Semester Project: Plants in the Human-Altered Environment

# PHAE Part 3: Characterize your plot (outdoors/in plot)

In Parts 3.1 through 3.4 of this lab, you will need to visit your plot. We will focus on collecting environmental data about your plot (physical characteristics and descriptions of the surrounding environment).

## **Part 3.1: Finding and marking your plot**

Now that you have a way to measure distances in the field, it’s time to go to your plot.

To take environmental and biological measurements in your plot, you first need to outline the borders of the plot. There are a few ways that you can do this, depending on what resources you have access to.

* You can use the coordinates from the previous step to find the exact center and corners of your plot. This would normally be done with a handheld GPS unit, but you can also do this with your smartphone.
  + If you enter a latitude and longitude into Google Maps, it will place a point at that location, and then you can walk around until the marker showing your location is on top of that point.
  + Remember to include the negative sign on longitude. If you leave it out, the coordinates will be on the wrong continent!
  + This method also relies on the precision of the coordinates you recorded in the last step. If you are missing some decimal places, the location may be different than what you intended.
* If you aren’t able to use a smartphone map to navigate, you can find your plot center and corner visually based on landmarks in the satellite image from Google Earth (for instance, a notable rock, tree, or other structure near a corner). This is approximate but can be helpful.

Whichever way you use to find your plot center and corners, mark those five points in some way. We would usually do this with small metal stakes brightly colored plastic flags, but you can use anything that is convenient. For instance, you can place a backpack or other visible item down, place a rock, make a pile of sticks – anything that will be visible to you as you move around.

Next, check that the length of each side is actually 20 meters, by counting your steps as demonstrated in Part 2.2 (or using a measuring tape if you have one).

Additionally, check that the diagonals of your plot (the distance from one corner to the opposite corner) are approximately 28 meters (again using the steps you calculated previously). Adjust your markers as needed until you feel you have accurately measured a 20 m × 20 m plot.

## Part 3.2: Measure geographic information about the plot

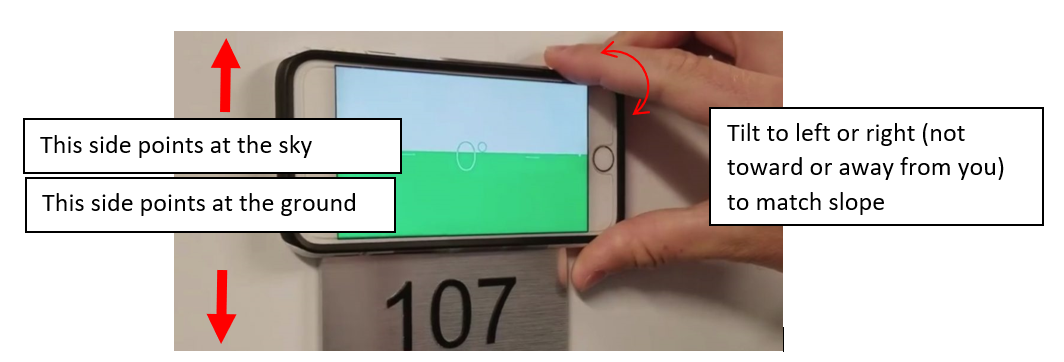
At this point, you should be in your plot, and have the corners and center of your plot marked, so you can see what plants are inside and outside your 20 × 20 m plot.

Before we start measuring trees, we need to collect some geographic information about your plot. We will measure slope and aspect (the direction a slope faces).

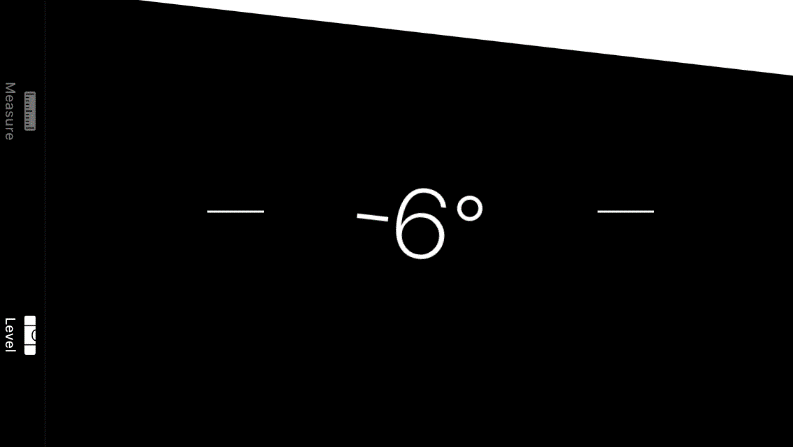
If your plot is on flat ground, you’re already done! Record slope as 0 and aspect as “flat.”

