Lesson Plan 1 – Introduction to Google Earth for Middle and High School

A Google Earth Introduction to Remote Sensing

Image – an image is a *representation of reality*. It can be a sketch, a painting, a photograph, or some other graphic representation such as satellite data. Satellites capture and store electromagnetic waves that are reflected or emitted from features on the Earth, somewhat like a camera.

Remote Sensing – remote sensing can be defined as the scientific and technical discipline that involves acquiring information of various Earth features from a distance. Sometime the distance is great, such as satellite-based remote sensing where the satellites are in orbit high above the Earth; other times the distance is much less, such as aircraft-based remote sensing where the airplane is much closer to Earth.

Geographic Information System (GIS) – GIS can defined as the technical discipline that uses computer-based (digital) geospatial data to map and model geographic information. Geographic Information Systems are composed of computer hardware, software, geospatial data (which we'll define shortly, so don't worry), and a person to operate the system.

Geospatial Data – data that has geographic location information associated with it.

Learning Objectives:

Upon successful completion of this lab, students will be able to:

- Navigate around the world using Google Earth
- Define Remote Sensing and GIS
- Understand the basics of digital geospatial data

This exercise was developed using **Google Earth Version 7.1**

Introduction to Google Earth

Teacher Prep time: Depends on the teacher's experience with Google Earth. One hour is required for those who are new to Google Earth. Fifteen minutes is required, to review the lesson, for those with a working knowledge of Google Earth.

Class Time Requirement: 50 minutes

Materials needed: Windows or Mac computer with Internet connection and Google Earth 4.3 or higher installed.

Teacher Prep Instruction: Unblock Google Earth for your class, if needed (talk to your IT personnel). Go to the following website to familiarize yourself with the content - http://www.google.com/earth/learn/

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Classroom Instructions:

1.) Start Google Earth by double-clicking the '**Google Earth'** Icon or browse the icon in the '**Start'** menu. This will start the program.

The entire Earth (as a globe) will be shown by default.

2.) Close '**Start-Up-Tip'** and start to explore and familiarize yourself with the Google Earth main menu on the top left on your screen.

File   Edit   View   Tools   Add   Help

3.) Windows-based: Click on **'Tools'**, select **'Options'** and note the five tabs across the top of the 'Options' box.

Mac-based: Under the Google Earth' main menu select '**Preferences**'

In the **'3D View'** tab in the **'Terrain**' box near the bottom, set **'Elevation Exaggeration'** to '**3**', as shown below in Figure 2. Click **'Apply'** to close the box. This will exaggerate the elevation relief by a factor of 3.
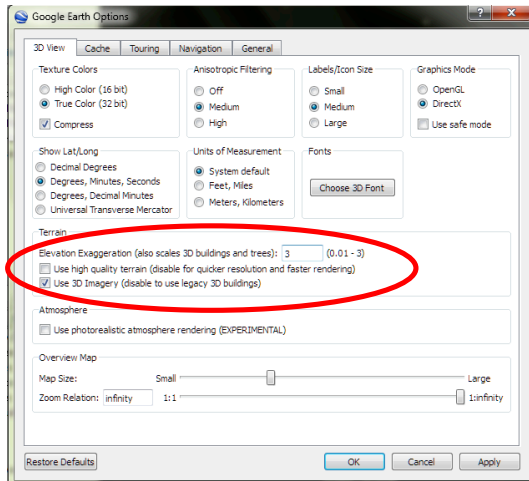
Hint: Before you begin using the navigation tools, make sure that the **'Borders and Labels**' layer is showing and checked. This will add country, state, and county borders and other information to the screen. To show the Borders and Labels, check the **'Layers'** panel on the lower left hand side of the screen as shown in Figure 3.

