# Plants in the Human-Altered Environment (PHAE) Research Project

**Module 4: Locate your study plot within the study area**

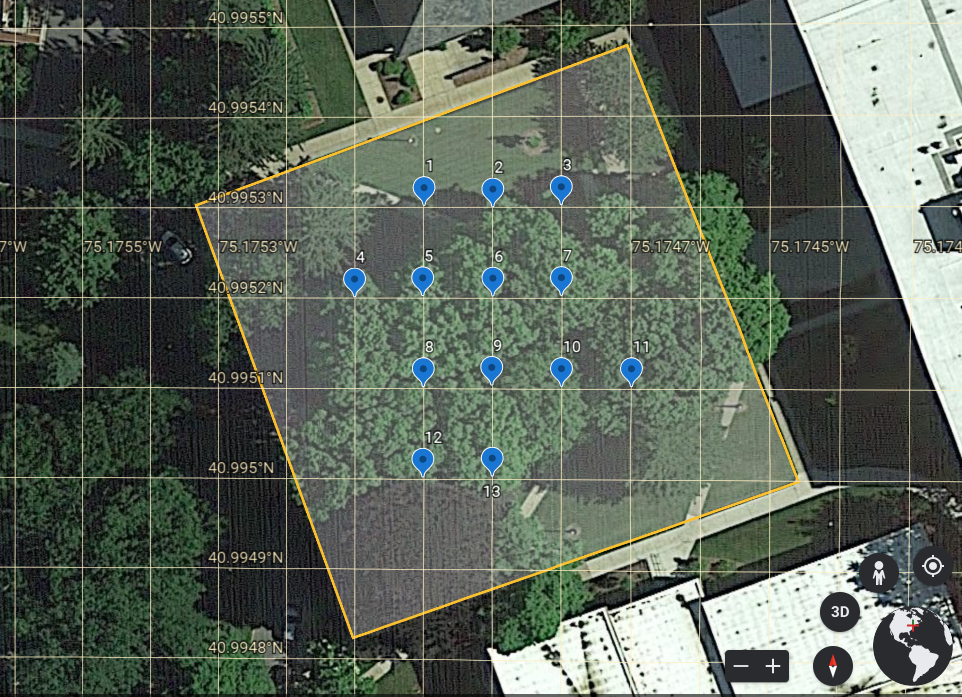
# This module can be completed entirely online/at home; you do not need to physically go to your study area.

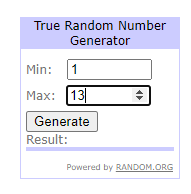
Part 1: Choose a plot location

Begin by randomly selecting the center for your plot within the study area. Randomly choosing a location is the best way to position plots without bias. To do this, you will overlay a grid of points on your study area, assign a number to each of the points that fall within the potential sampling area, and use a random number generator to select a point that will be your plot center. Follow these steps:

1. Open your saved project in Google Earth (from Module 1).
2. Open the Main Menu  , and then open Settings.
3. In the Formats and Units section, make sure that Units of Measurement is set to Meters and kilometers, and Latitude/Longitude formatting is set to Decimal.
4. Go to the Map Stylemenu. At the bottom of the menu, turn on gridlines.

1. You will now see a grid on top of the map (as in Figure 1). The vertical lines run North – South, and the horizontal lines run East – West (these are latitude and longitude lines).
2. Within your study site, number each of the points where a vertical and a horizontal line cross. Skip the points that are closest to the edges of your study area, as we are identifying a point to be the center of your plot. You can use the placemark features in Google Earth to do this, but any other method that works for you is also fine (take a screenshot and draw on it in a drawing program, draw a sketch of the grid on paper, etc.).

**Figure 1: (left) A study site with latitude-longitude gridlines, and each intersection of those lines marked with a point. (below) Random Number Generator from random.org**



1. Go to <http://www.random.org> to randomly select one of your points. Set the max to your highest number of points and click Generate. The randomly selected point will be the center of your plot.
2. Check for feasibility:

* Is the selected point in an area that you can access?
* Are there at least three trees or shrubs nearby?

If either answer is no, randomly generate a new number and re-evaluate.