If your plot is on a slope, we will need to take some measurements. This will require either a compass (if you own one) or a compass app on your smartphone. It will also use a level app. Compass and level apps installed by default on the iPhone (the level is in the Measure app). Several free compass and level apps are also available for Android. You will want a level app that tells you the degree of tilt (not just one that tells you whether or not the phone is level). **If you don’t have any way to measure these variables, you can skip this step, but it is very useful to measure it if you can.**

1. To measure slope, use a level app on your smartphone. Stand in the middle of your plot and hold your phone as though you were pressing it up against a wall (horizontal, screen facing you – see Figure 8).
2. Tilt the phone left or right to match the angle of the slope you are standing on. This will be an estimate – do the best you can. Record the slope measurement.
3. To measure aspect, stand on the slope so that you are facing downhill. Point your phone out in front of you using the compass app, holding it flat, screen pointing toward the sky. Record the compass measurement - ideally in degrees, if possible.



*Figure 8: How to hold your phone to measure slope.*



*Figure 9: Example slope measurement – phone tilted to the right, -6 degrees slope.*



*Figure 10: Example compass measurement. If this was the compass direction while facing downhill, the aspect is 30 degrees (or NNE – true NE is 45 degrees).*

**Enter your data from Part 3.2 here:**

|  |  |
| --- | --- |
| **Slope (write 0 if the plot is flat)** |  |
| **Aspect (write “flat” if the plot is flat)** |  |

## Part 3.3: Estimate impervious surfaces in your plot

Remember that the main goal of our project is to understand how plants grow in human altered environments. One way that humans alter the environment is through the creation of impervious surface area – ground and ground coverings that do not allow the infiltration of precipitation into the soil.

Water that strikes impervious surfaces can form puddles instead of being absorbed by the ground. Alternatively, it can become surface water runoff that enters streams or urban water management systems.

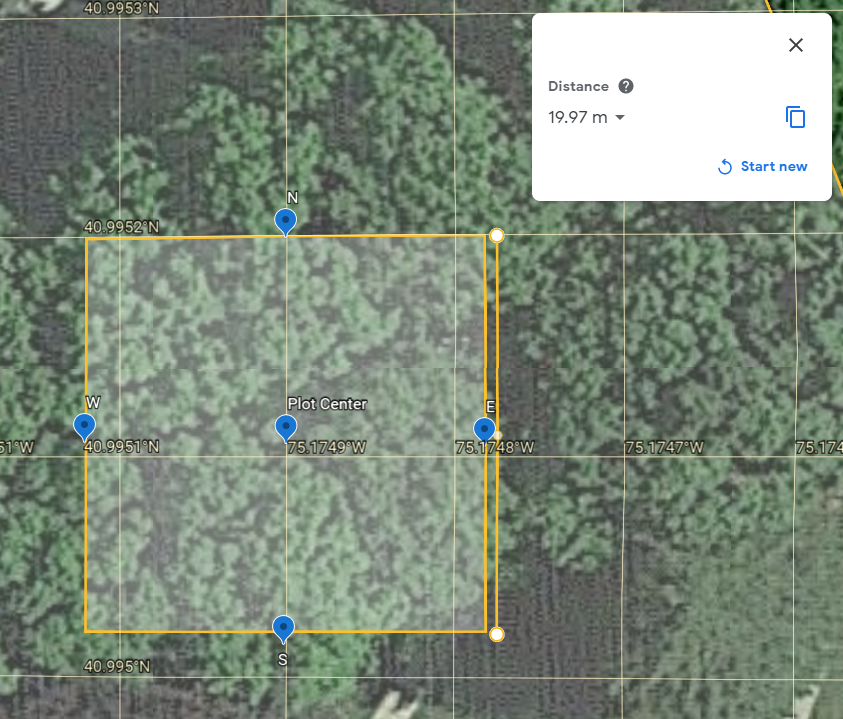
The steepness of the slope across a site can influence the rate of water movement, and the amount of sediment and pollutants that will be picked up by the flowing water and deposited in streams, or will need to be processed within water treatment facilities. Steeper slopes result in faster water runoff that can carry more and larger particles. In addition, impervious surfaces decrease the amount of water available to plants and the amount that becomes part of the groundwater that maintains streamflow. Increased runoff during storms can exacerbate the degree and impact of flooding, and streamflow between precipitation events may be reduced because there is less groundwater.

Urban areas generally have a much higher percentage of impervious surfaces than native forests and landscapes due to the higher degree of human alterations. Urban soil can become compacted due to excessive foot traffic, bicycle tracks, and vehicles that park or drive across the grass. That said, not all impervious surfaces are caused by humans – for instance, there are surface rock outcrops in parks and other natural areas.

In this section you will visually estimate the percentage of your plot that is impervious surface. To make your estimation easier & more precise, mentally subdivide your plot into four sections, and estimate the percentage of impervious surface within each section.

Examples of *impervious* surfaces: pavement, asphalt, packed gravel, exposed bedrock, bare compacted soil (like a hard dirt pathway).

Examples of *pervious* surfaces: fallen leaves, grass, mulch, exposed but uncompacted soil, loose rocks.



