Investigating Dynamics Between Alien & Native Plants Using NDVI in Kaua'i, Hawaii

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Introduction

The island of Kaua'i contains many of Hawaii's endemic species, but it also contains areas that have gone through 90%+ type conversion to alien plants. Many organizations, such as the National Tropical Botanical Garden, work toward reversing this trend.

The aim of this project was to utilize the Normalized Difference Vegetation Index (NDVI) to break out vegetation into low and high biomass and see if there is a correlation with the native plants found while out in the field.

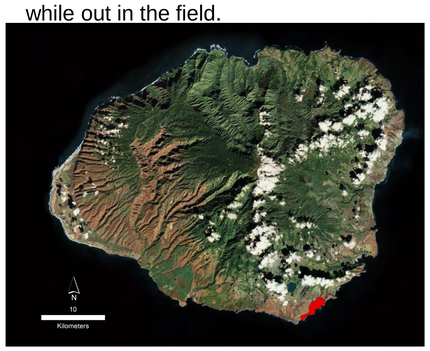

Figure 1. Island of Kaua'i with study area highlighted red in the Southeast.

Methodology

The Normalized Difference Vegetation Index was used in this study because it is used to determine the health and condition of vegetation and as alien plants are better competitors, the health of native plants deteriorates. The NDVI formula: is *NIR-Red/NIR+Red* .

The red and one of the near-infrared bands of aWorldView-2 Image acquired on May 29, 2012 was used to generate NDVI values for analysis.

In order to reduce analyst bias in the NDVI, break points in the NDVI were chosen by manually examining the range of values associated with each landcover class using the inquire cursor in ERDAS Imagine (see Figure 2) and seeing where the breakpoints were for water, and barren/built-up classes. The low and high biomass classes were determined by taking the remaining range of values and dividing them half. See Table 1.

Table 1. Classification & Pixel NDVI Value

	Pixel NDVI Value	
Type	Low	High
Water	-0.278846	0.0353012
Barren/Human Influenced	0.039789	0.26418
Low Biomass	0.268667	0.564863
High Biomass	0.569351	0.861058

The GPS points I acquired for the study were chosen before the NDVI classification was constructed as I did not want there to be any bias because if one looks for something hard enough they will find it. My GPS points were supplemented with GPS points taken by the rest of the vegetation team on data collection trips to the study area.