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| Paste a screenshot or photo of your numbered plot points, and circle the one selected: |

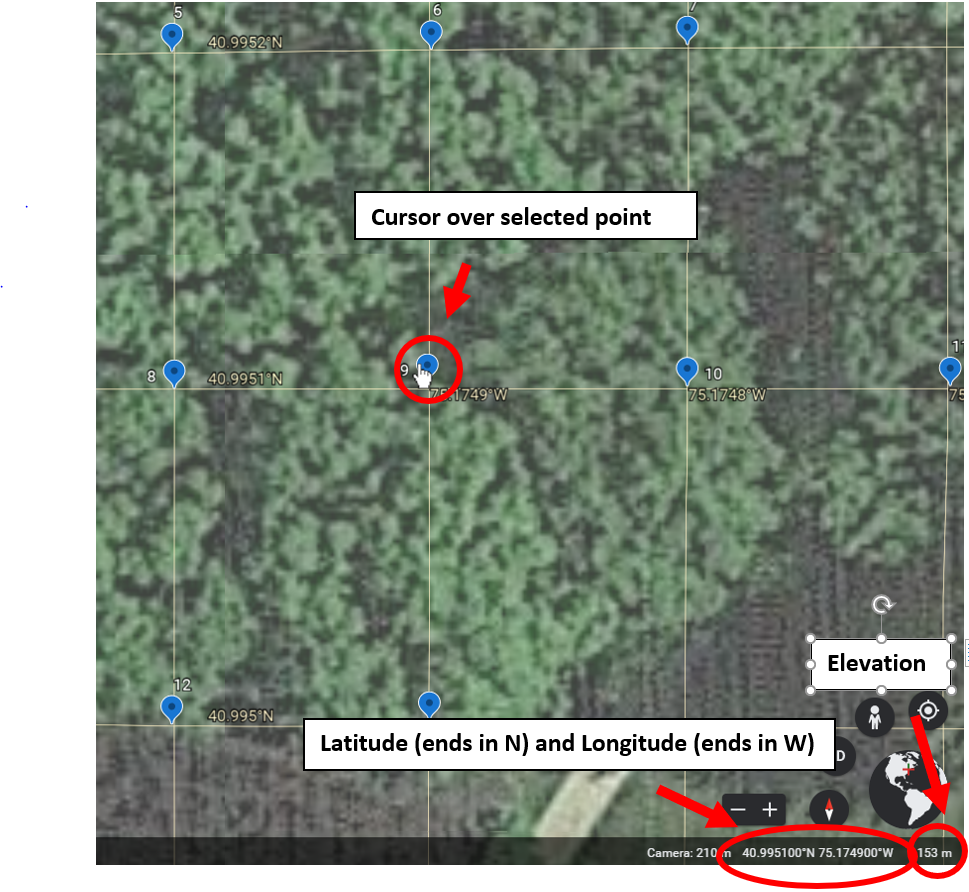
Part 2: Outline your plot, select plot size and shape

Study plot size often varies by the number of individuals present. In very dense vegetation, a smaller plot size would be appropriate. When few plants are present, the plot size should be larger. For this project, you should aim for a sampling plot of 400m2, and make adjustments if necessary.

Plots are most commonly either square, rectangular, or round. There are tradeoffs associated with each plot shape – for example, it is easier for a person working alone to measure out a circular plot (by using a rope tied to a center point and walking in a circle), but it is easier to subdivide a square into sub-plots for data collection.

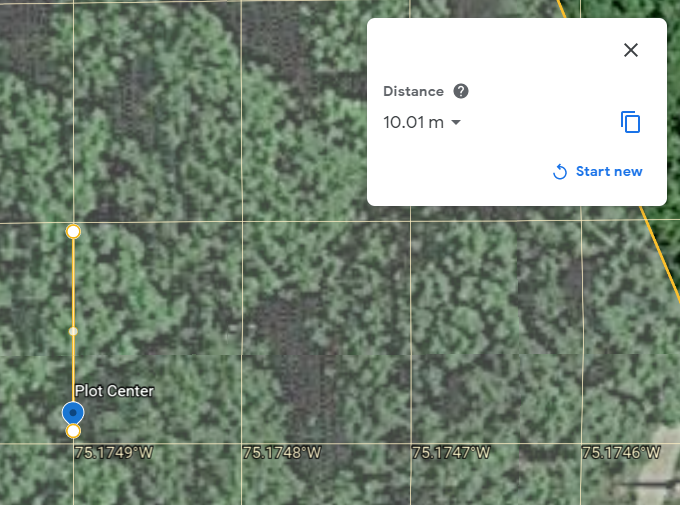
Your ideal plot for this project is a square that is 20m long on each side. If that is not ideal in your study area, you may opt to create a circular plot (the radius would be 11.3m), or rectangular plot that better represents the area. Begin by centering a 20m square on your selected points to see if that is feasible.

