EXERCISE

LCMS Data Explorer

Introduction

This exercise is designed to provide user guidance for navigating and downloading data produced for the USDA Forest Service's Land Cover Monitoring System (LCMS). The LCMS Data Explorer is the best resource environment for quickly viewing and downloading available data products. The LCMS Data Explorer is overlaid on a Google Maps-style interface. This should help those already familiar with Google's suite of mapping products become more quickly familiar with the explorer.

The LCMS Data Explorer can be found by clicking this link (https://lcms-data-explorer.appspot.com/).

Objectives

- Learn how to navigate the LCMS Data Explorer web application.
- Download a data selection from the LCMS Data Explorer.

Required Software

- A web browser other than Microsoft Internet Explorer.

Prerequisites

- Basic understanding of how to use a simple GIS, such as Google Maps or Google Earth.
- A study area or area of interest (AOI) within the LCMS mapped boundary.

Contacts

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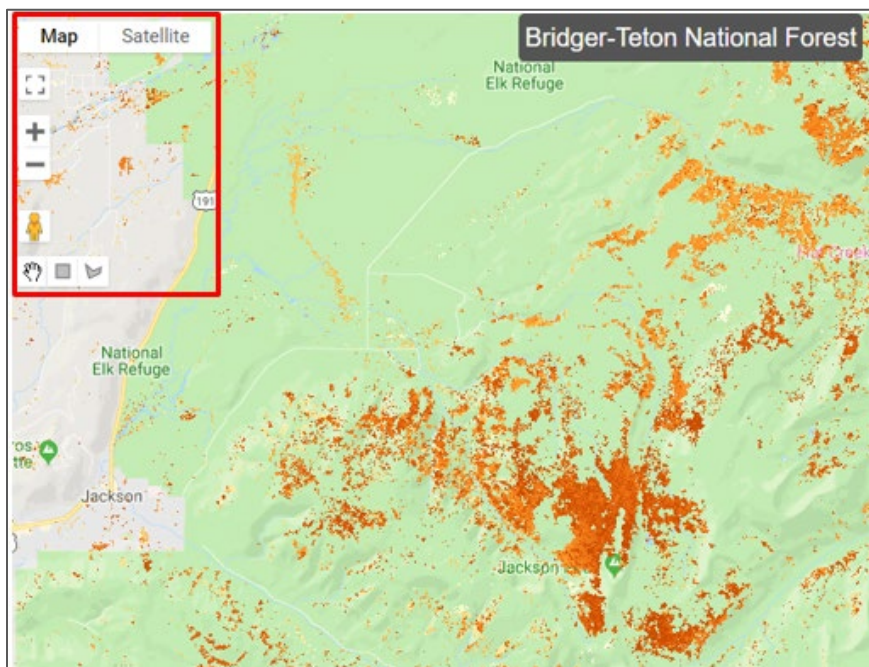- LCMS general inquires: sm.fs.lcms@usda.gov

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Part 1: Navigating the LCMS Data Explorer

This part of the exercise introduces the user to general navigation and functionality features of the LCMS Data Explorer.

A. Explore the Google Tools

Launch the LCMS Data Explorer by clicking this link (https://lcms-data-explorer.appspot.com/). We will begin by focusing on the tools along the left side of the browser window. These tools are default tools within all web mapping applications using Google. Therefore, some of the tools are used in this exercise while others are not.

1. At the top left you can choose between **map** view and **satellite** view for your base layer.
    i. **Map** view has a checkbox drop-down option to turn terrain view on and off.
    ii. **Satellite** view has a checkbox drop-down option to turn labels on and off.
2. The user can toggle full-screen on and off by clicking the icon below the map and satellite buttons.

