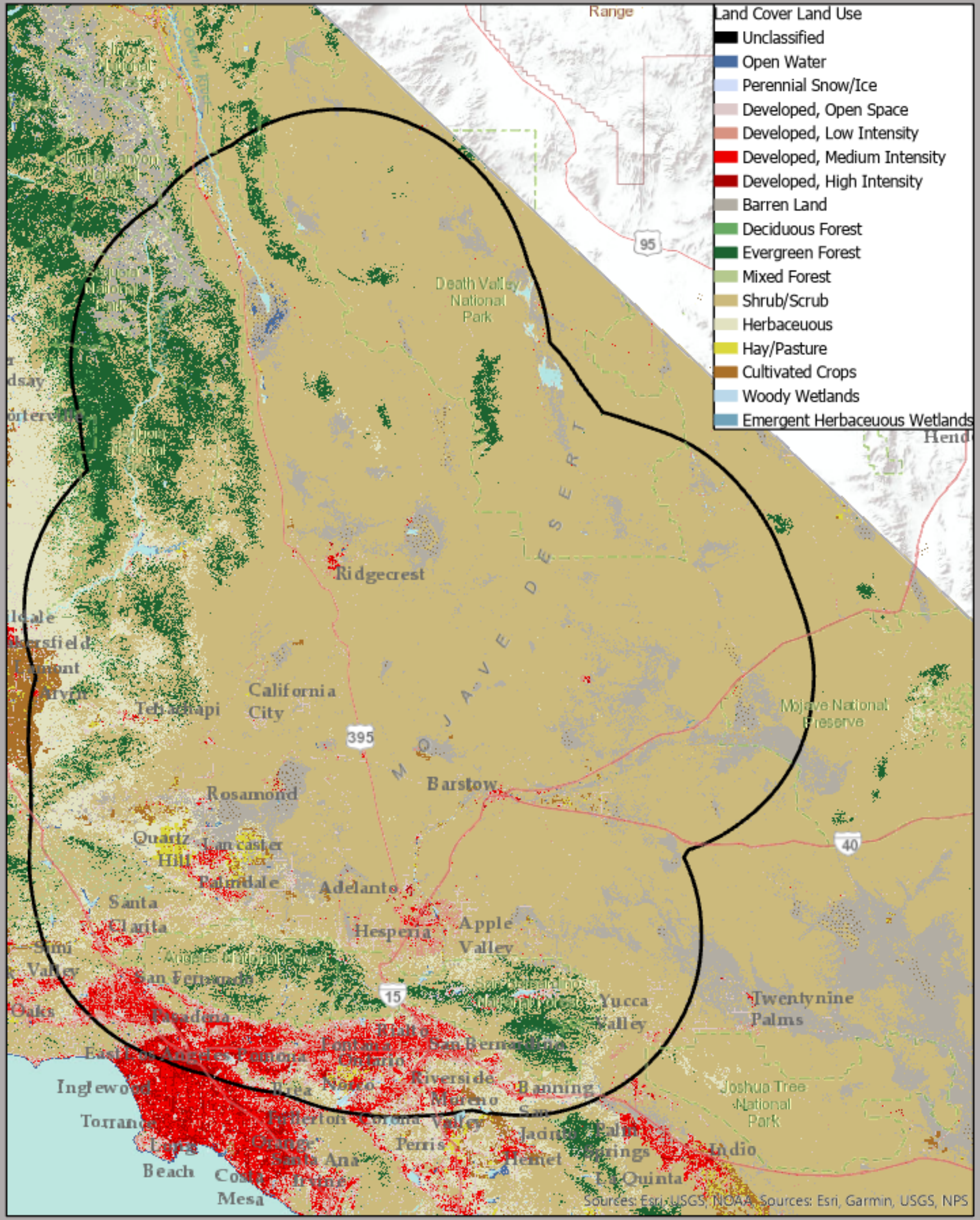
2018

Wet

Background



# of Preceeding Dry Years
0
1
2
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Land Cover Land Use
Unclassified
Open Water
Perennial Snow/Ice
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren Land
Deciduous Forest
Evergreen Forest
Mixed Forest
Shrub/Scrub
Herbaceuous
Hay/Pasture
Cultivated Crops
Woody Wetlands
Emergent Herbaceuous Wetlands
Ridgecrest
California City
Barstow
Rosamond
Adelanto
Hesperia
Apple Valley
Yucca Valley
Twentynine Palms
Death Valley National Park
Mojave National Preserve
Joshua Tree National Park
MOJAVE DESERT
Sources: Esri, USGS, NOAA Sources: Esri, Garmin, USGS, NPS

