

Introduction to GIS and Google Earth

Bradley Miller and Alex Cecil

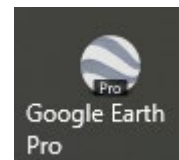
Orientation

Geographic information systems (GIS) is a technology that started in the 1960s when spatial analysis met computers that were increasingly available. GIS brings the information that humans have depended on maps to provide for centuries into a new digital format. However, GIS is not just digital pictures of maps. This technology enables the user to interact with the spatial information in new ways and perform new analyses across multiple “layers” of maps.

If you have used a digital device to help you navigate somewhere, you probably called it a GPS, but it was really a GIS that did most of the work. The “GPS” only determines your location. A GIS is needed to know where your destination is, the streets between you and the destination, and to calculate the best route to your destination. In fact, to identify your location, you probably weren’t using a GPS. You were probably using a GNSS because you were probably not just using satellites from the American constellation. But that is a story for another day!

To introduce you to the style and some of the tools available in a GIS, we are going to use a free GIS called Google Earth Pro.

1. Download and install Google Earth Pro on your computer by going to:
<https://www.google.com/earth/about/versions/#earth-pro>
(Note that there are multiple versions, including a web version. However, to do everything we want to do today, please use the desktop version.)

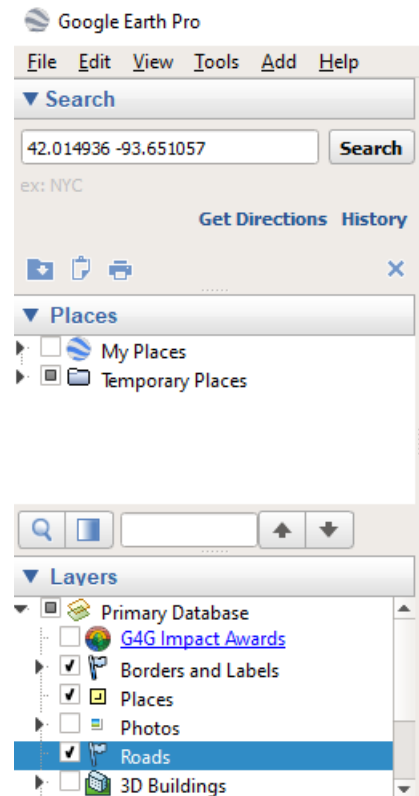


2. Locate the application icon in your computer’s app menu and launch it.

After launching Google Earth Pro on your desktop/laptop, take some time to orient yourself with the layout and what some of the buttons do.

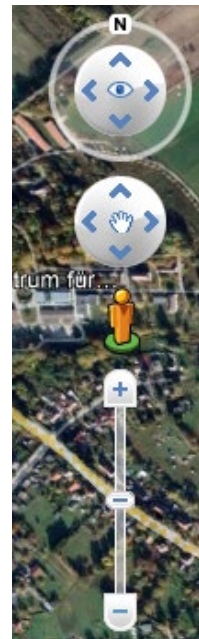
Left Side Panes

3. In the upper-right corner is the search box, which you can use to zoom to a location of choice. This search accepts place names and coordinates (<https://support.google.com/earth/answer/148068?hl=en>).
4. Below the search box is the “Places” pane. We will add our own map layer of interest to this pane in a little bit.
5. Under the “Places” pane is the “Layers” pane. This pane comes pre-populated with some map layers that can be of interest and illustrates a key component for working with GIS software. You can toggle layers on and off by clicking the check boxes to the left of the layer names. Try this out.



Navigation Tools

6. In the upper-right corner of the map space are a set of navigation tools that come to life when you mouse over them. Move your cursor over their outline to fully see them.
7. The top tool is for tilting and rotating. Click on different parts of that tool to see how it changes your map view.
8. To reorient the map with north at the top, click on the 'N' that is on the outer ring of this tool.
9. The next tool down is your pan tool. Click on those four directional buttons to see how they affect your map view.
10. Finally, there is the zoom bar. Click on the plus and minus buttons to zoom in and out.



Map Navigation

11. You can also navigate more directly by clicking and dragging across the map area.
12. If you have a scroll wheel, you can zoom in and out with that.
13. If you have a touchscreen, you can zoom in and out by pinching or expanding two fingers on the screen.

Menus and Toolbar

14. Across the top of the Google Earth Pro window are menu titles and a row of icons for a toolbar. Please click on each of these to get an idea of what they contain or do.



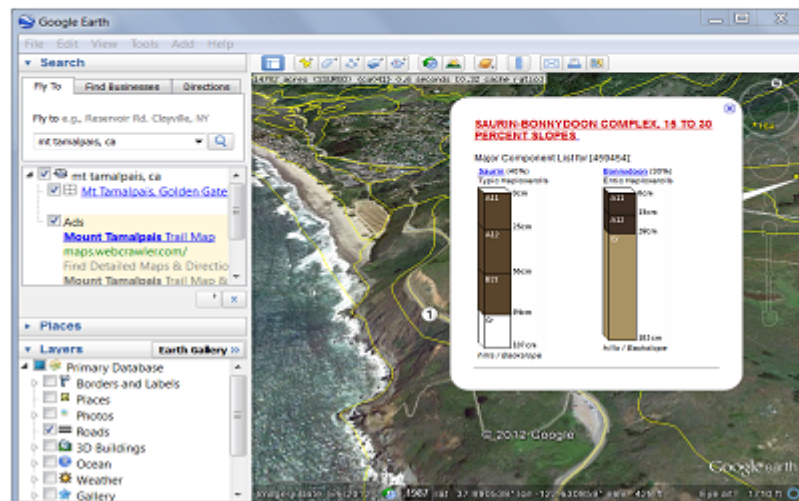
Add a Data Connection

As an environmental scientist, one of the first things you may want to know about a field you are visiting is what soils are mapped for that field. A GIS is a perfect way to interact with that type of information. However, you either need to have a data file for your area of interest (AOI) or connect to an internet service that dynamically downloads the information you want for the area you are viewing. Google Earth works well for interacting with web map services (wms) that dynamically download for the area you are viewing.

