Methods for Mapping Algal Blooms: Do They Produce Similar Results?

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Introduction:

Algal blooms occur when there is an overabundance of algae in a freshwater or saltwater body. Algal blooms often have negative effects on human health, the environment, and the economy. They increase during summer months due to heightened water temperatures. With the climate warming gradually, the occurrence of algal blooms will likely increase. Mapping algal blooms using geospatial data and analysis methods is incredibly important to understanding where algal blooms happen and how they have increased over time. In my research project, I use geospatial data to map an algal bloom in Lake St. Clair, Michigan. My data originates from the satellite Landsat 8 and was collected on July 14th, 2019. I use the Blue Normalized Difference Vegetation Index (BNDVI) and the Surface Algal Bloom Index (SABI) for my analysis of the data. I combine each of these, as well as the original data, with a supervised classification. The purpose is to determine if similar results can be derived from each of these methods.

Methods:

To determine if different methods of mapping algal blooms produce similar results, I will test various methods on an image of Lake St Clair, Michigan. The image was collected by Landsat 8 on July 14th, 2019. I will use the Blue Normalized Difference Vegetation Index (BNDVI), an index that measures densities of cyanobacteria on the surface. I will also use the Surface Algal Bloom Index (SABI), an index that measures biomass on the surface. After that, I will do a supervised classification on the original image and the two results from each index.
