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Lab 04 – Mapping the Distribution of an Invasive Weed

You now have a basic working knowledge of Google Earth Engine and should be able to start to generate scripts on your own. To help you exercise those coding muscles, the lab assignments from here on out will be a bit more "cryptic". When I introduce a new concept to you, I will explain it and provide some code to help. Aside from that assistance, you should be able to write your own scripts.

During lecture I talked about using the normalized difference vegetation index (NDVI) to map the occurrence of Cheatgrass across Utah. Here's a link to a script I put together to do just that:

https://code.earthengine.google.com/ea6a1641045ce89914627a1d6c9401e2

In the script, I combine multiple Landsat image collections and allow the user to select a year between 1984 and the present.

I .map() across each collection to generate an NDVI layer for each image as well as mask for clouds and I clip every image in the collection to the boundary that I have chosen.

After I merge the collections, I end up with a combined set of images between L5, L7, and L8 (they overlap in time) for a given year.

I chose to map Cheatgrass because it has a phenological growth pattern that is somewhat distinct from all other natural vegetation types in the Intermountain West. It grows early in the spring and senesces in early summer.

Therefore, in theory, cheatgrass should be green in the spring and brown in the summer.

Here's a normalized difference index using NDVI from spring and summer that takes advantage of that growth pattern:

$$(NDVI_{spring} - NDVI_{summer}) / (NDVI_{spring} + NDVI_{summer})$$

I generate the NDVI for all images, then, using only the spring and summer images, I renormalize the NDVI between the two seasons to come up with a new index that maps everything that highlights everything that is green in the spring, but less green in the summer.

In our neck of the woods, that tends to be Cheatgrass.

I apply a color ramp to the output image based on what I estimate to be the right range (I may be wrong. We need field data to validate and then generate a color ramp to fit the data).

You should know how to do this - except the Merge part and I've used a different date filter. I've also added a function that clips images within image collections. Just a different way of clipping.

What I've added here that's new is how to "fuse" different datasets in order to make one layer that includes not only the color ramped index, but also topography, political boundaries, water bodies, etc. All of this is under the

```
//*************************************************************************
//************************** MAPPING SECTION ******************************
//*************************************************************************
```

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There are a number of new commands in this exercise:

- Visualize()
- ee.Terrain.hillshade()
- mask()
- blend()
- ui.Thumbnail()

Your task is to interpret and experiment with these commands

Other than the Landsat collections and TIGER county boundary file, I use two other layers:

- USGS National Elevation Dataset 1/3 arc-second
- USGS NLCD 2016 Land Cover Map

Q1: Write short scripts that display only the elevation and land cover datasets (one script each). Provide the shared link using the 'Get Link' button.

Q2: Why is the elevation dataset an 'image' and the land cover dataset an 'image collection'?

Q3: What kind of data and/or data layers (bands) are available in each?

Q4: What do the functions above do? (you can find their documentation in either the Docs tab, or you can look them up in the GEE Users Guide by clicking the **?** at the top right of the screen and then 'Reference' at the top of the window that just came up.

Q5: In my Mask function, what do the numbers 11 and 31 refer to?

Q6: If you look at the Thumbnail that I sent to the Console window, you will notice that the projection is slightly different from the one that is used in the bottom display window (web Mercator). How did I accomplish this?

Q7: Modify my script to use the MODIS Vegetation Indices product (MOD13Q1) and NOT the Landsat collections.

Cool, sorta off-subject link:

https://medium.com/google-earth/visualizing-changing-landscapes-with-google-earth-engine-b2d502dc02a8

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