ENERGY, WATER AND HABITAT DIVERSITY AS PREDICTORS OF VEGETATION COVER IN URBAN AREAS

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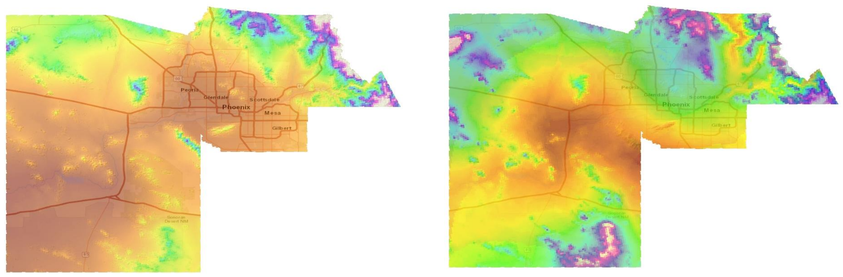
Bioclimatic Variables

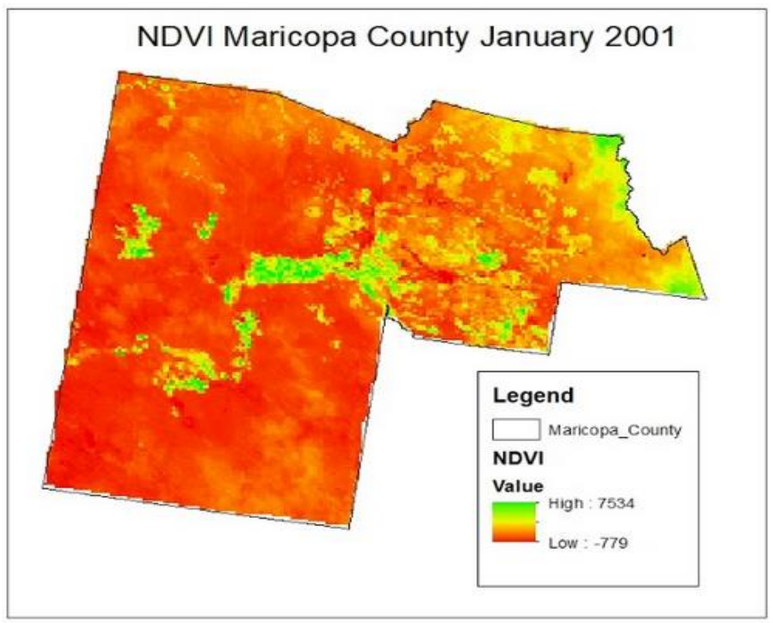
Bioclimatic variables represent annual trends (annual precipitation and mean annual temperature), seasonality, (annual range in temperature and precipitation) and limiting environmental factors (temperature of coldest and warmest month, and precipitation of the wettest and driest quarters). They are derived from monthly temperature and rainfall values to generate biologically meaningful variables.

BIO1 = Annual Mean Temperature
BIO2 = Mean Diurnal Range (Mean of monthly (max temp - min temp))
BIO3 = Isothermality (BIO2/BIO7) (* 100)
BIO4 = Temperature Seasonality (standard deviation *100)
BIO5 = Max Temperature of Warmest Month
BIO6 = Min Temperature of Coldest Month
BIO7 = Temperature Annual Range (BIO5-BIO6)
BIO8 = Mean Temperature of Wettest Quarter
BIO9 = Mean Temperature of Driest Quarter
BIO10 = Mean Temperature of Warmest Quarter
BIO11 = Mean Temperature of Coldest Quarter
BIO12 = Annual Precipitation
BIO13 = Precipitation of Wettest Month
BIO14 = Precipitation of Driest Month
BIO15 = Precipitation Seasonality
BIO16 = Precipitation of Wettest Quarter
BIO17 = Precipitation of Driest Quarter
BIO18 = Precipitation of Warmest Quarter
BIO19 = Precipitation of Coldest Quarter



Raw Data Collection

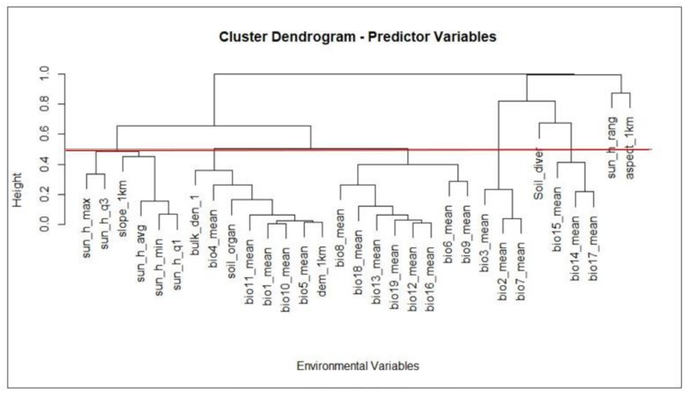
Raw data was collected from NASA Daymet and converted into 19 bioclimatic variables at a 1km x 1km resolution utilizing formulas from Worldclim. ArcGIS software and R were utilized to assist in the process.



