An Investigation to Remotely Sense Mineral Leeching Through Soils

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An Investigation to Remotely Sense Mineral Leeching Through Soils

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Abstract:
Satellite data of the Earth's surface provide a wealth of information on landscape conditions. I used Landsat data to determine an important geologic process that influences the composition of the soils. My project focuses on the experimental hypothesis that we can use plant vigor as a proxy to document mineral washing downslopes through soils. I constructed a Normalized Difference Vegetation Index (NDVI) composite image from Landsat data to help assess vegetation health in my target location - a national park south of Mount St. Helens. This location was selected because of its steep inclines, dense undisturbed vegetation, and fertile soils. It is my hypothesis that as water trickles down through the soil it picks up and moves the dissolvable minerals downslope, therefore providing more minerals that aid vegetation growth and vigor at the bottom of the slopes.

Future Examination:
Future examination would like to test this new process in an area which has been tested using the traditional method. If I was able to perform this in a location such as this we may be able to use this to see if certain soils would show the change in mineral washing more or less depending on their compositions and permeabilities. As this is a new process and never been used in the field I have the possibility to test new locations and see if it works.

Tools:
The data I used in this project was collected by Landsat 8 on August 7th 2014. This data was post-processed to extract imperfections in the image caused by weather in the local area. Because of this I have used a stack of usable bands to try and perform an NDVI to check on vegetation health in the area of interest.

Graph of test locations:
To the left is a graph of the up slope and downslope NDVI numerical pixel values. Even though these values are not connected by point number I have kept the lines to show how much space between these test points may have been positive showing where the upper slope vegetation was less healthy than the lower slope. As you may notice there are only a few locations where the green line dips underneath the blue. This shows us that even when the lower slope has less healthy vegetation it's only slightly less to the point where it may be a shadow or artifact in the image. This is why I took 30 test locations to try and remove issues in the output data.

Data Table:

<table>
<thead>
<tr>
<th>Up Slope</th>
<th>Down Slope</th>
<th>Average</th>
<th>Difference</th>
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</thead>
<tbody>
<tr>
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<td>0.3000</td>
<td>0.2500</td>
<td>0.2750</td>
<td>0.0250</td>
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</tbody>
</table>

Conclusions:
In conclusion I found that there was a correlation in the slope and the vegetation health. This seems to support my original hypothesis that the vegetation would be more healthy at the bottom of the slopes. This may be contrary to logical thoughts since the ones at the top would get more sun for longer periods of the day. This mineral washing is still a point of interest in a lot of research and may want to be used in soil studies over larger areas of land. This could dramatically decrease the cost of these studies. By using remote sensing on data already obtained we may be able to study old soil structures and their mineral washing features as well.

References: