Lesson Plan 2 - Middle and High School Land Use and Land Cover Introduction

Understanding Land Use and Land Cover using Google Earth

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.

Learning Objectives:

Upon successful completion of this exercise, students will be able to:
- Define land use and land cover
- Provide examples of land cover classes
- Understand how to create a simple land cover map

This exercise was developed using Google Earth Version 7.1

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 and an understanding of land use and land cover.

Prerequisite: Lesson 1

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. Explore the following website to familiarize yourself with the content http://www.google.com/earth/learn/

Classroom Instructions:
Access the following website to familiarize yourself with the concepts of Land Use and Land Cover - **http://landcover.usgs.gov/usgslandcover.php**

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<u>Classroom Instructions:</u>

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Background

Land *use* can be defined as *how land is utilized*. Examples include "Park", "Intermediate Density Residential", and "Industrial". Land *cover* is slightly different. A park, for example, could be a deciduous forest, a conifer forest, or a mixed forest, or some other type of natural or artificial ecosystem. The land use in this example is "Park", while the land cover *type* would be deciduous forest, conifer forest, or mixed forest. Similarly, an Intermediate Density Residential land use would be considered one *type* of developed land use.

Keep it simple, as this can be confusing if complicated examples are used. And keep in mind that there is some overlap between land use and land cover. For example, agricultural land use can also be agricultural land cover, if the *type* of agriculture is not defined in more detail.

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

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

Google Earth

**2.)** Re-familiarize yourself with the Google Earth main menu.

File   Edit   View   Tools   Add   Help

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

<u>Mac-based</u>: 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.

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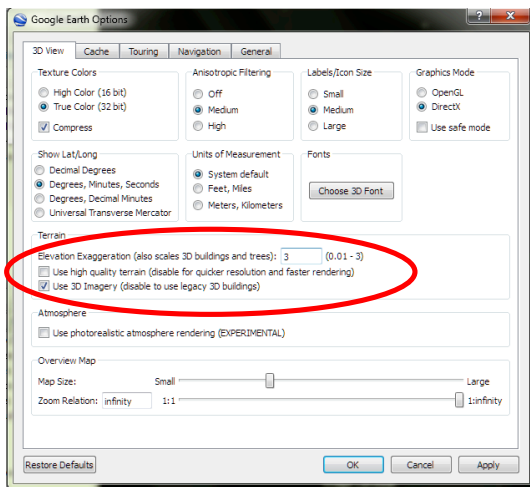
Hint: Before you begin use the navigation tools make sure that the 'Borders and Labels' layer is showing and checked. This will add country, state, and county borders and other information to the screen. To show the Borders and Labels, check the 'Layers' panel on the lower left hand side of the screen as shown in Figure 3.

You will find the '**Borders and Labels'** information in the 'Layers' menu on the lower left side of the screen.
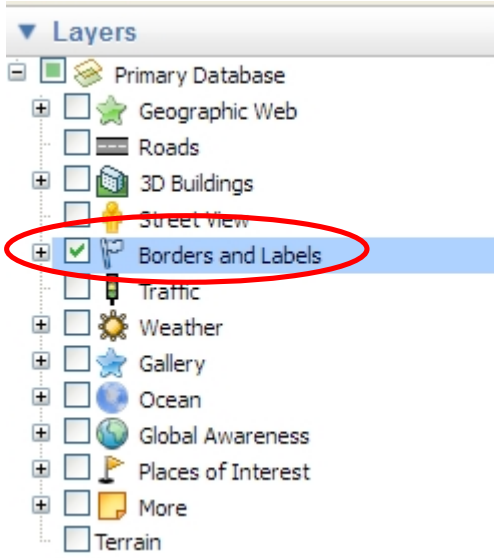
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2.) Zoom in and locate your county (zoom in until your county fills the whole screen).

Do you know the location of your school within the county? If not, zoom in and use local landmarks to locate your school.

3.) Create a Placemark for your school, and name it.

4.) Zoom out to ~1 km. Therefore you have to set the elevation to '**Meters, Kilometers'** in the '**Unit of Measurement'** tab. To get here you have to follow the instructions on how to set the elevation exaggeration above.

Hint: You can find the zoom distance on the bottom right hand corner in the picture, called 'eye alt'. This will provide you with an area of approximately 1 km^2.

Suggested classroom questions:

What is the predominant *land use type* around your school? In other words, what is the most common land use type on the screen? Is it residential use, or forest, or agricultural, or some other type?

_____

What is the second most common land use type?

_____

What land *cover* types exist around your school? Think about the different spatial patterns (shown by various color and texture patterns in the imagery). What do these spatial patterns represent? Are they neighborhoods (developed areas, with residential development), or areas of dense trees (forests), or some other land cover type? List three land cover types.

_____, _____, _____

Can you differentiate *natural land cover* from *developed land cover*? How might you tell the difference between natural and cultural features? Describe three natural and cultural (man-made, or *anthropogenic*) land cover types around your school.

