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CREATING A METHOD USING LANDSAT 8 IMAGERY AND ENVI TO MEASURE NDVI  
AND CALCULATE AMOUNT OF DISCHARGE FROM BLUE LAKE, UTAH

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Flow meters and other traditional techniques used to measure diffuse discharge at large springs is difficult due to variable field conditions, cost and past data availability. Landsat imagery can provide a highly reproducible, cost effective alternative that stretches back 35 years. We used Landsat imagery in combination with the image analysis program, ENVI, to calculate the amount of discharge from Blue Lake, an aridland spring in Utah's West Desert from June 2014 to July 2018. Past measures of discharge from Blue Lake were larger than the proposed amount of recharge into the lake which we believed did not accurately represent the water budget of this area. We hoped that the method created would solve this problem. Landsat Level 2 images were processed using a modified framework taken from papers by Rachael F. Thomas et al. In this paper, the authors used ENVI, the normalized difference vegetation index (NDVI) and the normalized difference water index (NDWI) to classify three types of pixels: water, mixed and vegetation in Landsat 5 and 7 images. NDVI gives the number of pixels that the program identifies as vegetation using a ratio of two equations using spectral reflectance data from Landsat. The ratio of equations yields a range from -1 to 1, where areas with large amounts of greenery have values from about .3 to 1 (according to NASA). Pixels have a specific area depending on which type of Landsat data is being analyzed. In this case with Landsat 8, one pixel is 30 meters by 30 meters. We chose a threshold of vegetation verses non-vegetation spectra using field observations of average vegetation extent and used these values in a United States Geologic Survey eddy covariance evapotranspiration. This equation uses established evapotranspiration rates of vegetation types in western Utah and Nevada to derive an equation that calculates spring discharge based on vegetation area. It was found that our calculated amount of discharge was about 50-64% of the proposed amount of recharge. This is a much more accurate picture of the water budget for Blue Lake and its surrounding wetlands. Therefore, we conclude that this method could be used in place of flow meters. With populations growing and water becoming scarcer, having methods in place to more conveniently and accurately measure water resources is vital.



Blue Lake, Utah