3. Below the full screen button are zoom tools for viewing the map at different scales.
    i. Zoom In and Out can also be accomplished using the scroll wheel on your mouse.
4. The orange person icon allows you to drop into street view.

    i. You can click and drag the person onto the map area. Any area that becomes highlighted in blue is available for you to drop the person to see surface level imagery in that area.
5. Lastly, and most important for this tutorial, are the pan and shape tools.

i. After clicking the pan tool you can click and drag the map around to a desired study area.

ii. The box drawing tool allows you to draw a rectangular box around a study. **This will become important when you get ready to download data.**

iii. The last tool in this row allows you to draw an irregular shaped polygon by creating your own vertices. A double-click will close the shape.

6. If you drew any shapes during the previous step while experimenting with the tool, we will explore a way to delete these shapes during the data download section later in the exercise so it is OK to leave them on the map for the time being.

B. Explore the LCMS Data Explorer map controls
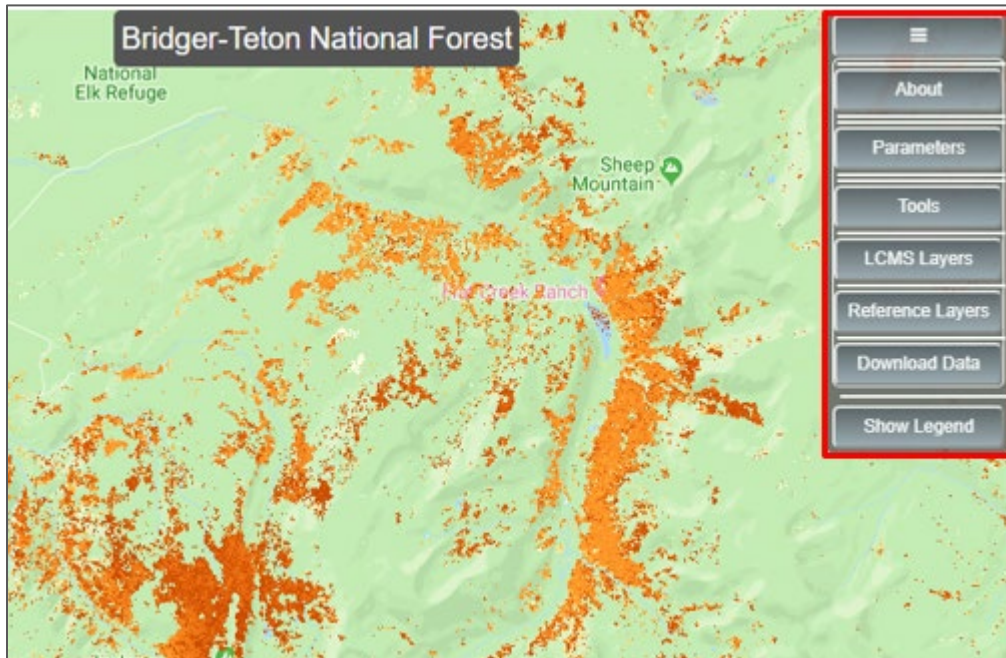
Next we will focus our attention on the tabs and tools along the right side of the browser window. These tools are the foundation of the LCMS Data Explorer and will be the area you focus most of this activity.

1. Begin by clicking the **About** tab at the top.
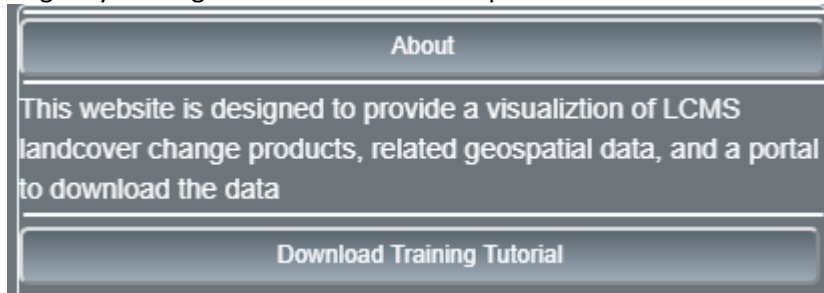
2. Read the information that appears below the button

3. You will notice a button labeled **Download Training Tutorial**. Clicking the button will download the latest version of this exercise if it is needed to be referenced in the future or by other users.

