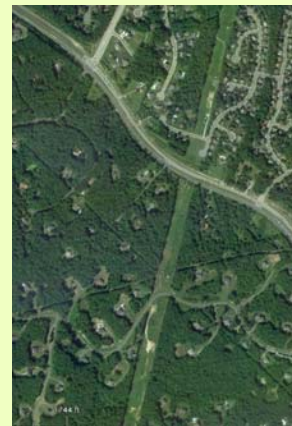# Searching for Patterns: Landscape Ecology

Virginia Geocoin Adventure
Activity Guide and Project Reflections

In this activity, your group will explore:

- **Geography and Geographic Terms**

- **Landscape patterns**

- **Landscape Ecology terms**

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A digital version of this document is available at: https://virginiaview.cnre.vt.edu/geocoin/

Landscape Ecology Activity Overview

Many animals and plants require a particular habitat, such as woodlands, to survive. For some of these creatures, the *amount* of habitat, and the way it *connects* to similar habitats, can be crucial. The Pileated Woodpecker is one well-known bird species that requires a large amount of connected woodlands to survive (over 4,000 acres for a nesting pair!).

We'll be going on a scavenger hunt in Google Earth—looking for locations that have experienced certain types of disturbance and change in their landscape. The travels of your Virginia Geocoin will give us the locations to study. (For more on the Virginia Geocoin, be sure to read the Getting Started Guide.)

The Pileated Woodpecker requires large areas of forest to survive and reproduce. *Photo © D. Gordon E. Robertson*

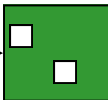## Landscape Ecology: Studying patterns across space and time

Ecosystem: A system that contains both the living (plants, animals, bacteria, etc.) and non-living (soil, water, sunlight, etc.) components in a particular area.

Landscape Ecology : studying how the pieces of an ecosystem relate to one another, through patterns and processes, across space and time.

Landscape ecology is the study of how the parts of an ecosystem relate to one another across space and time. Scientists who study landscape ecology can measure things like the connectedness or fragmentation of areas of habitat. They employ remote sensing and other geospatial technologies to help them understand how ecosystems change.

Ecosystems can change across space—habitats can become larger or smaller, or more interconnected, or less interconnected. These changes happen over time, so landscape ecologists look at both space and time when studying patterns and processes. The basic units ecologists look at are **patches**—areas composed of similar habitat (vegetation type, land use, etc.).

Types of Patterns

There are different ways a landscape can change over time that can affect animals like the Pileated Woodpecker. In our scavenger hunt, we'll be looking for examples of perforation, dissection, fragmentation, shrinkage, and attrition (Figure 1).

Type of landscape change	Before	After
Perforation		
Dissection		
Fragmentation		
Shrinkage		
Attrition		

Figure 1. Overview of landscape change patterns . (Adapted from Foreman, 1995). The green represents undisturbed areas (such as woodlands) and the white represents disturbed areas (roads, agriculture, neighborhoods and other development).

For each of the above types of landscape change, let's look at some examples that will help you as you search for them in Google Earth. (Note: all screen shots are © 2012 Google Earth).

Perforation (which means to put holes into something) is usually one of the first types of landscape alteration that happens as an area is developed. Small, unconnected patches of development cause small breaks in the undeveloped area. The majority of the landscape is still undeveloped.


Perforation: The more recent picture on the right (2011) shows two new small clearings in a largely wooded area (left-hand photo from 1998).

Dissection (which means to divide something), like perforation, often happens as an initial landscape change when an area is first developed. Anything linear in nature that cuts through an undisturbed area, such as a road, power line, or pipeline, can cause dissection.

Dissection: The picture on the left, from 1998, does not have the subdivision road that dissects the wooded area in 2011.