**A**

**B**

**D**

**C**

*Figure 11: A subdivided plot, into four subplots, for visual estimation of impervious surfaces.*

**Enter your data from Part 3.3 here:**

|  |  |
| --- | --- |
| **Plot** | **Estimated % Impervious surface** |
| **Subplot A** |  |
| **Subplot B** |  |
| **Subplot C** |  |
| **Subplot D** |  |
| **Whole plot (average of above)** |  |

## Part 3.4: Identify human-made and natural components of the environment surrounding your plot

As we determined in the last section, the amount of impervious area in a site is one indicator of the human alteration of that site.

Human alterations of the area surrounding a plot can also have impacts on the plot, both physical (e.g. runoff from surrounding impervious surfaces onto the plot), and aesthetic (the “viewscape” outward from the plot toward the surrounding environment).

In this section you will create an index of the human impact on the area surrounding the plot. This index, combined with the percent impervious surface value of the plot, can provide a more complete view of the degree of human alteration and impact on your plot.

To do this, you will be visually estimating the amount of human made and natural features visible in the environment surrounding your plot.

**Example human-made features:** This category includes all human constructed features, with the exception of areas covered by mulched organic materials (like needle, leaf, or bark mulch). This includes buildings, pavement, gravel walkways, utility lines, and other materials not “natural” in origin. If your view includes a row of utility lines, consider the entire length from uppermost to lowermost utility line as human-made (even if you can see trees behind them), since the entire view behind the lines has a human impact.

**Examples of natural features:** This category includes all features that are non-human in origin, including all organic, biotic materials and many natural abiotic materials. This includes features such as grass, plants, mulch, and flower beds (although not the walls surrounding them), as well as natural rock outcrops or exposed soil. It does not include gravel pavement, log homes, or rock buildings, even though the materials are natural, because the feature is a human construct.

Instructions:

1. Begin by going to the center of the plot. Find the north direction (you can use a compass, compass phone app, or the map of your plot). While facing directly north, visualize a line extending from your feet to the sky in that direction. Visually scan along the length of that line to estimate the percentage of its length that crosses human-made materials. Record that value as VH0 (which should be a number from 0 to 100).
2. Use a compass (or compass app, or map) to turn your body 10° clockwise. Facing in this new direction, repeat the process in the last step, and record the value as VH10.
3. Repeat this process in 10° increments until you have rotated in a complete circle. You should now have measurements VH0 through VH35.

*If you don’t have a tool to measure 10° increments, you can take approximate measurements using one of the following methods:*

*Alternate method 1:*

1. *Based on your map of the plot, face the north side of your plot and take measurements as in #1 above. Record this value as VH0.*
2. *Repeat this for each of the four sides of your plot. The east side is VH90, the south side is VH180, and the west side is VH270.*
3. *Practice making quarter-turns (for instance, between facing north and facing east) that you can fit 10 “segments” in that quarter turn, including facing the two sides (or eight directions in between N and E). These will be approximately 10° increments. Use these short turns to fill in the rest of the measurements (VH10 – VH80 should be between the N and E side, VH 100 – VH170 should be between the E and S side, etc.*

*Alternate method 2:*

*Take a panoramic photo from the center of your plot (e.g., using the panorama option on your phone camera). Make sure you turn in a complete circle. Divide the photo into 36 sections and make the visual estimates from the photo. You could also take four panoramic photos (N to E side, E to S side, S to W side, W to N side), and divide each into 9 segments.*

A close up of a tree

Description automatically generated*Figure 12: View looking northward (0°) from plot center, showing a vertical line from plot center to the sky. The line has been divided into sections representing human-made features and natural features.*

A picture containing game, riding, track

Description automatically generated*Figure 13: View looking outward from plot center, at 10° intervals, with vertical lines from plot center to the sky. The proportion of human-made features will be visually assessed and recorded at each interval.*

A close up of a building

Description automatically generated

*Figure 14: Map of a square plot with 10° intervals marked. Notice that small rotations made from in the center of the plot are large segments at the edges of the plot and beyond.*

**Enter your data from Part 3.4 here:**

|  |  |
| --- | --- |
| **Measurement** | **Estimated % Human-Made** |
| **VH0** |  |
| **VH10** |  |
| **VH20** |  |
| **VH30** |  |
| **VH40** |  |
| **VH50** |  |
| **VH60** |  |
| **VH70** |  |
| **VH80** |  |
| **VH90** |  |
| **VH100** |  |
| **VH110** |  |
| **VH120** |  |
| **VH130** |  |
| **VH140** |  |
| **VH150** |  |
| **VH160** |  |
| **VH170** |  |
| **VH180** |  |
| **VH190** |  |
| **VH200** |  |
| **VH210** |  |
| **VH220** |  |
| **VH230** |  |
| **VH240** |  |
| **VH250** |  |
| **VH260** |  |
| **VH270** |  |
| **VH280** |  |
| **VH290** |  |
| **VH300** |  |
| **VH310** |  |
| **VH320** |  |
| **VH330** |  |
| **VH340** |  |
| **VH350** |  |
| **Average VH:** |  |