Land Cover Classification and NDVI Post Hurricane Irene

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Background

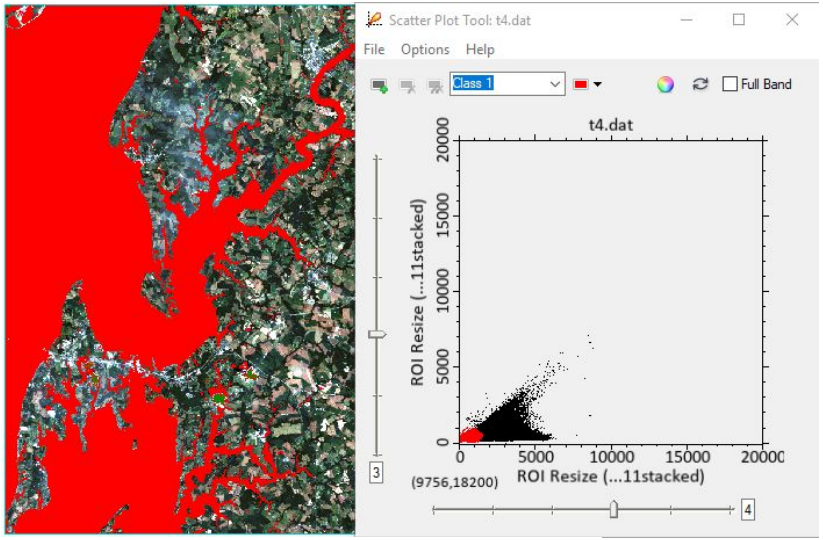
- Hurricane Irene was the first major hurricane of the 2011 Atlantic hurricane season.
- From August 26 to August 28, 2011, the hurricane generated strong wind gusts and heavy flooding rain throughout Maryland's eastern shore.
- The wind gusts averaged 60 mph and precipitation totaled an estimated 6-12 inches by the end of the storm.
- Many trees were uprooted and multiple types of crops were destroyed.

Objectives

- Use NDVI to help classify different vegetation
- Create a map of NDVIdiff by using pre and post hurricane imagery.
- Create an accurate land cover map of Queen Anne's County, MD post Hurricane Irene by doing a supervised classification.

Methods (NDVIdiff)

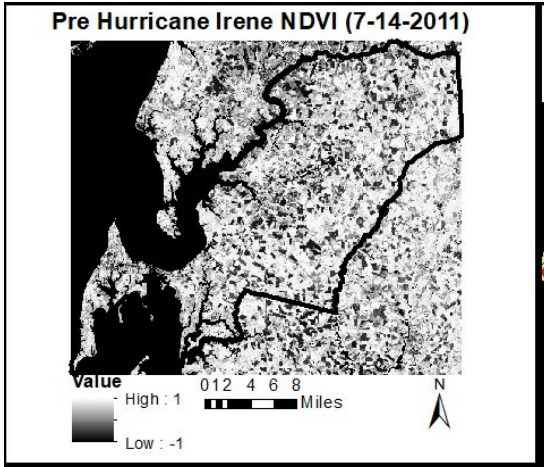
- The pre-hurricane image was taken July 14, 2011 and the post-hurricane image was taken August 31, 2011, three days after the event.
- The water, cloud, and built area mask was created by using the spectral plot tool before calculating NDVI.
- The data value for the mask was set to 0.
- NDVI was calculated in the Band Math calculator by using the Red and NIR bands.
- NDVIdiff was was calculated in the Band Math calculator by subtracting pre hurricane NDVI from the post hurricane NDVI.