Fragmentation (which, in this case, means to break something up into unconnected parts) often follows perforation or dissection. Fragmentation results in the formation of **patches** and can reduce the connections between patches of undeveloped habitat.
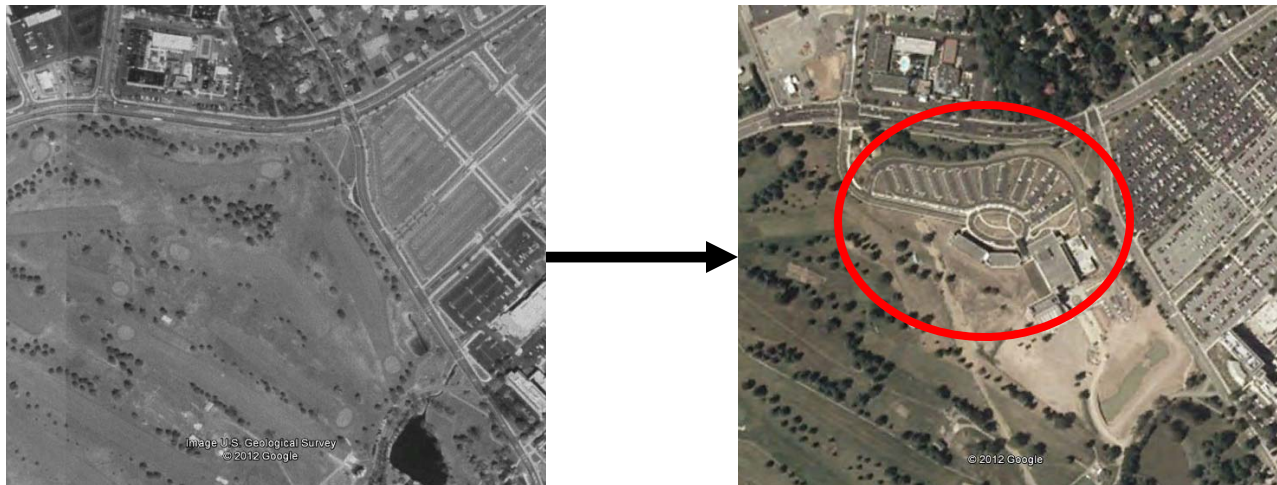
Fragmentation: The building of a new parking lot (circled in the newer photo on the right) fragmented a grassy field habitat area into smaller patches.

Shrinkage of patches can follow fragmentation. Shrinkage is when existing patches of undeveloped habitat become smaller in area.
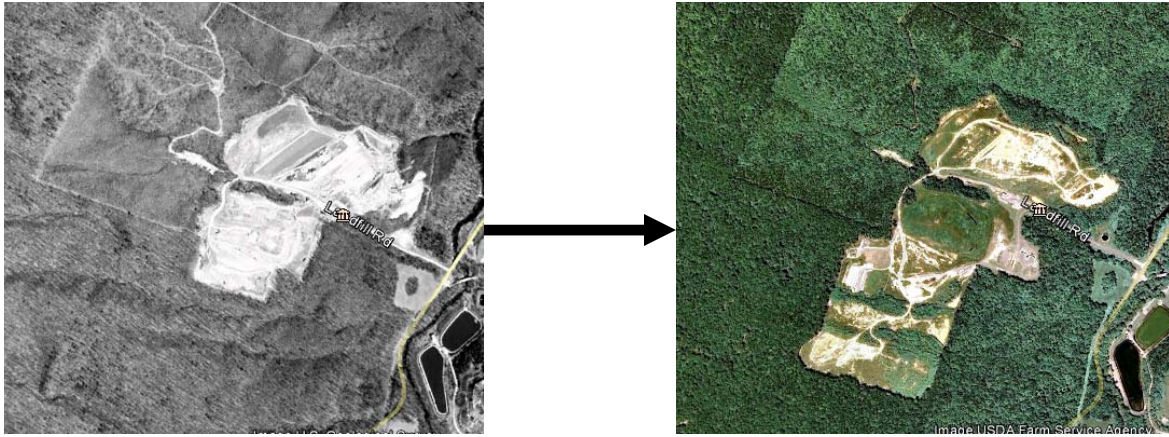
Shrinkage: the picture on the left is from 1996, and the one on the right is from 2011. As the landfill grew, the woodland habitat patches around the landfill grew smaller.