C. Explore the Parameters Tab

1. Click the **Parameters** tab located directly under the About tab within the right pane.
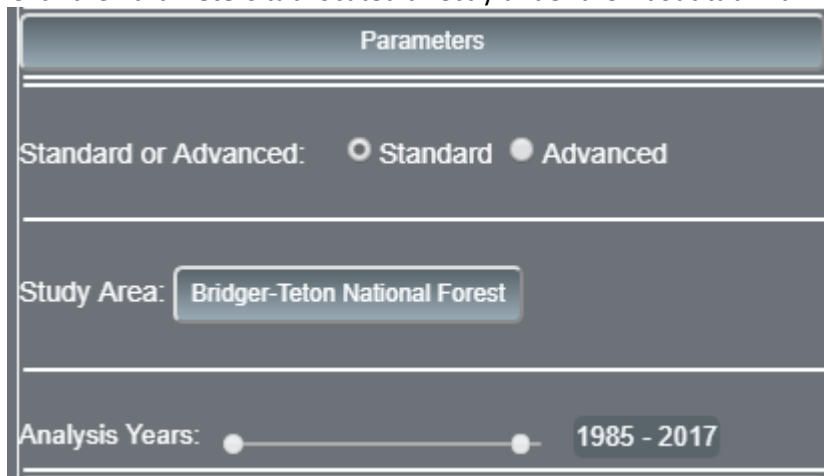

2. You will notice two radio buttons where you can select **Standard** or **Advanced** mode. For the first part of the exercise let's make sure **Standard** mode is selected.

Note: Advanced mode will be explored later in the exercise.

3. Below the mode selection, is a button for selecting your study area. The button displays the name of the currently selected study area. When you click the button you are presented with a list of possible study areas where LCMS has been completed. Choose which study area you want to focus your analysis.

4. Lastly in within the Parameters tab is a slider to refine Analysis Years. Take a moment to adjust this to see how the map changes. Finally, use the slider to choose a set of years, or a single year, to focus your analysis.

D. Explore the Tools Tab

1. Next, click the **Tools** tab.
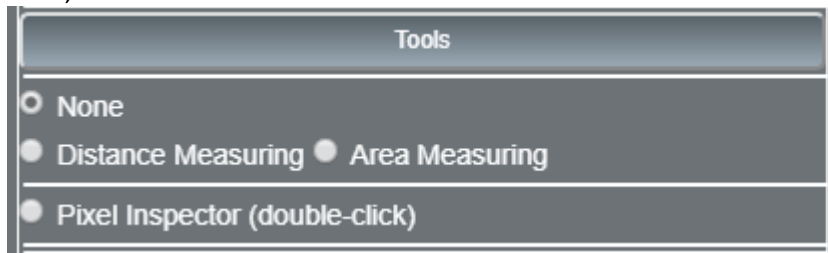
2. This set of tools allows you to get some information directly from the web map without downloading data.

3. The first set of radio buttons allow you to measure distances and areas within the map.

   i. Try each one and pay particular attention to the additional dialogue instructions that appear under the radio buttons when in the tool area.

4. The measuring tools can be turned off by clicking the radio button next to **None**.

5. Click the radio button next to **Pixel Inspector**, and then double-click a location on the map where data appears to be present. These areas should be colored in either a brown or green continuous scale. Information related the location you chose as well as data values for the LCMS layers you have selected in the LCMS Layers tab will be displayed.
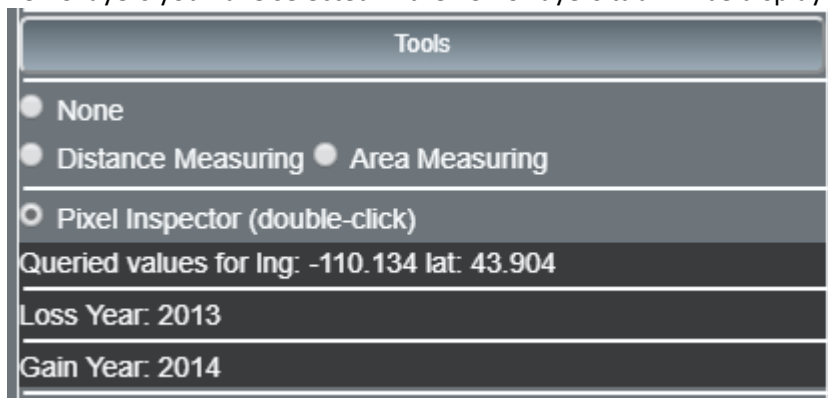
Note: *You may see less information than in the graphic above depending on what LCMS Layers are selected and where you clicked on the map. We will explore the LCMS Layers tab in the next subsection.*