Environmental Predictors

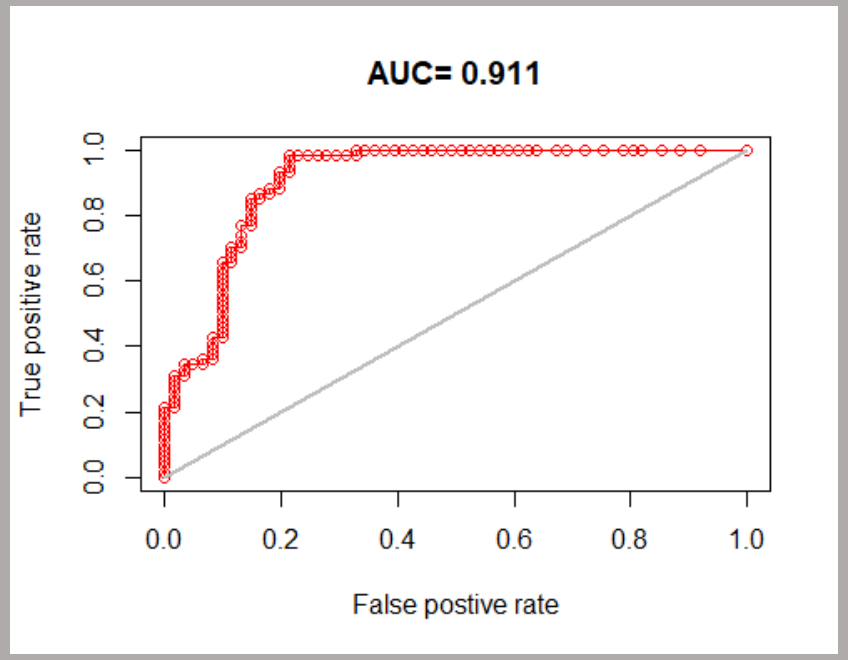
Predictor	Category	Source
Precipitation (30 year annual average, 1981-2010)	Climate	PRISM Climate Group
pH (depth 0-5cm)	Surface	POLARIS
Sand percentage (depth 0-5cm)	Surface	POLARIS
Albedo (mean, June 1, 2018 – August 31, 2018)	Surface	MCD43A3 (MODIS product)
Spectral Texture (difference day and night temperatures, June 1 – August 31, 2008-2018)	Surface	MODIS 11A2
Enhanced Vegetation Index	Vegetation	MODIS 13A1
Flow Accumulation	Vegetation/Hydrology	National Hydrography Dataset + USGS National Elevation Dataset
Grazing (past/present)	Disturbance	US Bureau of Land Management grazing polygons

Results

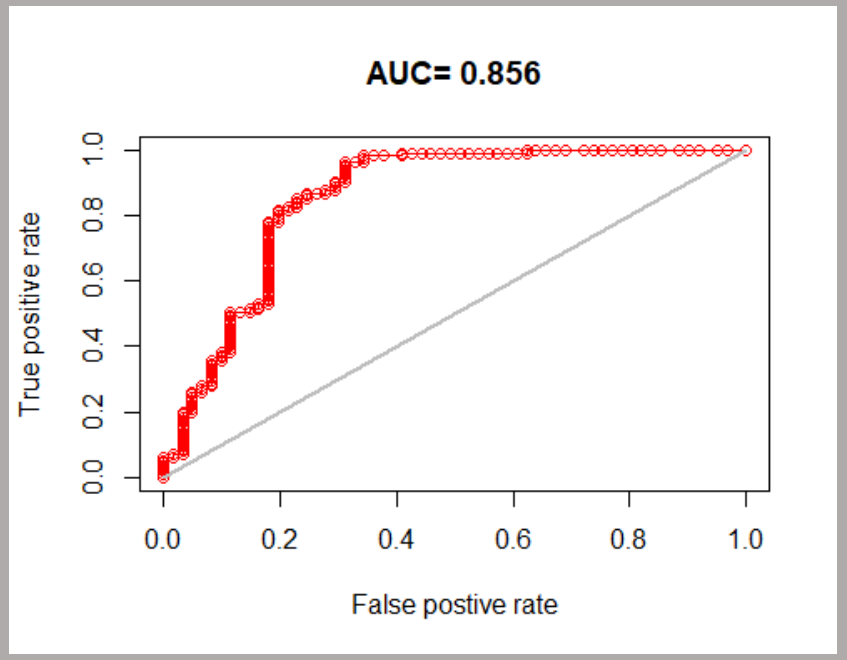
Final models:

