Pacing

(Borrowed from GLOBE Biosphere Investigation Instruments)

A pace is equal to walking two steps. Knowing how long your pace is will be helpful during many GLOBE field investigations.

Directions for Determining Pace

1. Record the pacing data table (shown below) into your science notebook.

Trial 1	Trial 2	Trial 3	Average Paces =(trial 1+ trial 2 + trial 3)/ 3	Pace/ Meter = (average/ 10m)	# of paces for 15 meters = 15m x (pace/m)	# of paces for 21.2 meters = 21.2m x (pace/m)	# of paces for 30 meters = 30m x (pace/m)

2. Lay out a 10 meter or longer measuring tape on a flat, open area (e.g. a parking lot, field, or hallway).
3. Remember that one pace equals two steps. Starting with your toe at the 0 meter mark, pace off, using a normal, comfortable stride.
4. Count your paces until you reach 10 meters. Keep in mind you may have .5 paces (landing on your non-counted foot) or you may have .25 or .75 paces (landing in between your feet).
5. Record your number of paces in the pacing data table.
6. Repeat steps 2-4 two more times. Calculate your mean pace distance (by adding up the three lengths and dividing by three).
7. Now find your pace per meter by dividing your average paces by 10 meters.

Determining the Number of Paces to Travel a Given Distance

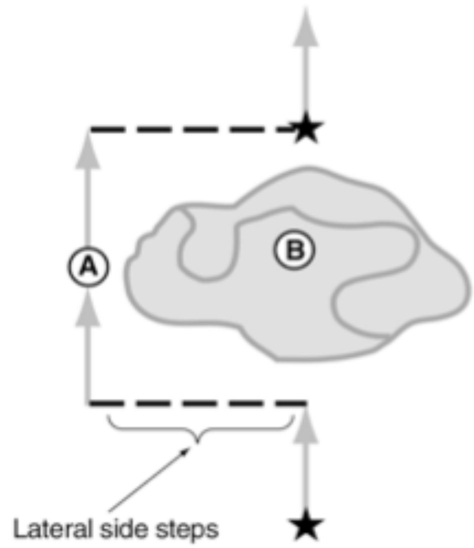
Once you know your pace per meter and you know the distance you are trying to go (e.g. 30m the length of one side of a standard 30m x 30m sample site) you can calculate how many paces are needed.

# of paces needed = desired distance(m) * # of paces/m

Possible desired distances:
- 30 meters (the side length of a sample site)
- 15 meters (the side length of a quadrant within a sample site)
- 21.2 meters (the length of the diagonal within a quadrant – measured from site center to any corner)

*You could also lie out a 30m tape and simply count your number of paces for all the required distances (30, 21.2 and 15 meters). Be sure not to skip the step of repeating each measurement 3 times and finding an average.

NOTES: Pacing in the woods or over hilly terrain is quite different than pacing a flat distance in a schoolyard or parking area. Remember the following tips:



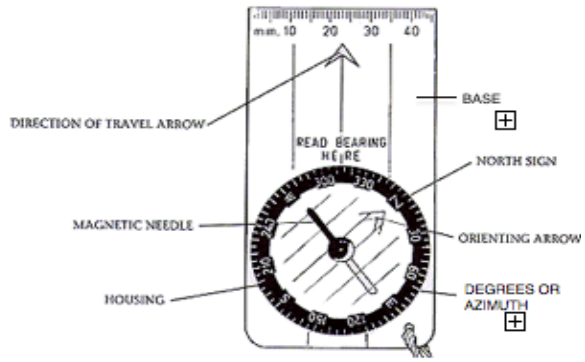
- When initially measuring your pace walk using a comfortable stride. Resist the temptation to take exaggerated steps because your pace will naturally become shorter in the woods or over hilly terrain.
- When pacing up or down a hill, you are actually traveling a shorter horizontal distance than it seems, and you many also pace irregularly due to the terrain. Be aware of your paces and compensate by taking slightly shorter or longer steps as necessary.
- When large objects (boulders, large trees, etc.) are in the way, take a few lateral side steps, pace forward, then take the same number or lateral side steps back to your original compass bearing (see figure). If an observation is required while side stepping and pacing around an obstacle then estimate the reading from the sidestepped position.
- If an object is too large to conveniently side step, stop at the object and send a team member out in front of the object (at least 10m) at the desired azimuth and have a team member stand where you are. Once they are both in place, walk around the object until you are directly in-line with your two team members. Estimate the number of paces taken up by the object and then start counting paces again heading toward your team member who is positioned at the correct azimuth.

How to Use a Compass

(Adapted from GLOBE GPS Investigation, Wisconsin Department of Natural Resources Explorer Program, Environmental Education for Kids)

A compass is useful for many applications. In the case of GLOBE field investigations the compass will be used to set up field sites that can be measured and returned to every year.