E. Explore the LCMS Layers Tab

1. Click on the **LCMS Layers** tab.
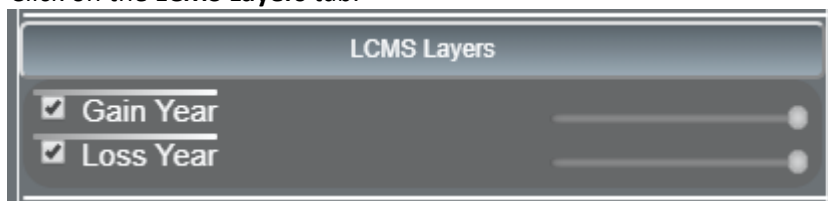
2. You can also hover over each of the LCMS layer names to see additional text describing the layer.

Note: If any of the descriptive pop-ups don't make sense at first glance, be sure to download the metadata for further description. How to access metadata will be described later in Part 2: Downloading Data.

3. Each layer can be turned on and off by selecting the checkbox to the left of the layer's name.

4. The opacity of each layer can also be adjusted with the slider to the right of the layer name.

5. **Show Legend** is a button available at the bottom of the tabs list. Click on the button and scroll through the list to better understand the visualizations that represent the various data layers within the LCMS Layers tab.

   i. The legend can be toggled on and off by clicking this button and will always be available no matter what tab you choose.

6. Many users may find this information to be enough for the project they are working on. If you want to explorer additional LCMS layers, see the **Advanced** mode options described in **Part 3** of this exercise.

F. Explore the Reference Layers Tab

1. Click on the **Reference Layers** tab.

2. At this point, you may need to use the scroll bar that appears to the right of the tab list to see everything. Especially if you haven't closed tabs as you have been going along.

   i. This tab hosts several non-LCMS data layers that may be useful in conjunction with LCMS data.

3. Notice the boundary layers and other national scale reference data you may be familiar with. This tab will also have area specific reference data based on the **Study Area** chosen within the **Parameters** tab.
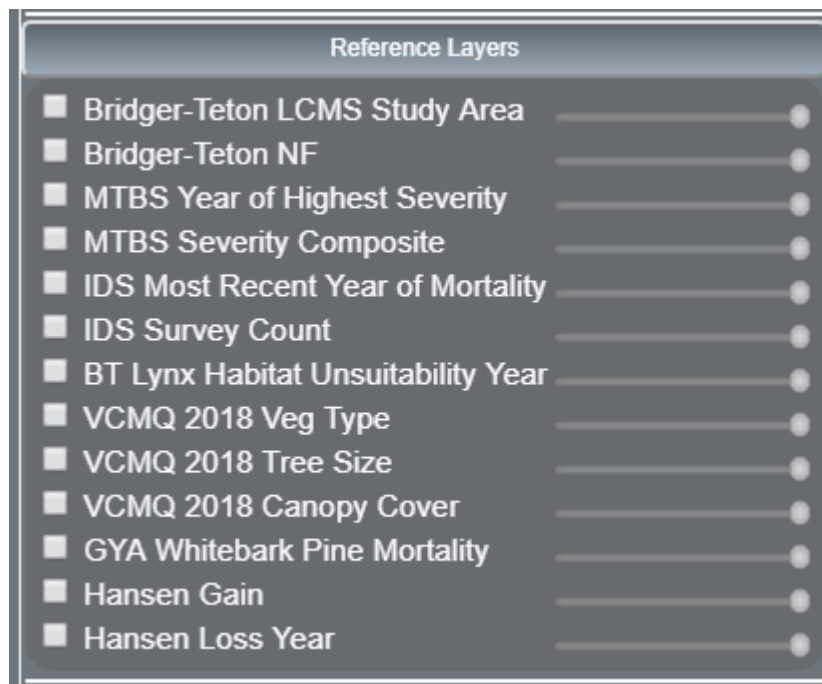
4. Hover over each layer name and some of them will have additional text that describes more about the layer.