Can bioclimatic variables be used to determine what influences NDVI (Normalized Difference Vegetation Index) variables?

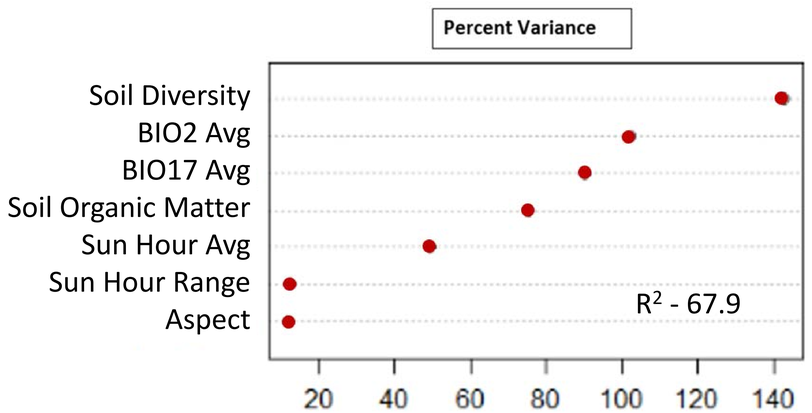
Methods

After the bioclimatic variables were determined we took the average of all variables from 2001 to 2016 and ran a Pearson Correlation. We then grouped variable factors utilizing cluster analysis with a threshold of 0.5 to define variable groups. The cluster dendrogram revealed seven predictor variable groups.



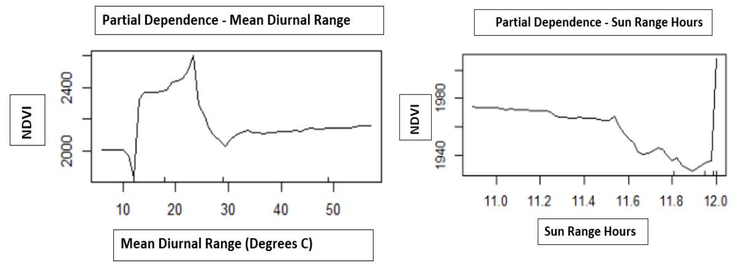
We conducted a variable inflation factor test (VIF) to ensure multicollinearity was reduced. Then random forest modeling was ran on the remaining seven variables. Random forest modelling determined how the remaining variables influence the distribution of NDVI variables.

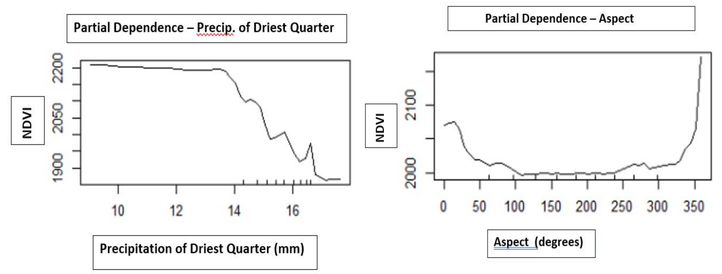
Results

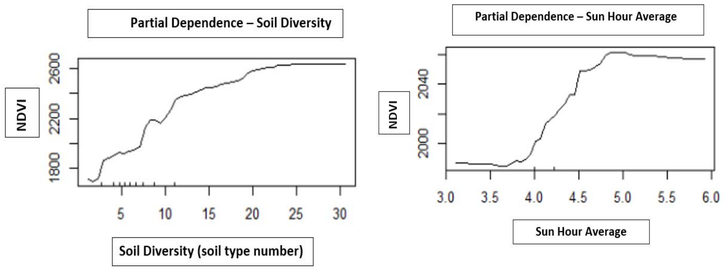


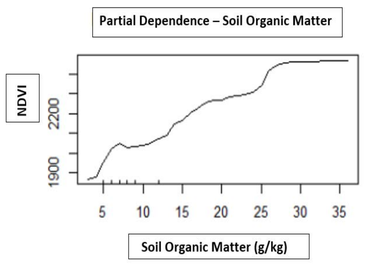
Partial Dependency Plots (PDP) were then run to determine the influence of each variable on NDVI.

Acknowledgement: This research was made possible by CAP LTER.









Conclusion

We used our geodatabase to determine the most important variables that influence NDVI over a 17 year period in the Phoenix metropolitan area.

Our results found **soil diversity, mean diurnal range, and precipitation of the driest quarter** most influenced NDVI while **aspect** and **sun hour range and average** had the least affect on vegetation cover in the Phoenix Metropolitan area.

Next Steps

The results of this research will be in the CAP LTER database for reference and public use.