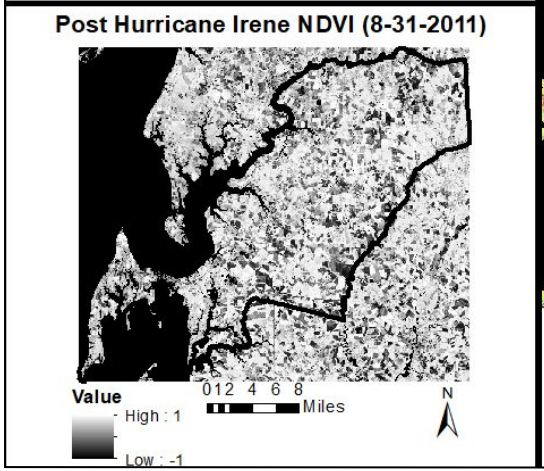


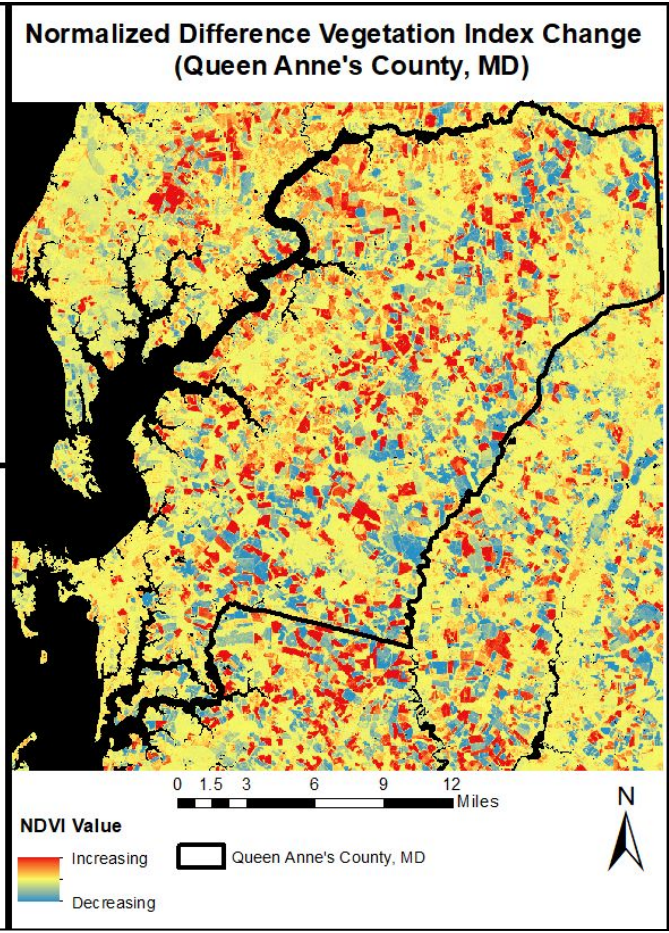
$$NDVI = \frac{(NIR - Red)}{(NIR + Red)}$$

Results (NDVIdiff)

- NDVIdiff shows where vegetation health has increased and decreased.
  - Red means an increased amount of health vegetation.
  - Yellow means that there was no change in NDVI
  - Blue means a decrease in healthy vegetation.
- Interpreting NDVI values
  - .20 to .50-shrub/grassland
  - .50 to .70-other vegetation
  - .70+ grass and forest

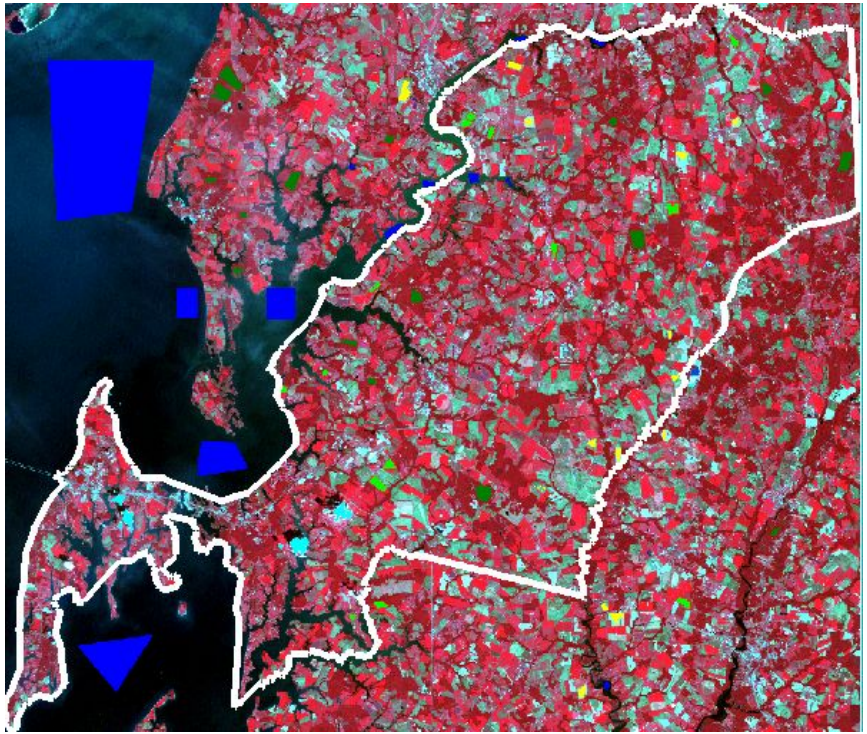






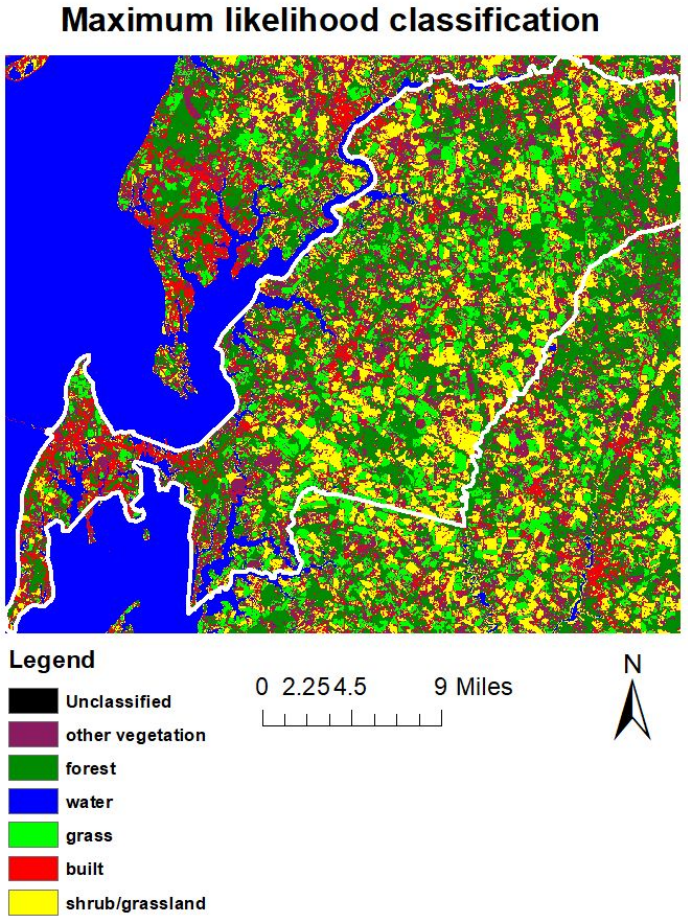
Methods (Land cover)