Attrition (which means reduction) can follow fragmentation or shrinkage, and means patches of undeveloped area are completely removed.

Attrition: The very small woodland patch circled in the photo on the left (from 2007) is not present in the photo on the right, the same area in 2008. A new development was built during this time span.

Hints for completing the scavenger hunt: Try starting your search near your home town. You may know of a new development or building in your community—try looking at this area in Google Earth with the time slider to get the hang of looking for landscape changes. Other things to watch for: pictures taken during winter (leaves off), changes in shadows, and changes in color saturation may all look like small landscape changes. Be sure to zoom in enough to the area to determine what is truly landscape change due to development.

Exploring Patterns

You or someone else in your group should have dropped off a Geocoin in a Geo-cache a while ago (See Virginia Geocoin Adventure: Getting Started Manual if these terms sound unfamiliar). Now, we can use your Geocoin's log information to explore landscape changes over time.

1. Log in to www.geocaching.com with the login you used when you dropped off the geocoin.

Note to Leaders: You'll want to make sure that your Geocoin has traveled to at least 3 (hopefully more) different places before starting this activity . If it has not, then you can always select a different geocoin to complete this exercise. You can conduct a search for Trackable Geocoins on www.geocaching.com., and under the 'Play' menu, select 'Find Trackables'. You can search for a "Trackable by name", and enter VirginiaView (for a listing of all VirginiaView Geocoins), Map@syst (for a listing of all Map@syst Geocoins), 4H (for a listing of all 4H geocoins), or any other geocoin name that you might be familiar with! You can sort these lists by distance traveled (number of miles)!

2. Go to the tracking log page for your geocoin.

• Go to the Play -> Find Trackables menu item to go to the Trackables page. Enter the Tracking Code (from the coin itself) or the Trackable name (from the coin package, for example, VirginiaView Geocoin-79). Click on the geocoin name to view the log page.

Note to Leaders: Be sure that Google Earth is already installed on your computer(s) – visit http://www.google.com/earth/index.html for the download and basic information. For a primer on how to navigate in Google Earth, visit http://sitescontent.google.com/google-earth-for-educators/tutorials-and-tips and look under "Basic Tutorials and Tips."

4. From your geocoin's log page, click on "View in Google Earth" under the Trackable Options menu. (You may need to scroll up to the top of the log page to see this). This will launch Google Earth and the tracks for your geocoin will now be listed on the menu and should show up as a yellow track on the map (Figure 2).
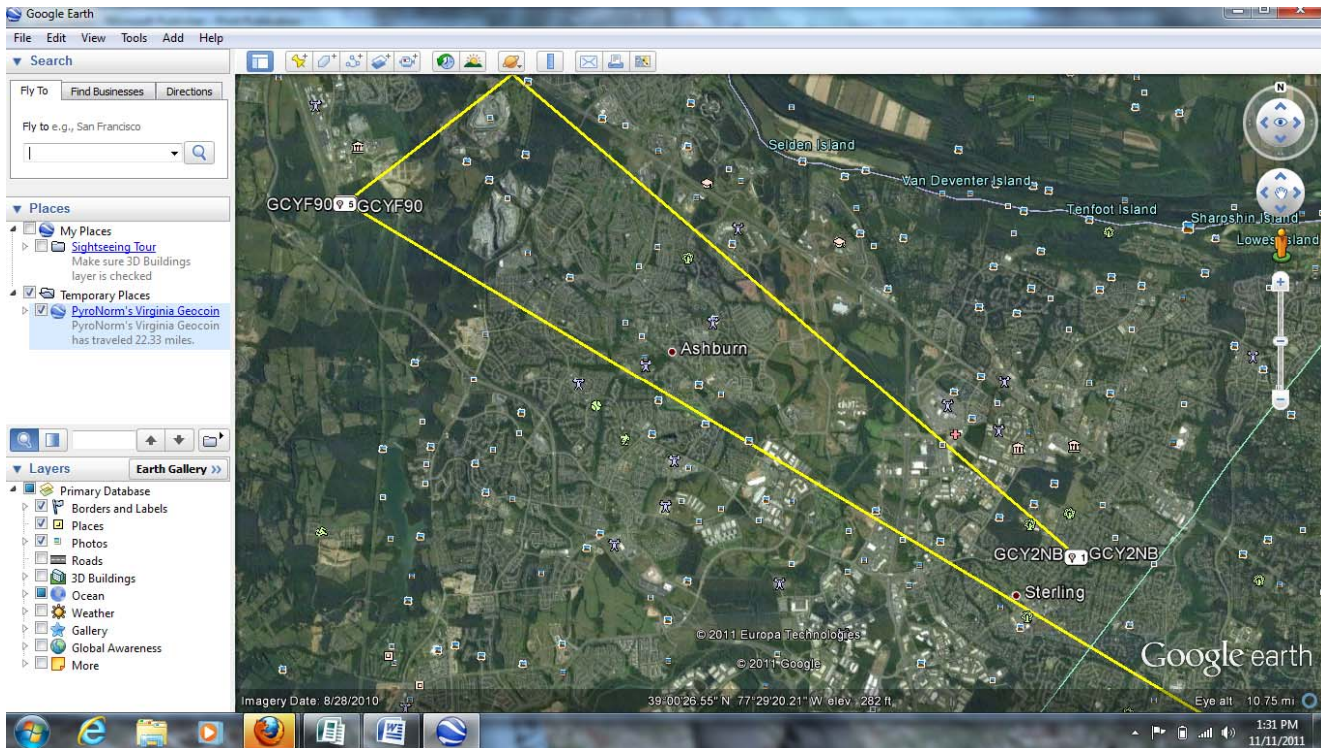
Figure 2. Points and yellow tracks between the geocoin stops in Google Earth.