Natural features: _____ - _____ - _____

Cultural Features: _____ - _____ - _____

EARTH
OBSERVATION DAY

AMERICA
VIEW

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Land Cover and Land Use Mapping

Let's make a *land use map/ land cover* map of the area around your school.

A map is a two-dimensional model of an area on the surface of the earth. Most maps are oriented with north at the top of the map, and south at the bottom (east is right, and west is left).

On the picture above you can see the 1 km^2 area around my school. The school is the area within the red circle. Notice that the image is oriented with north at the top, shown by the 'North up' button circled in yellow.

Now that you have identified several land cover and land use types, we will now begin to create a simple land use map of the area around your school.

5.) First, uncheck the '**Borders and Labels'** Layer, (this will make the mapping process easier).

6.) Click on the '**Polygon**' tool in the toolbar button menu, circled below in red. With the map zoomed at 1 km$^{2.}$ .Polygons are like Placemarks, and can be named and edited.

Hint: See 'Drawing Paths and Polygons' in the User Guide if you have any questions.

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7.) After you've selected the **'Polygon Tool'** by clicking on it, you will see a box appear

6.) Click on the '**Style, Colors'** tab, and make changes. The '**New Polygon'** box showing the 'Line Color/Lines ' as 'Yellow' and with a 'Width' of 3.0, and the 'Area' as Outlined. **Note** that the Description tab has also been filled in with the name: Residential Area.
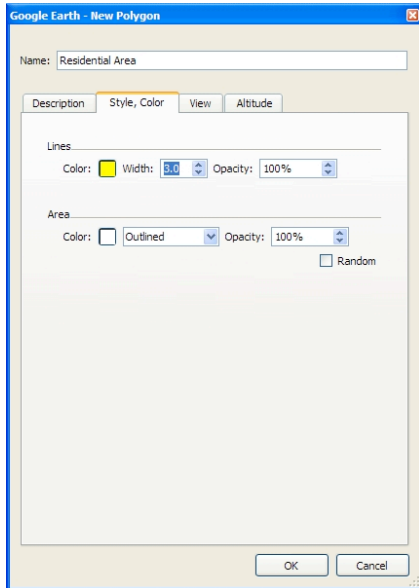
8.) Once you have set the '**New Polygon'** box as described above, use the '**Polygon**' tool to draw a polygon around a contiguous area that represents the most common land use/ land cover type in the 1 km^2 area around your school.

You will notice that once you have created the polygon it will be added to the '**Places'** folder.

> **Hint:** Each time you click the mouse while creating a polygon, you will create a **node**. A node is a point that defines the end of a straight line. By clicking along the edges of the common land use area, you will create a many-sided object (a polygon) that outlines the common land use type. To delete the last node you've drawn, right click your mouse.

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The image above shows the Polygon outlining the most common land use showing the line color as yellow and with a width of 3.0, and the area as outlined. This is a high-density residential area.

Hint: Practice drawing polygons and making adjustments to their borders. If you are unsure about how to adjust the boundaries, click on this link
http://www.google.com/earth/learn/beginner.html#tab=drawing-and-measuring

9.) Finish mapping the common land use/ land voer types around your school. There may only be one or two, or there may be three or more.

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Hint: Don't worry too much or spend too much time being extremely accurate with the borders of your map. The idea is to get an idea of what land use types surround your school.