- Data was acquired from from USGS EarthExplorer. The pre and post hurricane image was taken by Landsat 4-5.
- Subsetted the data to Queen Anne's County.
- Created a minimum of 15 roi's for each of the 6 land cover classes.
- Confirmed land cover roi's by using Google Earths high-resolution imagery.
- Used NDVI to differentiate between vegetation types
- I chose Maximum Likelihood for the classification method.



Results (Land cover)

- Maximum Likelihood Classification
- **Composition - 6 land cover types**
  - Water-25%
  - Forest-21%
  - Other Vegetation-18%
  - Shrub/Grassland-14%
  - Grass-11%
  - Built-9%



Discussion

- The overall accuracy of the map was 99% and the Kappa value was .97 which means that there is 97% better agreement than by chance alone
- The other vegetation and built classes were the main source of error for the classification
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  - This is likely happened because I grouped residential areas, roads, and buildings into one class.

Confusion Matrix: Z:\481final\data\finalclass2.img

Overall Accuracy = (103917/104802) 99.1556%
Kappa Coefficient = 0.9704

	Ground Truth (Pixels)				
Class	ROI:other veg	ROI:grass	ROI:water	ROI:builtROI:	shrub/gr
Unclassified	0	0	0	0	0
other vegetat	1999	104	0	37	6
grass	3	3262	0	0	0
water	0	0	88114	0	0
built	606	0	0	235	8
shrub/grassla	0	0	2	2	2873
forest	11	0	0	1	0
Total	2619	3366	88116	275	2887

	Ground Truth (Pixels)	
Class	ROI:forest	Total
Unclassified	0	0
other vegetat	54	2200
grass	4	3269
water	0	88114
built	46	895
shrub/grassla	1	2878
forest	7434	7446
Total	7539	104802

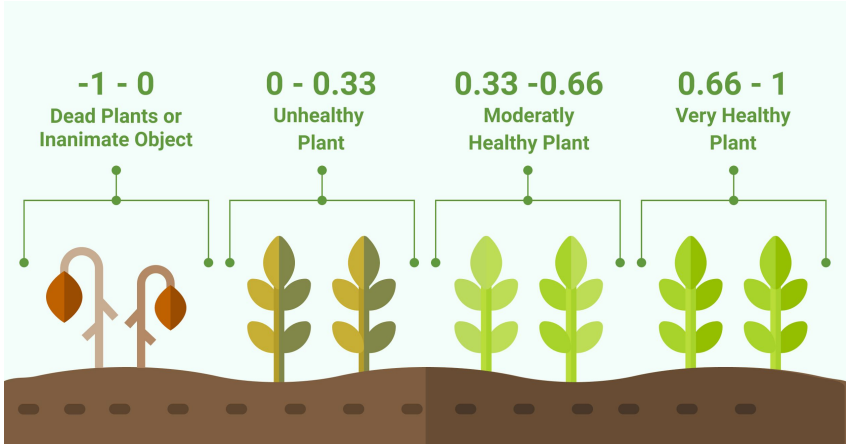
	Ground Truth (Percent)				
Class	ROI:other veg	ROI:grass	ROI:water	ROI:builtROI:	shrub/gr
Unclassified	0.00	0.00	0.00	0.00	0.00
other vegetat	76.33	3.09	0.00	13.45	0.21
grass	0.11	96.91	0.00	0.00	0.00
water	0.00	0.00	100.00	0.00	0.00
built	23.14	0.00	0.00	85.45	0.28
shrub/grassla	0.00	0.00	0.00	0.73	99.52
forest	0.42	0.00	0.00	0.36	0.00
Total	100.00	100.00	100.00	100.00	100.00

Conclusion

- NDVI is a helpful tool for making classification maps
- Areas classified as shrub/grassland had low NDVI values ranging from .2-.4. When looking at NDVIdiff those areas had decreasing NDVI values. This means that the unhealthy vegetation was likely caused by the hurricane or change in seasons.

Future Research

- Look at change in NDVI for 1 month, 3 months, 9 months , and 1 year post Hurricane Irene. This study would be helpful with understanding vegetation recovery.
- Make classification maps for each of these time periods.
- Use a satellite with high spatial resolution



Acknowledgements

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