This study is concerned with the environmental impact of hydraulic fracturing, or “fracking,” in communities with large numbers of fracking wells, as well as the impact of fracturing water use on agriculture in Larimer and Weld County, Colorado. A significant portion of the land in Larimer and Weld County from chemicals in wastewater pits near the fracturing wells. Given the tremendous economic benefits of fracking, oil and gas companies can afford to pay more than potential uses of this water, in particular agricultural users. Thus, hydraulic fracturing companies take potential water use away from agricultural production in counties where both fracking and agriculture are significant industries. This suggests that the increase of fracturing wells beginning in 2004 is an important point of change for water use and potential effects on agricultural vegetation health, as the number of wells increases, the health of agricultural vegetation should decrease due to the lack of water.

Background

2010 Larimer & Weld County (RGB: 4, 3, 2)

2011 Larimer & Weld County (RGB: 4, 3, 2)

2012 Larimer & Weld County (RGB: 4, 3, 2)

2013 Larimer & Weld County (RGB: 4, 3, 2)

2020 Irrigated Land (RGB: 4, 3, 2)

2010 Irrigated Land (RGB: 4, 3, 2)

2011 Irrigated Land (RGB: 4, 3, 2)

2012 Irrigated Land (RGB: 4, 3, 2)

2013 Irrigated Land (RGB: 4, 3, 2)

2020 Non-Irrigated Land (RGB: 4, 3, 2)

2010 Non-Irrigated Land (RGB: 4, 3, 2)

2011 Non-Irrigated Land (RGB: 4, 3, 2)

2012 Non-Irrigated Land (RGB: 4, 3, 2)

2013 Non-Irrigated Land (RGB: 4, 3, 2)

2020 River Region (RGB: 4, 3, 2)

2010 River Region (RGB: 4, 3, 2)

2011 River Region (RGB: 4, 3, 2)

2012 River Region (RGB: 4, 3, 2)

2013 River Region (RGB: 4, 3, 2)

Results and Analysis

The results that I obtained from my band index calculations were somewhat inconclusive. Because of the time constraints on my project, I was not able to gather enough data in order to find statistically-significant patterns for the values of my band indices. Given that in real time I did not get usable image from 2005, 2007, 2009, and 2012, this means that I only had 10 data points to use for each of my indices. However, the data I gathered was able to produce some trends that I might be able to examine further if I continue my study.

As important outcome of my research was the difference between the indices that I used. When I calculated the NDVI for the non-irrigated region I found a decreasing trend in the average pixel values per year. However, when I calculated the SARVI values for the pixels in the same non-irrigated areas, I found an increasing trend over the time period of my study. As a continuation of my study, it would be interesting to further compare the indices I used in order to determine which one best represents the levels of healthy vegetation. I could also compare additional indices as well in order to find the most accurate index for measuring vegetation health in the Larimer and Weld County region. I could carry out similar experiments to determine the appropriate band index to use for water composition as well.

NDVI results

When I calculated the NDVI on my three regions of interest (Larimer and Weld County, irrigated region, non-irrigated region), the data for the irrigated and non-irrigated regions showed a generally decreasing trend. This suggests that the amount of healthy vegetation in those locations decreased from the beginning of the time period of my study to the end. But, the overall trend for the entire region of Larimer and Weld County was an increase in vegetation health. The NDVI values for the entire region of Larimer and Weld County suggest that there has actually been an increase in healthy vegetation from the beginning of my study to the end. It is difficult to see the result for the entire area of Larimer and Weld County, but a measurement of overall vegetation health because the area contains a diverse range of vegetation features. However, the values for both the irrigated and non-irrigated regions showed a general decreasing trend in healthy vegetation. When segmenting the image into smaller subimages representing specific land surface types, I was able to get a better idea of the effects of fracking.

SARVI results

Interestingly, in contrast to the NDVI calculations for the non-irrigated region, when I calculated the vegetation health values using SARVI for the non-irrigated region I found a generally increasing trend in the data values. This indicates that the wells in the non-irrigated region could have been driven by soil changes from year to year. Therefore, this index may be more useful than NDVI when determining levels of healthy vegetation surrounding fracturing wells, and it could show a more accurate representation of the effects of the wells in areas with more sparse vegetation. As stated in the introduction to the analysis and results subsection, an interesting continuation of my study would be to do a deeper study comparing the accuracy of NDVI to SARVI as well as other band indices (in measuring vegetation health surrounding fracturing wells).

Conclusion

Both of the regions that I analyzed using NDVI (and the PCA-calculated index) showed generally decreasing trends in water reflectance from the beginning of my study to the end. The trends in the data using the NDVI calculations were likely driven by the changes in vegetation health due to the development of fracking has caused a change in water composition over the time period of my study. As a continuation of my study, it would be interesting to compare the changes in water composition over the time period of my study. As a continuation of my study, it would be interesting to compare the changes in water composition in those locations decreased from the beginning of the time period of my study to the end. But, the overall trend for the entire region of Larimer and Weld County was an increase in vegetation health. The NDVI values for the entire region of Larimer and Weld County suggest that there has actually been an increase in healthy vegetation from the beginning of my study to the end. It is difficult to see the result for the entire area of Larimer and Weld County, but a measurement of overall vegetation health because the area contains a diverse range of vegetation features. However, the values for both the irrigated and non-irrigated regions showed a general decreasing trend in healthy vegetation. When segmenting the image into smaller subimages representing specific land surface types, I was able to get a better idea of the effects of fracking.

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Conclusions

Although my results did not show statistically-significant trends for any of the bands I calculated, the results that I found did show some trends that would be interesting to examine further. Additionally, the processes that I used are useful in analyzing the changes in vegetation health due to the development of fracking. A significant part of the economy. Additionally, analysis of water composition using remote sensing techniques could show meaningful information about the effects of fracking. The limitations of my study were largely due to the time constraints. It is possible to continue my research as well in order to gain more meaningful trends in the data. Another possibility is to expand the data collection for my study to include all years for my study. It might help show more meaningful trends in the data. Another possibility is to expand the data collection for my study to include all years for my study. It might help show more meaningful trends in the data. Another possibility is to expand the data collection for my study to include all years for my study.