5. Now you can zoom in to each stop (each point or vertex) on your geocoin's journey. Don't forget to use the starting location (and/or your own community) when doing your scavenger hunt!

6. You'll also need to use the historical imagery on Google Earth. While zoomed in to a geocoin stop, click on the Clock symbol at the top menu bar. This brings up the time slider. You can change the date by dragging and sliding (Figure 3).
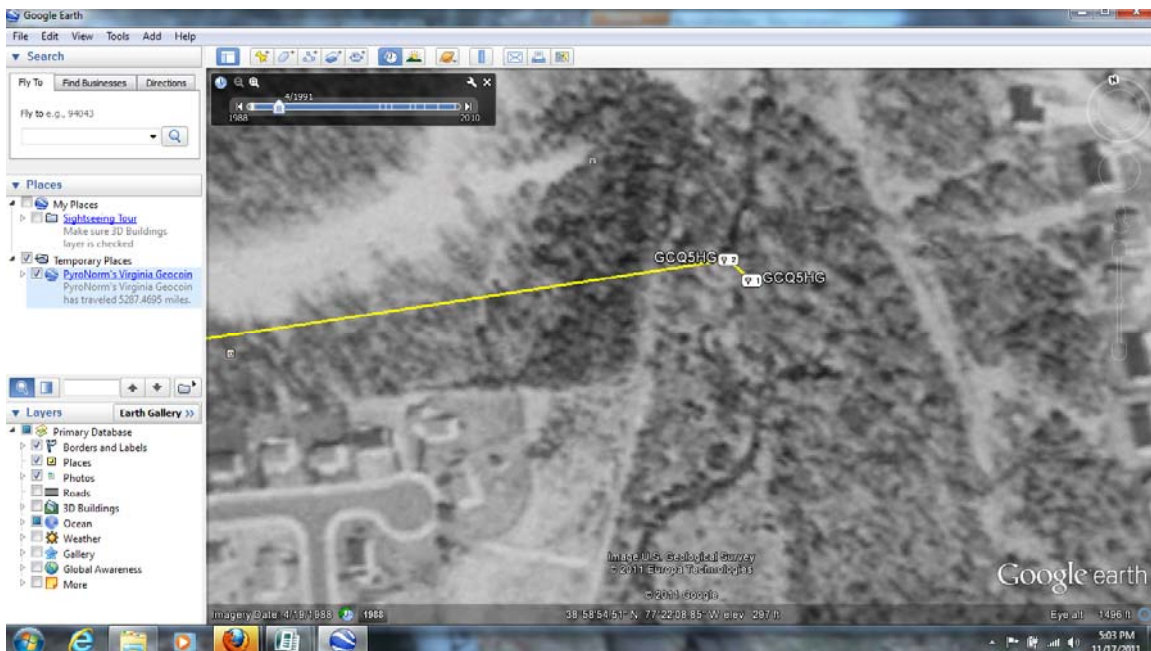

Figure 3. Using historical imagery and the time slider.