5. Like the LCMS layers, each of these can be turned on and off using the check boxes and the opacity can be adjusted using the sliders.

6. Remember the **Show Legend** button at the bottom of the tabs list for more insight into what you are seeing for each layer.

Part 2: Downloading Data

This part of the exercise introduces the user to data selection and the download functionality of the LCMS Data Viewer.

A. Explore the Download Data Tab

1. Click on the **Download Data** tab.
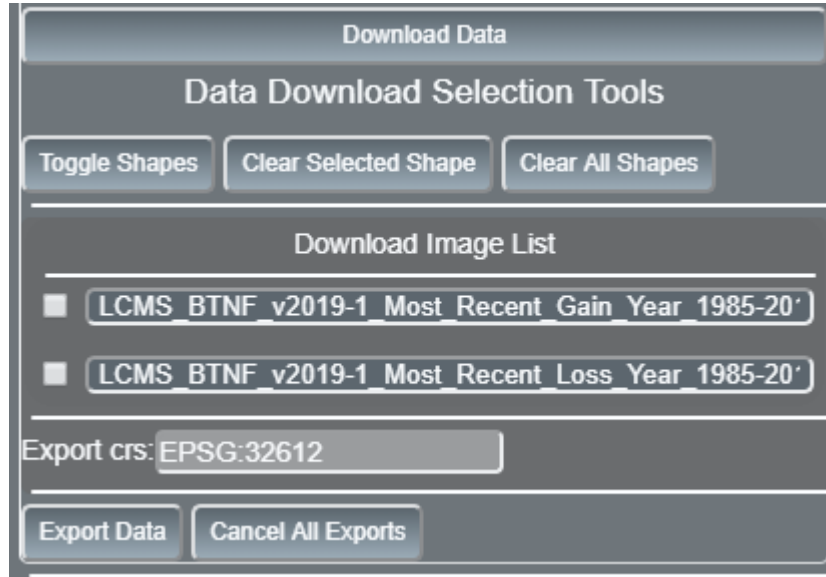
2. First, click the button on the top right, **Clear All Shapes**. This will remove all the shapes you may have created during the first part of this exercise while we were exploring the drawing tools.

B. Select an AOI

1. Zoom into an area on the map where you would like to focus your attention, or you can zoom out to the entire study area.

2. Use either the **rectangle** or **polygon drawing tools** on the left side of the browser and draw around your entire study area or just a subset within.
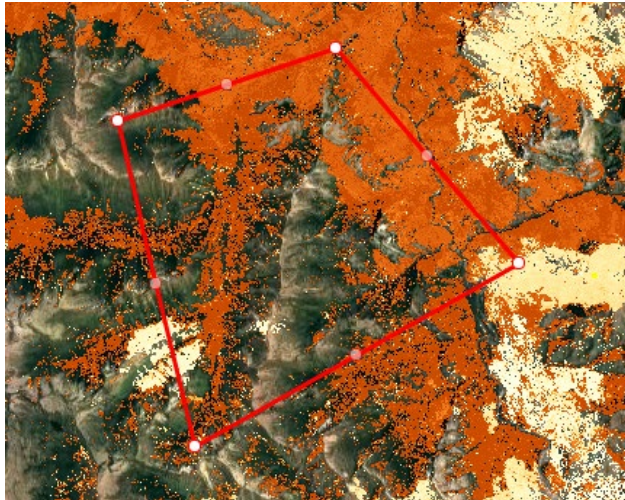

3. Once drawn, you can turn these shapes on and off using the **Toggle Shapes** button.

4. You can draw multiple shapes if you wish. If you don't like a shape you have drawn, you can select it using the pan tool from the left side, and then press the **Clear Selected Shape** button.

i. You know a shape is selected when its vertices become visible as white dots.