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You will find the '**Borders and Labels'** information in the 'Layers' menu on the lower left side of the screen.
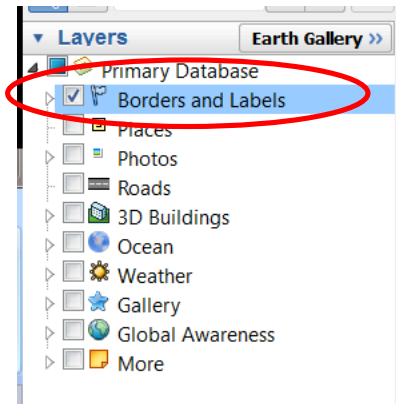
Now that we have *geospatial references* (the technical term for 'borders and labels') to help navigate, we'll begin to use Google Earth by creating and editing a **'Placemark'** of your house.

5.) Use the navigation tools on the upper right hand side on the screen to navigate to your house. These tools will allow you to zoom in and out of a location, change your cardinal orientation within a location, and pan across the map.

Navigation Tools, incl. 'pan tool'
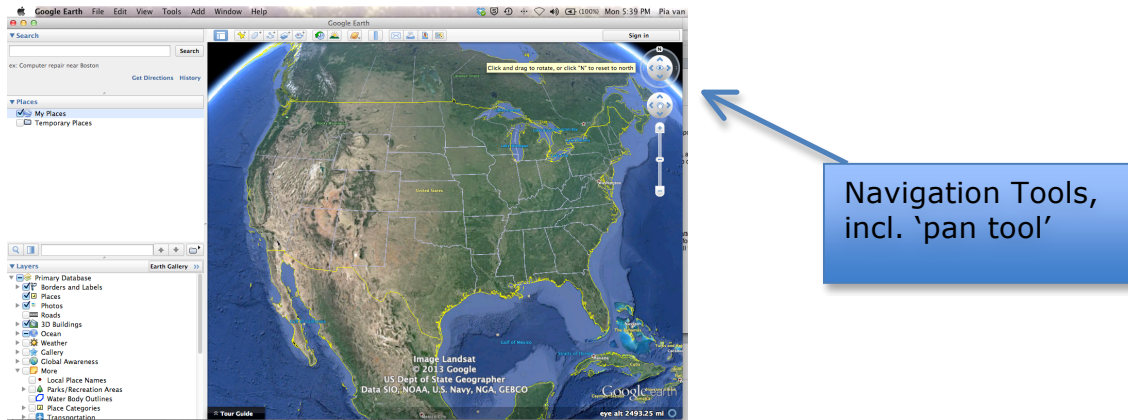
This is typically the first thing that new Google Earth users do.

Navigating to your house can be done either by using the '**pan tool'** and dragging on the Earth while using the mouse and the scroll button or you can enter the address in the **'search'** bar on the upper left hand side of the screen. Zoom in all the way by double clicking the image or pulling the zoom slider all the way up until the image becomes fuzzy.

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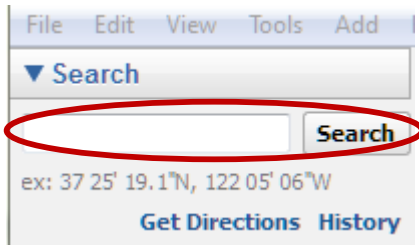
Hint: If you notice that features such as new buildings, houses, or roads are missing on Google Earth, it is the images are older than the new features. Mapping systems like Google Earth require constants updates. If the images are not updated frequently, the data becomes out of date, especially in areas that are experiencing rapid changes in land cover ("development", in the case of new buildings, houses, and roads).

6.) Once you locate your house, click on the **Placemark** icon, the yellow pushpin circled in red in the **icon menu** on the upper left corner of the map.

7.) Click on the '**Placemark**', opening a window called '**New Placemark'**. Drag the yellow pin (placemark) over your house. Now change the Name 'My House' in the 'new placemark' window. Click the '**OK'** button to close the 'New Placemark' box.
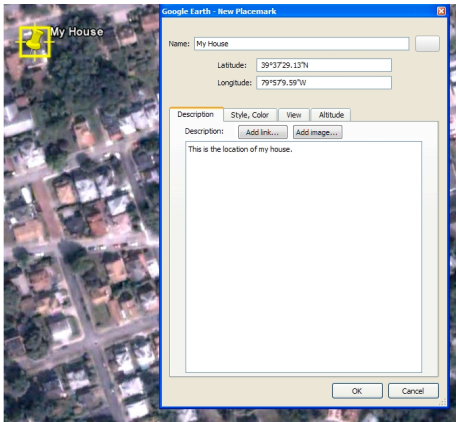
Hint: You can add a description of your house in the Description box. You can also change the color and type of Placemark, as well as the View and Altitude of the Placemark.