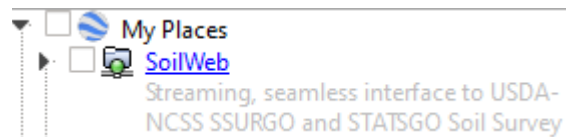
1. Do a web search for “soilweb apps” or just navigate to:
<https://casoilresource.lawr.ucdavis.edu/soilweb-apps/>.
2. Click on the link for “SoilWeb Earth”.

SoilWeb Earth

Soil survey data are delivered dynamically in a [KML](#) file, allowing you to view mapped areas in a 3-D display. You must have [Google Earth](#) or some other means of viewing KML files installed on your desktop computer, tablet, or smartphone.



3. This will start the download for the file "SoilWeb.kmz". Kmz files are the common file format that Google Earth Pro can read information from. In this case, the file will provide Google Earth Pro with the internet address for the wms.
4. Open the "SoilWeb.kmz" file. This should automatically be recognized as a Google Earth Pro file.
5. Now back in Google Earth Pro, notice that a new layer called "SoilWeb" has been added to the "Places" pane.
6. By default, your new layer has been added to the "Temporary Places" folder, which means that it will be cleared when you close the application.
7. To make the SoilWeb layer always available to you, click and drag the "SoilWeb" layer from the "Temporary Places" folder to the "My Places" folder.



8. Test the SoilWeb layer by zooming into an area of your choice.
 - a. At first, it will not display anything if you are zoomed out too far.
 - b. As you zoom in, you will start to see white lines delineating generalized soil areas.
 - c. If you zoom in further, you will eventually get yellow delineations of soil map units.
 - d. There will sometimes be delays as you navigate to different map areas, as the Google Earth Pro downloads the needed data. You can watch for the blue-grey wheel in the lower right corner of the Google Earth Pro window to indicate if it is still downloading data.




9. Click anywhere on the map where you see a yellow map label. A pop-up window will show you information about the soil series found within that soil map unit and will include a variety of links for additional information about those soils. Try them out.

Pinning a Location

Google Earth Pro has a feature for pinning locations that you may want to easily find again.


1. In the search bar (upper-left corner), type "Agronomy Hall, Ames, IA". Hopefully, you recognize the campus area. The building located is where Dr. Miller has his office and where the TA is available for office hours in the learning center (1102 Agronomy Hall).

2. In the toolbar of icons across the top of Google Earth Pro, click the button with a yellow thumbtack as an icon. 
3. Click on the blinking thumbtack that has appeared on the map to be directly centered over our beloved Agronomy Hall.



4. Now, in the window that popped up, called "Google Earth – New Placemark", name this pin "The Great Agronomy Hall".
5. Click "OK"
6. Note that this pin now appears under "My Places" in the "Places" pane. You can now navigate back to Agronomy Hall on the map anytime by double-clicking that pin in the "Places" pane.

Measuring Distances

1. In the toolbar of icons across the top of the Google Earth Pro window, locate the icon that looks like a ruler standing vertically.  Click it to open the "Ruler" window.
2. Using the "Line" tab, your cursor is a tool that can measure a straight-line distance by clicking once on the starting location and then clicking again at the end location.
3. Enter "Mackinaw City" in the Search box, and then click 'return' or the "Search" button.
4. After Google Earth Pro navigates to that place, zoom out a little to observe that there is a bridge connecting the lower peninsula of Michigan with the upper peninsula of Michigan.
5. Using the "Line" function of the "Ruler" tool, measure the length of that bridge in miles.
6. Close the "Ruler" window to return your cursor to its regular functioning for panning the map.



3. Open the “Ruler” tool and use the “Polygon” function to measure the area of Curtiss Hall (without the lecture hall/back section) by clicking only three times and then ending with a double-click. This will give you a quadrangle (squares and trapezoids are examples of quadrangles). The double-click at the end tells Google Earth Pro that it is your last point, and it will close the polygon by connecting where you double-clicked to the first point where you clicked. Each of the points where you clicked is called a vertex (plural is vertices). So, your quadrangle has four sides and four vertices.



4. Take note of the area of the quadrangle you delineated for the area in acres.
5. In the “Ruler” window, click “Save” and name your quadrangle polygon to have it added to your “Temporary Places” folder in the “Places” pane.

6. Repeat this process, but this time use six vertices. Note the area of this new polygon in acres. Feel free to save it.
7. Now, delineate the study field however you would like to obtain your final answer for the area of this field in acres.
8. Oh, bonus question. How many different soil map units are mapped within central campus?

For More

These activities are just the tip of the iceberg for what you can do with geospatial technologies. Wait until you get to use a full GIS, have access to multi-spectral imagery, and can perform spatial analysis on combined layers. You can get started with all of this and more with Agron 2700 (Geospatial Technologies). The class is offered in the spring semester and has two sections (in-person and arranged). Presentations are online, and class time is devoted to supporting students through the 13 hands-on labs. The in-person section is for those students who want to be sure to have a seat in the classroom, but there is always room for students in the arranged section to come to the scheduled class time when they need help.