5. If you wish to start the selection process over completely, you can press the **Clear All Shapes** button as in **step 4**.

C. Export Data

1. Next, let's export data based on our parameter and AOI selection. This will allow us to use the LCMS data outside of the web environment.

2. Take a look at layers listed below the Download Image List. The data present in these LCMS layers are based on the selection(s) you make within the **Parameters** tab and will update in real-time based on adjustments to those parameters.

3. Use the checkboxes to select which layers you want to download.
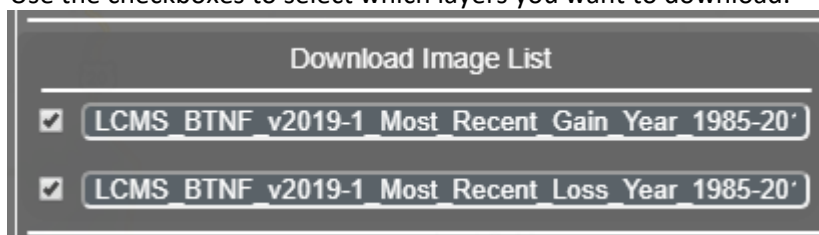
4. You can change the name of your exports to make it easier to recognize your study area after you have downloaded them.

5. You can also define a projection for your data different than the default UTM by changing the code to the right of **Export crs:**

Export crs: EPSG:32612

6. Click the **Export Data** button.
   i. The data will be subset to the AOI you chose earlier and projected to the chosen projection.
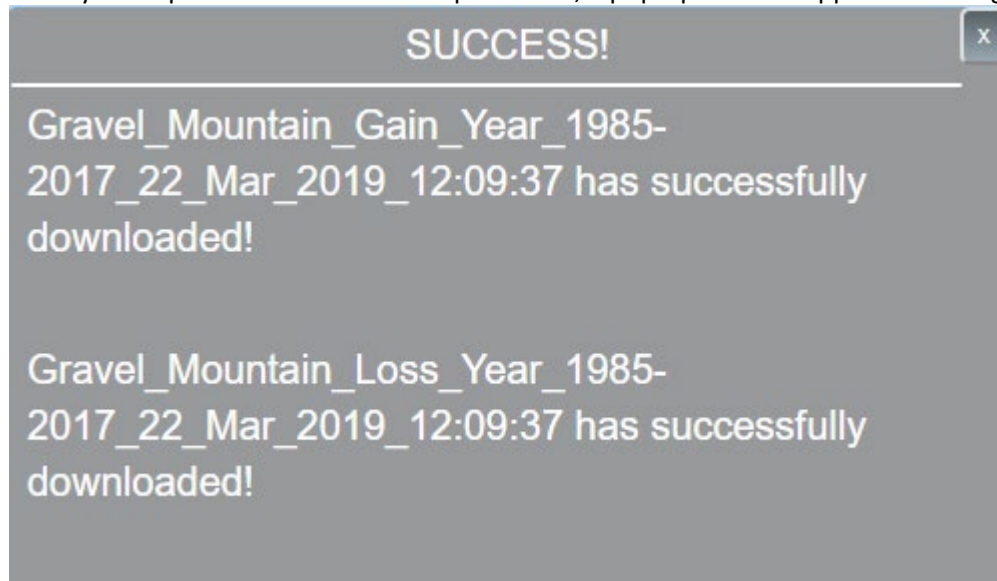   ii. You will see a small gear icon at the bottom center of the map showing you that your request is being processed. If for some reason you wish to suspend this process, it can be stopped using the **Cancel All Exports** Button.