1. If you didn’t use placemarks in the previous step, you will need to add one now. Go to Projects  → New Feature → Add placemark and put a placemark at the center of your plot. Click on the placemark. This will open a box in the upper right corner. Click on the edit button  in that box. This will open a panel on the left side of the screen. In this panel, scroll down until you see Latitude and Longitude. Record these numbers, including all of the decimal places.
2. Determine the elevation of the center of your plot by hovering your cursor over your point and reading the number in the lower right corner (see Figure 2). (This also shows latitude and longitude, but is less precise than the method in the previous step.)



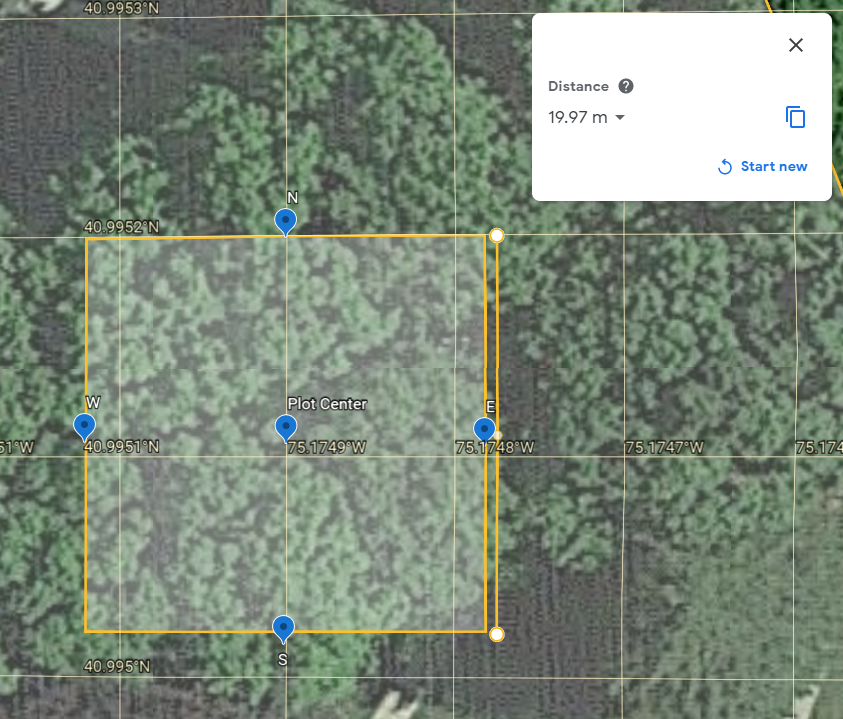
**Figure 2: Latitude, longitude, and elevation of the center of your plot. Do not use the number next to “camera” as elevation – that is a measure of your “zoom”, not the elevation of the land. In this example, the elevation is 153 m above sea level, not 210 m.**

1. Use the Ruler  tool to measure 10 meters in each cardinal direction (north, south, east, west) from your plot center. Put a placemark at each of these 10 meter distances (see Figure 3).



**Figure 3: Measuring a point ~10 meters north of the plot center. You may not be able to get the line to be exactly 10 m – between 9.9 and 10.1 is ok.**

1. Use the Draw line or shape  tool (bottom left) to draw a square based on these four points. The four points should not be the corners of the square – the sides of the square should face N, S, E, W. The cardinal directions should be in the middle of each side (see Figure 4).
2. Use the Ruler  tool to check that the sides of your plot are ~20 m long. If they are too long or too short, adjust your plot borders until the square is 20 x 20 m. (It might not be exact – between 19.9 and 20.1 is ok).
3. Hover over each corner of the plot and record its approximate latitude and longitude.



**Figure 4: Outlining a 20 m x 20 m square plot based on the four points surrounding the plot center. Remember, you are not connecting those four points as the corners of your square – you are using them as guidelines to draw a square that has sides facing N, S, E, W.**

Enter your data here:

|  |  |
| --- | --- |
| Elevation at center point (in meters) |  |

Remember that longitude values should be negative in our hemisphere (so if your value is 75.15 W, enter – 75.15). Enter all of the decimal places you have – the more precision, the better.

|  |  |  |
| --- | --- | --- |
| Point | Latitude | Longitude |
| Center |  |  |
| NW Corner |  |  |
| NE Corner |  |  |
| SW Corner |  |  |
| SE Corner |  |  |