You can also read and edit the information in the Placemark box at any time. To do so, using the mouse, right-click on the Placemark and draw down to 'Properties', then left-click. This will open the Placemark box, allowing editing of the Placemark's attributes.

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Suggested classroom questions:
Where is your house located?

One way to answer is this question is to provide an address (for example, 123 Main St. Newtown, USA 54321). Another is to provide the geographic coordinates of your house.

Record the Latitude, Longitude and Elevation of your house.

Lat_____ Long_____ Elevation_____

What is the topography of your town?

Use the navigation tools to change the angle of your perspective from looking straight down, to looking sideways, called an oblique perspective.

My town's topography is _____ (flat, hilly, rolling, etc.). What is the most descriptive term that describes your town's topography?

Now that you've had a chance to play with Google Earth and locate your house and explore the topography, let's explore the data Google Earth uses. First, let's define a few terms that will be useful as we progress.

Remotely sensed images are comprised of many square cells called **'pixels'** (pixel stands for '***picture element'***, one element of a picture). Each pixel is shown on the computer screen using a single color. In addition, in Google Earth or in a Geographic Information System, each pixel has a *geographic location* (your house was shown using pixels, right?) Therefore we refer to the images that are made up of pixels as one type of *geospatial data*.

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Let's explore the geospatial data that makes Google Earth so exciting.

8.) Go to the '**Layers**' box and click the **'More'** layer. Make sure that you open the **'More'** feature by clicking the small arrow box next to it.

Uncheck all features besides the '**DigitalGlobe Featured Imagery**, '**SPOT Image**', '**DigitalGlobe Coverage**', and the **'US Government'** to see some of the different data sets used in Google Earth.
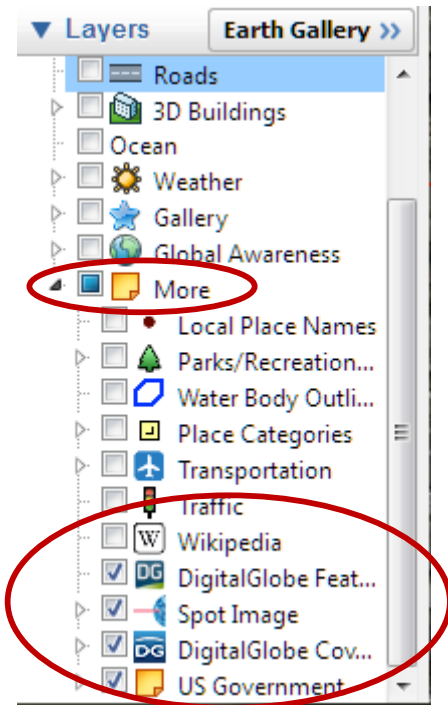
Slowly zoom out from your town so that you can see your state. The colored boxes are the 'footprints' of the satellite images that have been acquired for use in Google Earth by the US Government, GeoEye, SPOT, and Digital Globe, all of whom operate remote sensing satellites to monitor the Earth (this is just a small sample of the organizations operating satellites).

> **Hint:** Google Earth consists of many; many different remotely sensed data sets. Some of these remotely data sets are from high elevation aircraft and others are from satellites. The strips either represent different data sets, or data sets acquired at different times of the year (summer vs. winter, for example).

Explore some of the colored boxes on your map within in your state and compare the images. Why does the image consist of so many different colors? It may have to do with when the data was acquired or the type of data that is being represented. For example, uncheck all the imagery options under the '**More**' tap within the '**Layers**' menu and leave only the "**DigitalGlobe Coverage**" layer on and you will see a multitude of colored lines. Zoom out and you will see a multitude of colored boxes. If you expand the "Digital Globe Coverage" layer by clicking on the arrow in the 'Layers' box you will see that the layer

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actually consists of data from multiple years and that if you deselect certain data years it becomes apparent that each color corresponds to one year's data.