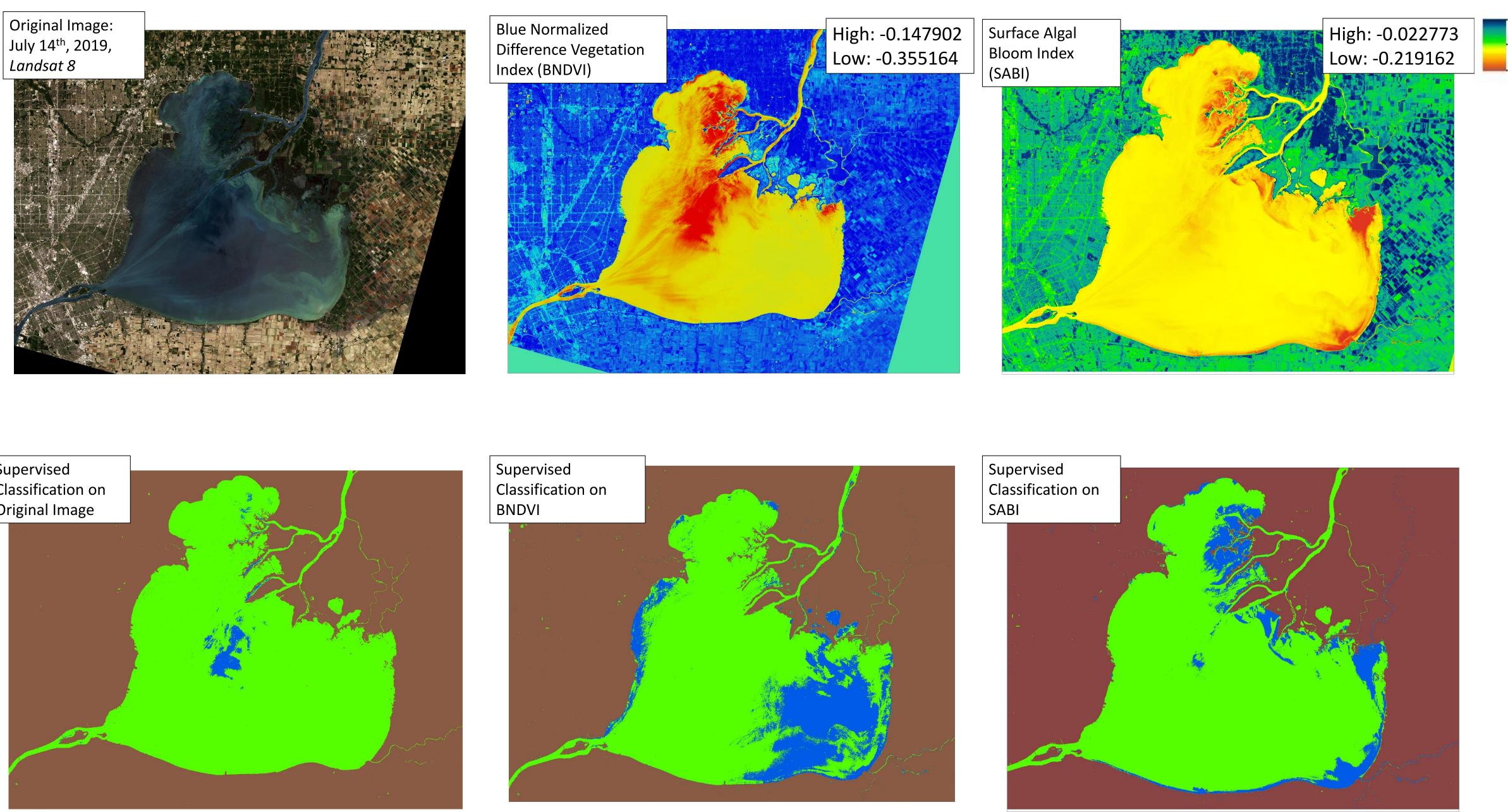
Blue Normalized Difference Vegetation Index
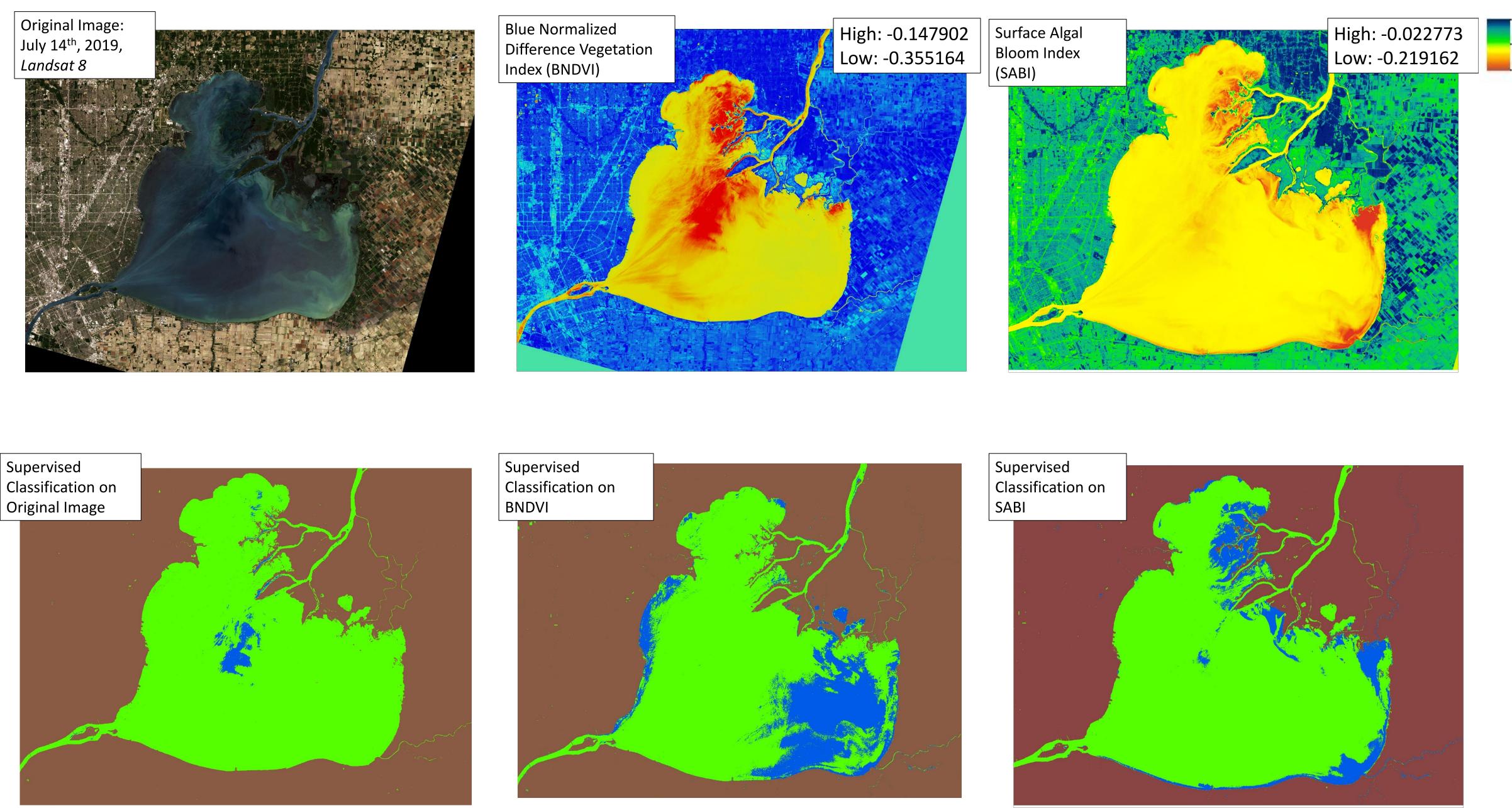$$BNDVI = (NIR - Blue) / (NIR + Blue)$$

Surface Algal Bloom Index
$$SABI = (NIR - Red) / (Blue + Green)$$

Original Image: July 14th, 2019, *Landsat 8*

Blue Normalized Difference Vegetation Index (BNDVI) — High: -0.147902 Low: -0.355164

Surface Algal Bloom Index (SABI) — High: -0.022773 Low: -0.219162

Supervised Classification on Original Image

Supervised Classification on BNDVI

Supervised Classification on SABI

Conclusions:

After examining my results, I concluded that the Blue Normalized Vegetation Index (BNDVI) appeared to give the best result. The BNDVI result had a slightly larger span between the highest value and the lowest value than the SABI result did, leading me to believe that it gave a more accurate result. The sections of the lake represented by red (lower values) in the BNDVI result correspond with sections in the original image that appear darker, which makes sense as the parts of the lake without cyanobacteria on the surface would appear darker. I concluded that the supervised classification was not a good way to display the results, as it introduces my own bias. While I can look at the higher values and assume that they may be representative of an algal bloom, I would need more information about the specific values necessary to define an algal bloom in order to make a conclusion on the matter.