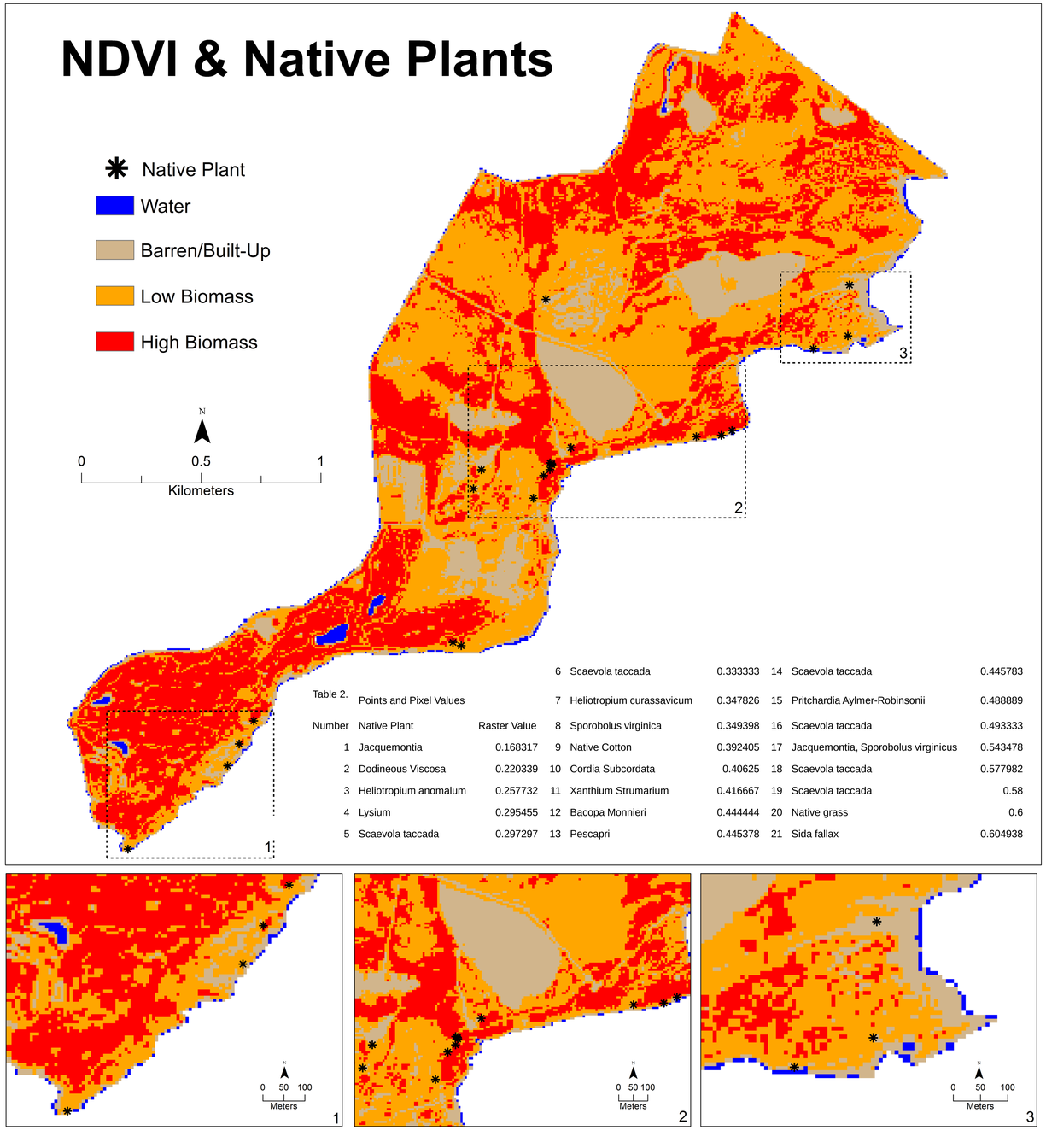

Table 2. Points and Pixel Values

Number	Native Plant	Raster Value	Number	Native Plant	Raster Value
1	Jacquemontia	0.168317	6	Scaevola taccada	0.333333
2	Dodineous Viscosa	0.220339	7	Heliotropium curassavicum	0.347826
3	Heliotropium anomalum	0.257732	8	Sporobolus virginica	0.349398
4	Lysium	0.295455	9	Native Cotton	0.392405
5	Scaevola taccada	0.297297	10	Cordia Subcordata	0.40625
11	Xanthium Strumarium	0.416667	14	Scaevola taccada	0.445783
12	Bacopa Monnieri	0.444444	15	Pritchardia Aylmer-Robinsonii	0.488889
13	Pescapri	0.445378	16	Scaevola taccada	0.493333
17	Jacquemontia, Sporobolus virginicus	0.543478			
18	Scaevola taccada	0.577982			
19	Scaevola taccada	0.58			
20	Native grass	0.6			
21	Sida fallax	0.604938			

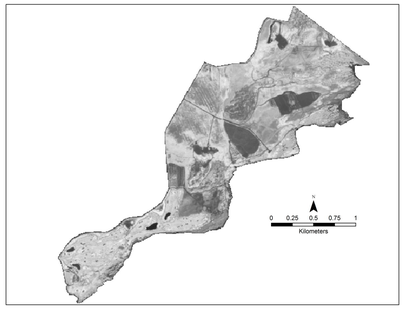

Figure 2. Pixel values were chosen by running the inquire cursor over areas in the grey scale NDVI.

Results

The data appear to show that there is a correlation between low biomass and native plants, with alien plants showing up as high biomass (such as the golf course in the bottom left part of the study area). 81% or 16 of the 21 native plant points that were taken fell in the low biomass area, with 4 falling into high biomass and 1 in the barren/built-up area.

Conclusion

The correlation between low biomass and native plants is one that can prove useful as shifts in the patch boundaries of alien plants could signal an increasing encroachment by these species. Something that was very interesting in the study was that 11, more than half, of the native plant points fall close to both low biomass and high biomass pixels. This could be due to the growth and invasion of alien plants that are pushing out native plants. That can also prove useful as it can be seen as a sort of battleground in which no land can be lost to alien plants.

Further research should include the collection of more native vegetation points in these contact areas where low and high biomass meet, to determine if there are native plants there and to expand the sampling area into in order to develop a larger sample size that will add to the analysis presented here.

Acknowledgements

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References: Evaluation of the NDVI in plant community composition mapping. Kuefer C. and Loope L. (2009) Prevention, Early Detection and containment…