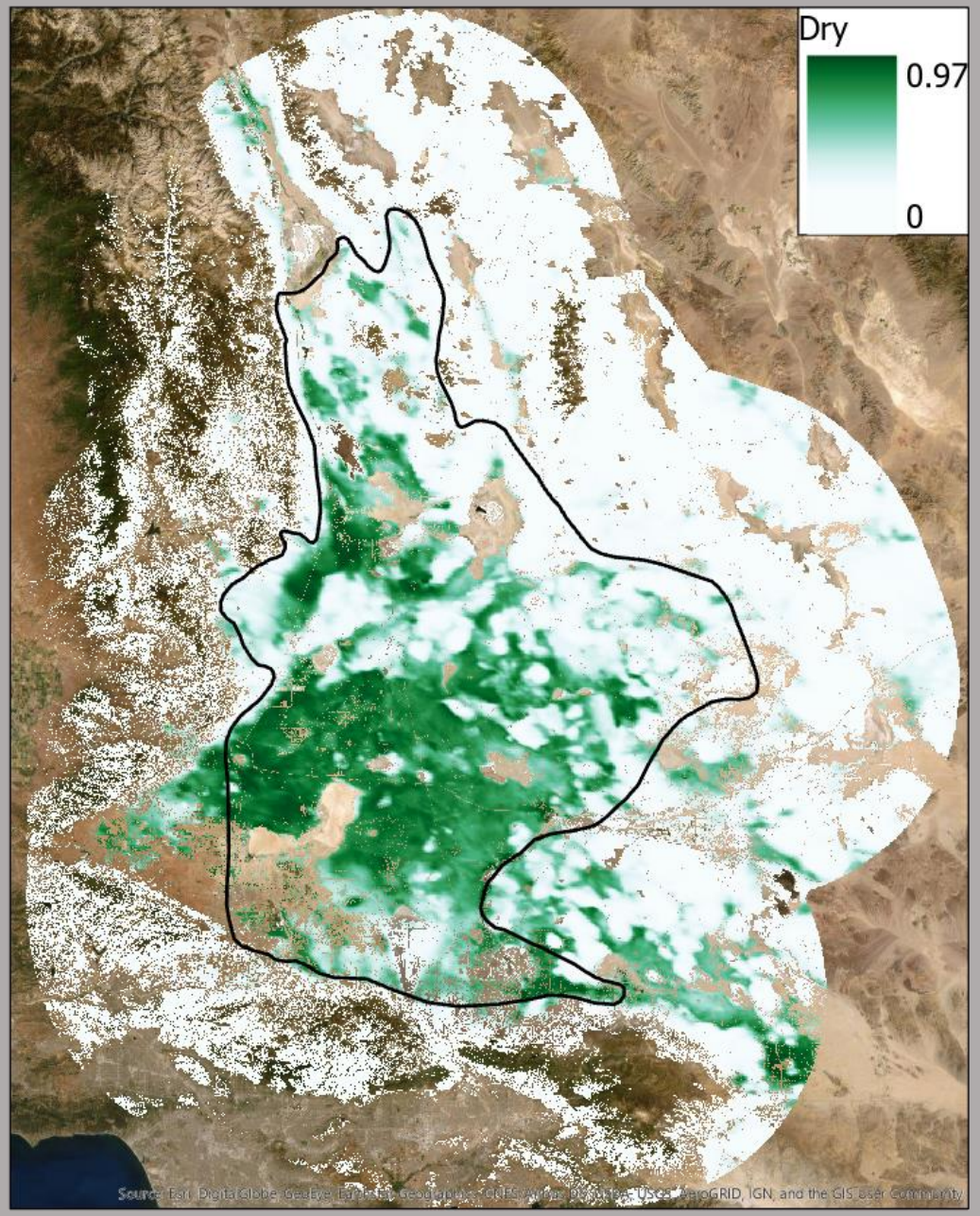
- Occurrences: Dry vs. Wet (dry performed better)
- Background: Desert (similar results as All but perhaps more useful)
- Environmental Predictors: Spectral Texture, Albedo, EVI