Note: *Many things within the LCMS Data Explorer are cached. If you leave the web application and return at a later date, the previous view extent, shapes you have drawn as well as exports you have selected will be preserved for future use.*

7. Once your export selection has been processed, a pop-up window appears showing SUCCESS!

SUCCESS!   x

Gravel_Mountain_Gain_Year_1985-
2017_22_Mar_2019_12:09:37 has successfully
downloaded!

Gravel_Mountain_Loss_Year_1985-
2017_22_Mar_2019_12:09:37 has successfully
downloaded!

Note: *You may see a pop-up on your browser asking for permission for the LCMS Data Explorer to download files, click Allow.*
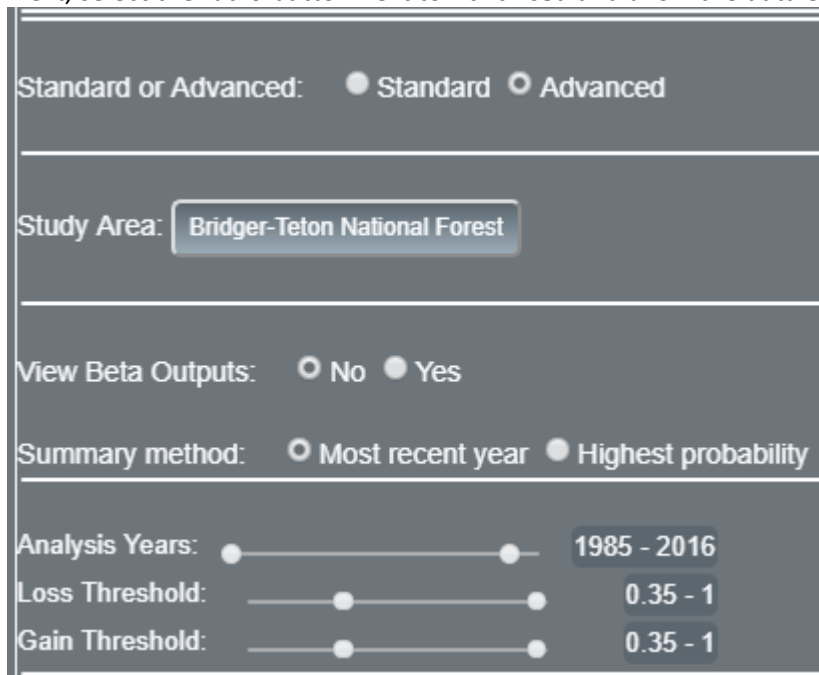
8. Each exported file should be available within Downloads folder on your hard drive, along with an associated metadata file.
9. It is worthwhile to read through the metadata file to understand the data, possible values for the layer, and further data descriptions.
   i. Contact information for help and troubleshooting can also be found within the metadata.

Part 3: Navigating in Advanced Mode

In the previous parts of this exercise we were using the LCMS Data Explorer in Standard mode. This part introduces the user to the **Advanced** mode. Not all tabs within the interface will have advanced features. This part will highlight where to find these features, and it is recommended that the user reference Part 1 and 2 of this exercise to become familiar with their location and implementation.

A. Selecting Advanced mode

1. Expand the **Parameters**.
2. Next, select the radio button next to **Advanced** and allow the data explorer to refresh.

3. Advanced mode allows the user to explore additional LCMS data products as well as fine tune the data displayed within the explorer.
4. You will notice the addition of **Summary method, Loss Threshold** and **Gain Threshold**.
5. In Standard mode these selections were locked and non-adjustable by the user using these parameters:
    i. Summary method: Most recent year
    ii. Loss Threshold: 0.35-1
    iii. Gain Threshold: 0.35-1
6. The user now has enabled selection within these parameters. The first is Summary methods, and the options are **Most recent year** or **Highest probability**.
    i. As it implies, most recent year will display the most recent year of occurrence above your specified loss and gain thresholds as specified within the loss or gain threshold slider.
    ii. Highest probability will display the highest probability of loss or gain within your selected thresholds as specified within the loss or gain Threshold slider.