You map should look something like the example below. Note that the example is not perfect, but shows the various land use types around the school.
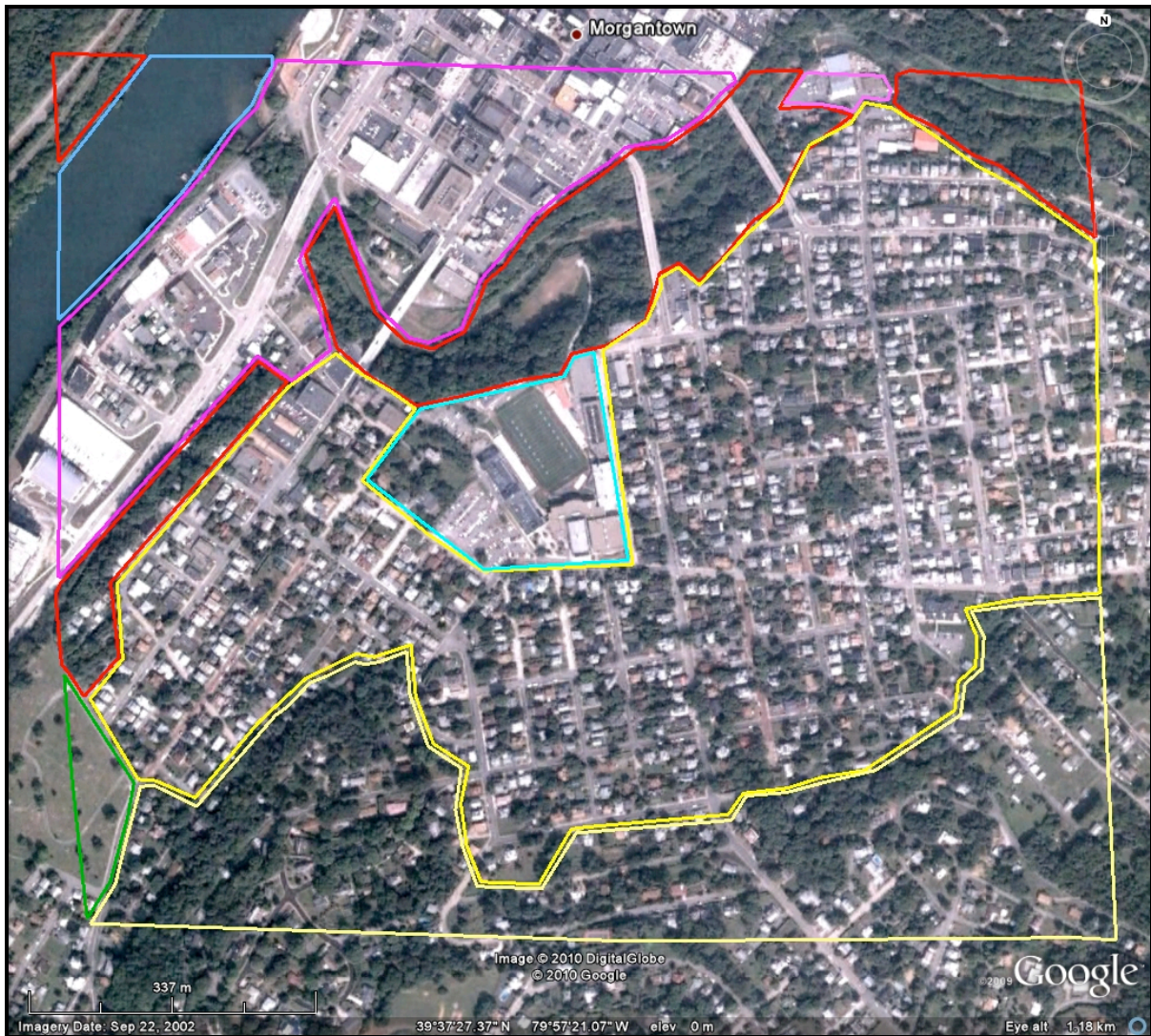

Next we will color the land use polygons, create a legend, and have our final map. Once we have our map, we can use it to begin to understand how land use influences such things as local climate, water quality, water quantity, and the wildlife that life in your area.

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10.) Fill in the polygons using the same color for the same land use classes (all forest should be the same color, for instance). In the **'Places'** box on the left, place the mouse over the polygon that you want to edit (fill in with a color), and right-click. Draw down to '**Properties'** (windows-based) or '**Get Info**' (Mac-based) , and click again. Up pops the '**Edit Polygon**' box. Click on the '**Style, Color**' tab and select a color in the '**Area**' section and select '**Filled**'. The '**Edit Polygon'** box showing the 'Forest' Area filled in dark green. Note that the outline will not show when '**Filled'** is selected.
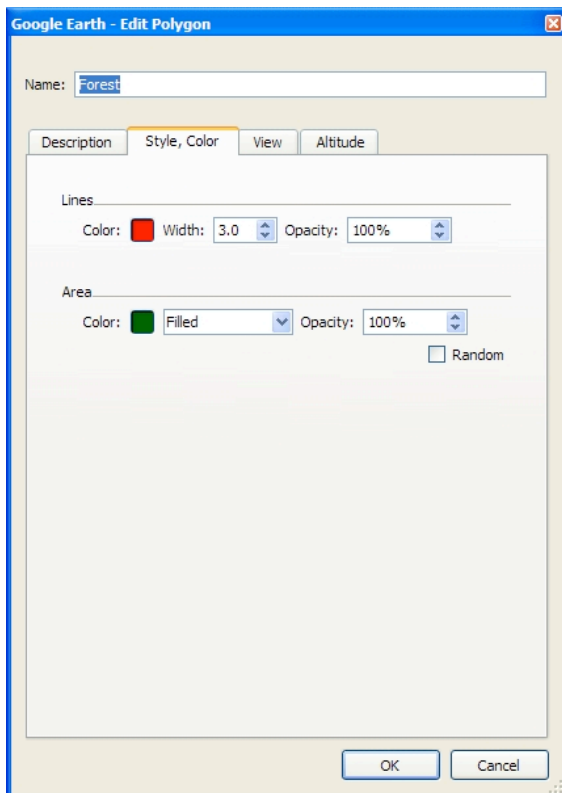
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Your map should look something like the example below.

That's it! You've created a land use map of the 1 km^2 area around your school. Now you can answer questions about the different types of land use and land cover around your school.