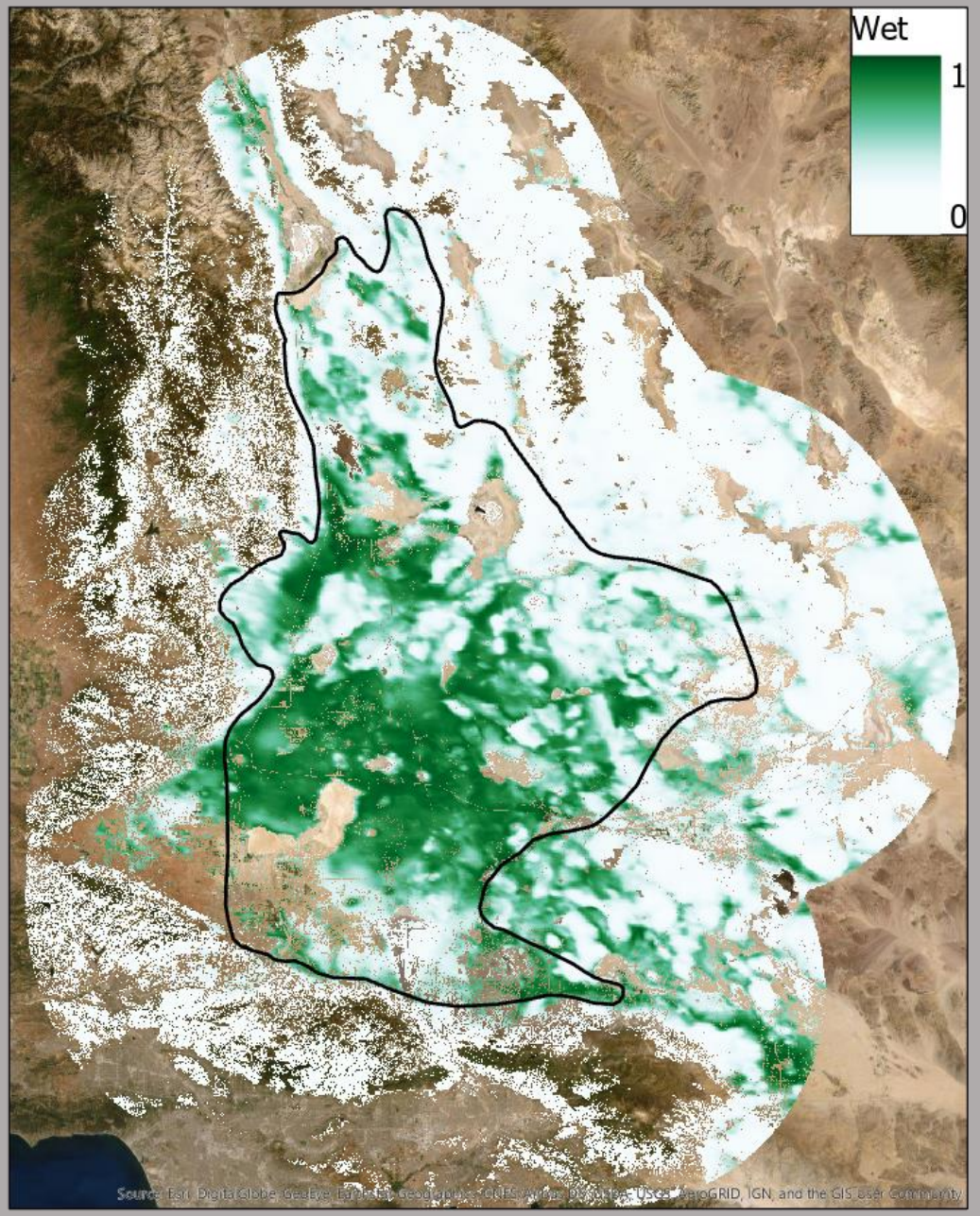
Dry



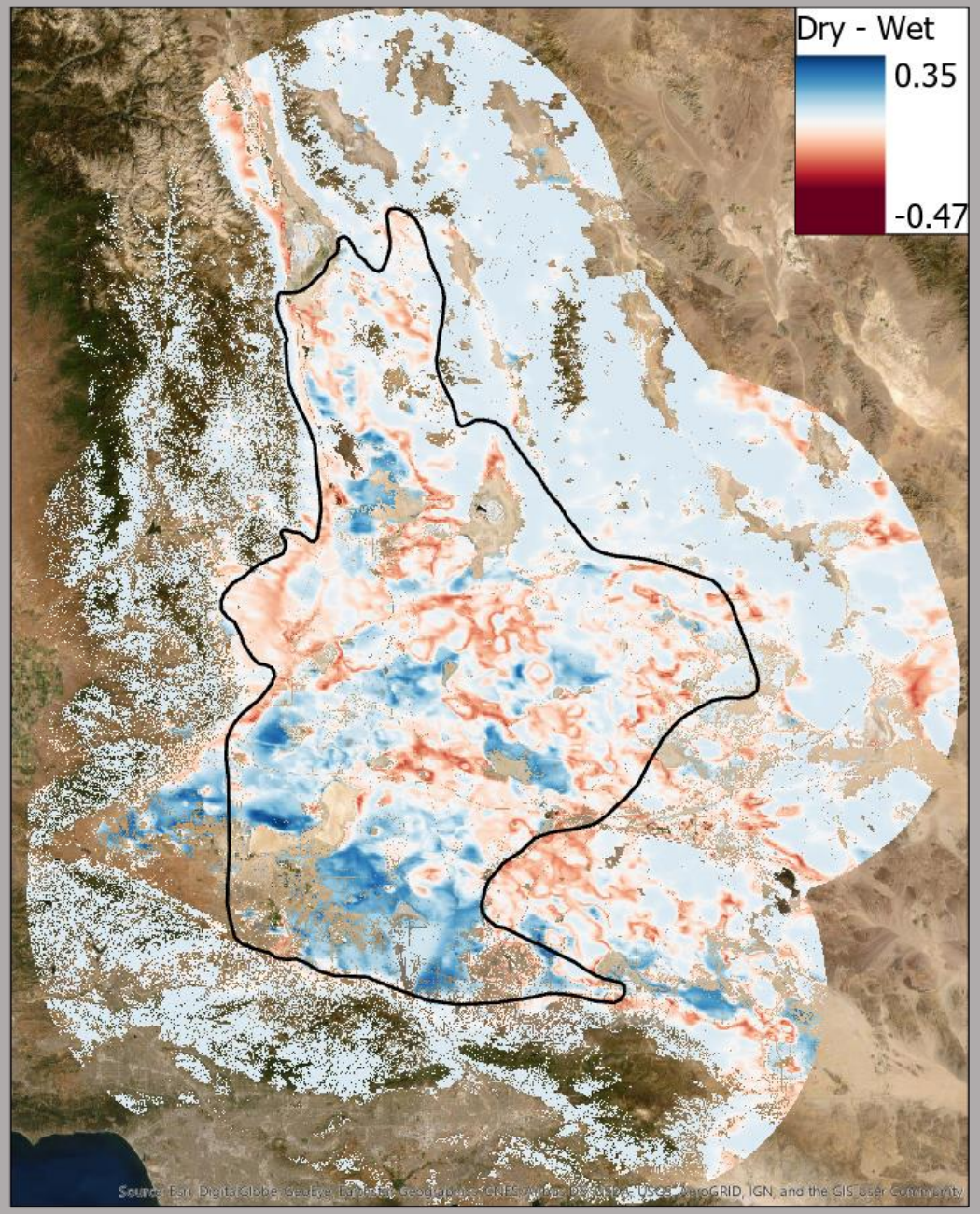
Wet

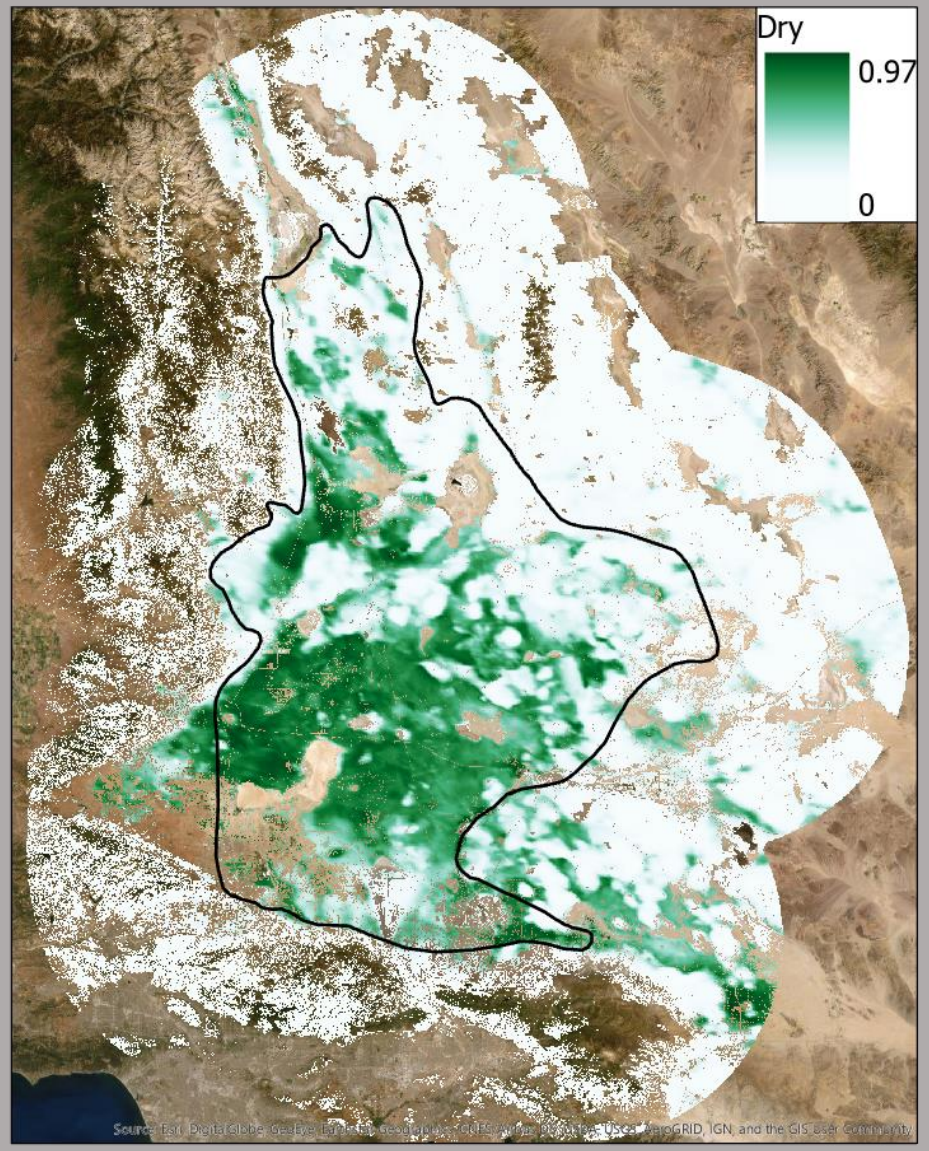



Dry
0.97
0
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community


Wet
1
0
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Dry - Wet