> **Note:** *Loss and Gain are a proportion expressed as a decimal from 0.0-1.0. This value represents the proportion of classification trees within the Random Forest model ensemble that classified a particular pixel as loss or gain. If the value is 0.0, none of the individual classification trees classified the pixel as loss or gain. If the value is 0.5, half of the individual classification trees classified the pixel as loss or gain. If the value is 1.0 all the individual classification trees classified the pixel loss or gain. Loss and gain are modeled independently so any one location can have some level of loss or gain and can even express both within the same year.*

B. Explore the Tools Tab in Advanced Mode

1. Expand the **Tools**.
2. Explore **Pixel Inspector** with the additional LCMS layers.
   i. Return to Part 1, Section D for guidance.
3. Click the radio button next to **Time Series Charting**,
4. You can then choose either NDVI or NBR as a reference index when exploring the resulting charts. This will make more sense after giving the tool a try.
5. **Double-click** a location on the map where data appears to be present and a chart window will display within the tabs menu.

6. This line chart shows the loss and gain probability, land cover and land use classes for the pixel you chose, across the years you chose in the Parameters tab.

7. Navigate to the **Show Legend** button at the bottom of the tabs list and scroll to the **Land Cover** and **Land Use** sections for converting the numbered cover and use classes into named classes.

8. NDVI and LandTrendr (https://emapr.github.io/LT-GEE/index.html) fitted NDVI are used as the reference index.

    i. The index can be changed to NBR by selecting **Close Chart** in the bottom right corner of the chart area, selecting the **NBR** radio button under Time Series Charting and reselecting the pixel.

    ii. A chart can be downloaded by choosing **Download PNG** in the bottom left corner of the chart area.

9. This data can also be viewed tabularly.

10. Click the **Table** button on the bottom of the chart area.

○ Time Series Charting (double-click)
Index for charting: ○ NDVI ● NBR
Charting Progress

time	NDVI	LT_Fitted_NDVI	Land Cover Class	Land Use Class	Loss Probability	Gain Probability
1985	0.651	0.644	Trees	Forest	0	0
1986	0.663	0.641	Trees	Forest	0.05	0
1987	0.631	0.638	Trees	Forest	0.05	0
1988	0.631	0.634	Trees	Forest	0.14	0
1989	0.654	0.631	Trees	Forest	0.02	0
1990	0.641	0.632	Trees	Forest	0	0
1991	0.639	0.624	Trees	Forest	0.07	0
1992	0.532	0.621	Trees	Forest	0.07	0
1993	0.61	0.617	Trees	Forest	0.02	0
1994	0.604	0.614	Trees	Forest	0.1	0
1995	0.675	0.611	Trees	Forest	0.05	0
1996	0.649	0.607	Trees	Forest	0.06	0
1997	0.636	0.604	Trees	Forest	0.06	0
1998	0.593	0.601	Trees	Forest	0.11	0

Download CSV | LineChart | Table   Close Chart

11. This table can be downloaded by choosing **Download CSV** in the bottom left corner of the chart area.

    i. **Download CSV** can also be chosen initially while viewing the data as a line chart from the earlier steps.

12. Close the chart.

C. Explore the LCMS Layers Tab in Advanced Mode

1. Expand the **LCMS Layers**.

2. As before, hover over each layer name and some of them will have additional text that describes more about the layer.

3. Again, remember the **Show Legend** button available at the bottom of the tabs list. Click on the button and scroll through the list to better understand the visualizations that represent the newly available data layers.

D. Explore the Download Data Tab in Advanced Mode

1. If you still have an AOI drawn on the map you can continue to use it or press the **Clear All Shapes** button and draw a new AOI.

2. Within the Data Download tab you will see additional layers available for download.

3. You can download these additional layers using the steps outlined in Part 2 of this exercise.

4. Remember, the data present in these LCMS layers are based on the selection(s) you make within the **Parameters** tab and will update in real-time based on adjustments to those parameters.

Congratulations! You have successfully completed this exercise. You now know how to navigate the LCMS Data Explorer and download data for use within your own project.