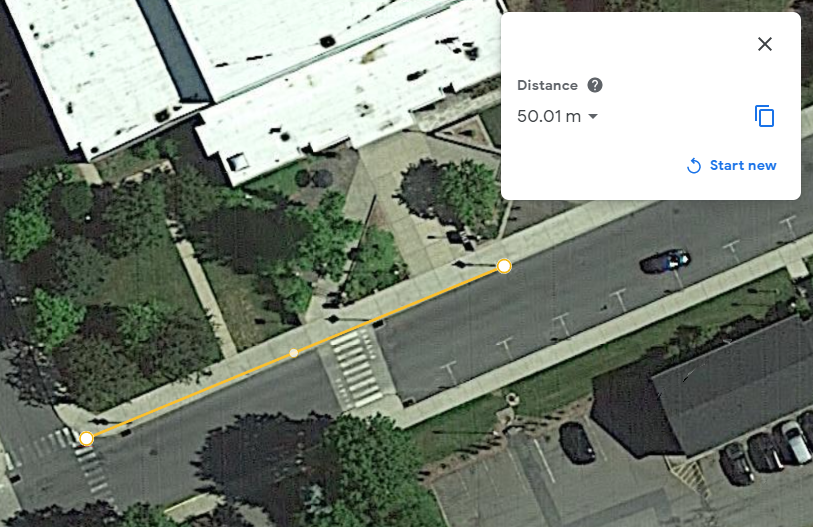
|  |
| --- |
| Paste an image of your finished map from Google Earth here: |
| Question: Do you see any reason(s) that your 20m by 20m square plot will not be feasible as a study site? Should it be a different shape or size? Why or why not? |

## Part 3: Get ready to measure your plot (measure your stride)

Typically, ecologists would use a 50-meter transect tape (basically a giant tape measure) to map out a study site in the field, but without access to equipment, we have to get creative. Before you go to your site, it will be useful to know the length of your stride – how long each step you take is. This is a great way to measure distances when you don’t have access to a long measuring tape. Instead of measuring directly, you can figure out how many steps it takes you to walk 20 meters, and then walk that number of steps to measure that distance in the field.

1. Go back to Google Earth and find a location near you that is convenient and has clear landmarks (like your street and driveways/mailboxes/buildings etc. along that street; Figure 5).
2. Use the Ruler  tool to measure a 50-meter distance (we need a longer distance to get a better sample size, because not every step you take is identical). Line the distance up with landmarks you know you can find in person (again, like the edge of a driveway, a mailbox, fire hydrant, etc.)
3. Go outside and find your landmarks. Walk from one landmark to the other, using your normal stride (don’t take steps that are bigger or smaller than how you normally walk). Count your steps.
4. Divide the number of steps by 50, to get the number of steps you take per meter.
5. Multiple your steps-per-meter by 20 to get the number of steps you should take to measure out one side of your plot (20 meters).

*Why are we not just directly measuring the number of steps it takes you to walk 20 meters? Because the length of your steps can vary. If you walk a longer distance, you get a more accurate average stride length.*



**Figure 5: Example pathway for measuring stride. In this case, you could count the number of steps it takes to walk from the end of the crosswalk (left) to the point on the sidewalk aligned with the tree (right).**

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| **Example calculations:**  *It takes me* 94 *steps to walk the* 50 *meter distance.*  94 / 50 = 1.88. *It takes me 1.88 steps to move one meter. (Yes, you can’t take fractions of steps. This is fine - don’t round for now.)*  1.88 x 20 = 37.6. *It will take me 37.6 steps to measure out a 20 m distance for the side of the plot. (Now we can round – In the field, I’ll take 38 steps.)*  *It will also be useful to know the number of steps it takes to cross from one corner of the plot to the opposite corner. The diagonal of a square is the length of its side times .*  20 x = 28.28  1.88 x 28.28 = 53.2. *It will take me 53.2 steps to walk from one corner of the plot to the opposite corner. (I’ll round again and take 53 steps.)* |

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| Paste a screenshot of your stride-measuring path(s) here: |

Enter your data here (**if working as a team, both students should complete this**):

|  |  |  |
| --- | --- | --- |
| Measurement/calculation | Value | Units |
| Number of steps |  | # steps in 50 m |
| # steps divided by 50 |  | Steps per meter |
| Steps per meter x 20 |  | Number of steps you need to measure 20 meters (plot side) |
| Steps per meter x 28.28 |  | Number of steps you need to measure diagonally across your 20 m x 20 m plot (corner to corner) |