7. As you use the time slider for each point, look for changes in landscape composition over time. Were new roads added? Did forested areas shrink? Did fields turn into developed areas? If you can't see any changes over time, try zooming out a bit and looking again. Once you see a landscape change, zoom in to that area. Determine which type of landscape change (See Figure 1: perforation, dissection, fragmentation, shrinkage, or attrition) bests describes it. Use the **Add Placemark** (Push Pin) tool in Google Earth to mark the location of change. Name the placemark with a description of the change and its category (for example: development, attrition).
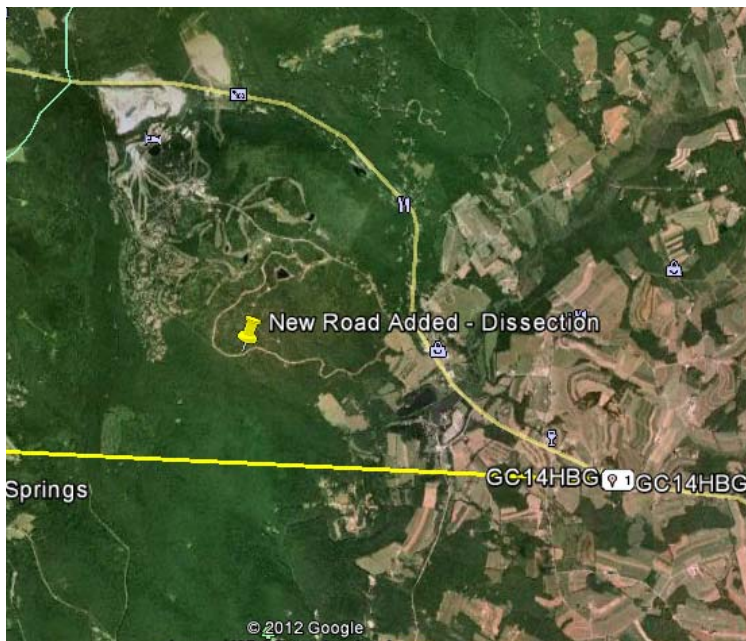

Figure X. Placemark added for an area of landscape change near a geocoin stop (GC14HBG).

8. To complete the scavenger hunt, create a blank document in Microsoft Word (or similar program). Create a heading with each type of landscape change (**perforation, dissection, fragmentation, shrinkage, and attrition**), and under each heading, add the following:

- A screen shot of the area that displays this type of change

- The location of this area (latitude and longitude—found at the bottom of the screen in Google Earth)

- What caused this landscape change (a new road, commercial development, etc.)

- Speculate the potential impacts this change in the natural landscape might cause for wildlife, water quality, and the environment in general.

- The dates of the imagery in Google Earth both before and after the change. (found on the time slider).

Note to Leaders: If you are unfamiliar with creating screen shots and pasting them into Microsoft Word, use the instructions at http://office.microsoft.com/en-us/help/copy-the-window-or-screen-contents-HP001038284.aspx OR you can click on the **email button** on the top Google Earth menu bar. Select the "Graphic View" (first radio button) option to email yourself a picture of the map. Then you can download the image and insert it into your document.

Resources

Tutorials for using Google Earth:

An Introduction to Google Earth Pro https://virginiaview.cnre.vt.edu/wp-content/uploads/2020/07/smGoogle-Earth-Pro-Manual.pdf

Foreman, R.T.T. (1995). Land Mosaics: the ecology of ecosystems and regions. Cambridge University Press. pp. 656.