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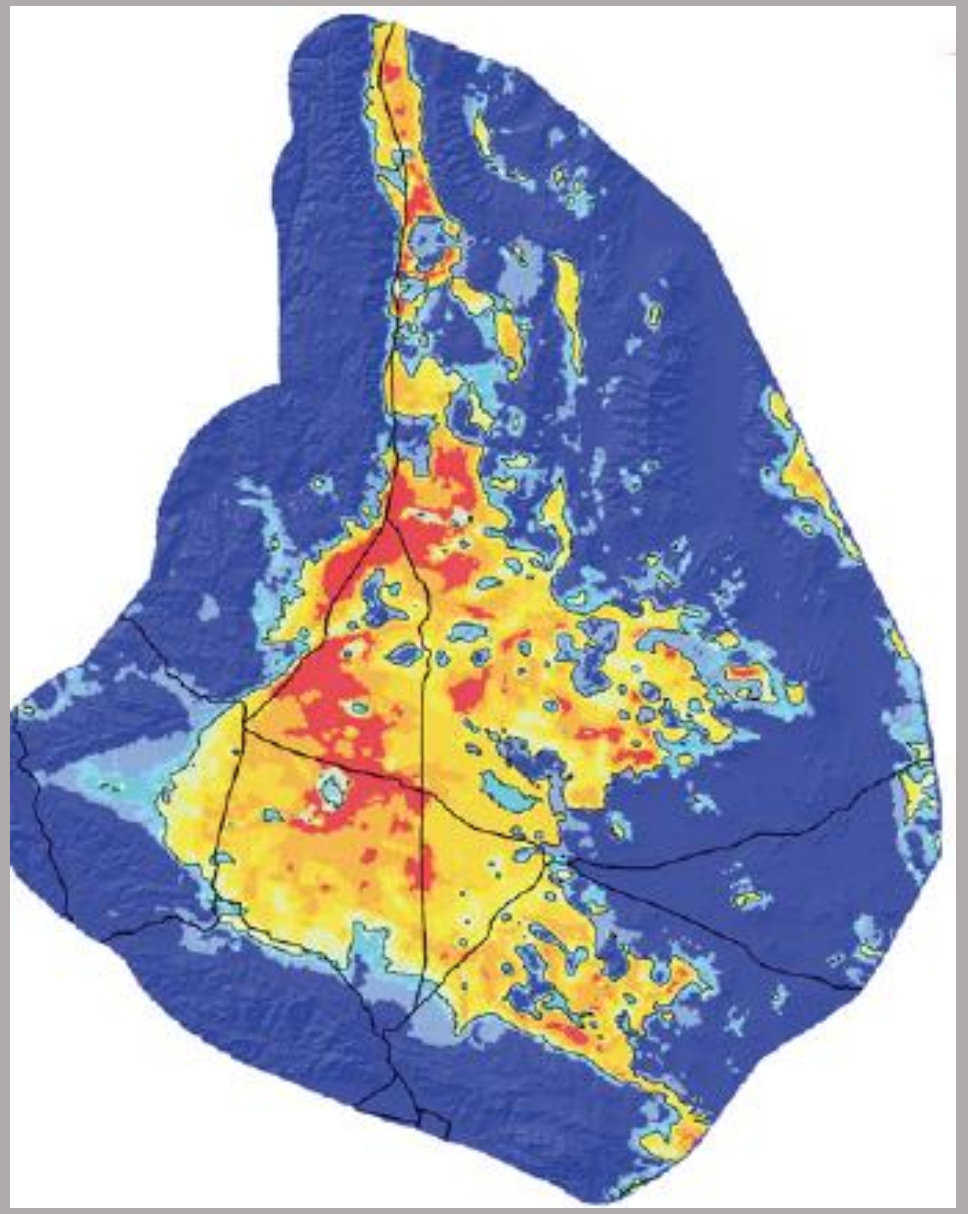

Inman et al. 2013

Conclusions

- It seems like teasing apart Dry and Wet can give you some idea of optimal vs. marginal
- Surface type (spectral texture and albedo) are the most important variables for MGS habitat suitability
- Ideally, we can find ways to model vegetation community structure to understand biological interactions better

"PO [presence only] data, and consequently MaxEnt, may be best used for helping to ask better questions instead of answering them“

Merow, C., Smith, M. J., and Silander, J. A. Jr. (2013) A practical guide to MaxEnt for modeling species' distributions: what it does, and why inputs and settings matter. *Ecography* 36, 1058-1069.