Investigating a Compass



1. Review the parts of the compass.
2. Examine the degrees noted on the housing of your compass. Degrees are typically in increments of 2° or 5°.
3. Hold the compass flat in the palm of your hand with the direction of travel arrow pointed away from you.
4. Practice turning the housing.
5. The red part of the magnetic needle points toward Earth's magnetic north pole.
6. Move slowly around the area, and watch how the needle always points the same direction.
   a. It doesn't always point in the same direction? Is there any metal around? Jacket zippers, keys, field tools, desks – How do these objects effect the magnetic needle?

Magnetic Declination

As you may know there are two North Poles on Earth. Magnetic North – where the compass points – is an area of highly magnetic rock under central Canada. True North is geographically at the top of the Earth (90° N) – maps are based on True North. Declination is the angle between the two. The size and angle depends your location. Declination is important to navigating correctly and can also be important in orienting your sample site to satellite images. Compasses have either a mechanism to set the declination so it is accounted for in your compass reading or a scale to make the calculation yourself. (To find your local declination, see *GPS Investigation: World Magnetic Declination Map*.)

Using a Compass

Goal 1: Face North
- Hold your compass in front of you, turn the housing dial until the N is lined up with the direction of travel arrow – where it says, "Read bearing here".
- Now turn your body, NOT YOUR COMPASS, until the red part of the magnetic needle is inside of the orienting arrow. A catchy way to remember this is – Red in the Shed
- You are now facing north. Practice again using E (90°)

Goal 2: Which direction are you facing?
- Turn your body to face a direction of your choice.
- Turn the housing until Red is in the Shed.
- Read the degrees that are lined up with the direction of travel arrow – this is the azimuth.

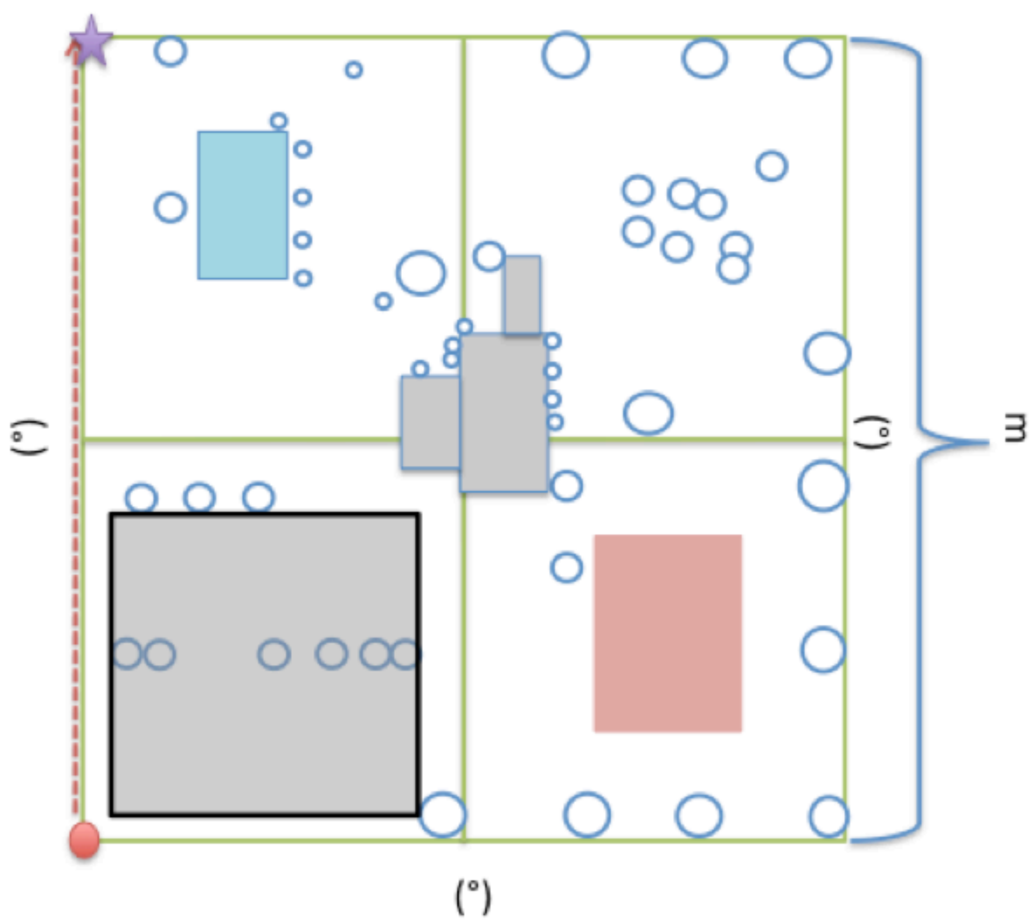
Goal 3: Find the azimuth of an object
- Holding the compass correctly in your hand, select a nearby object and turn to face it.
- Turn the housing until Red is in the Shed.
- Read the azimuth – this is the direction to the object from where you are standing.

Goal 4: Pace on an azimuth
- Turn your housing to the desired azimuth for pacing.
- Turn your body until Red is in the Shed.
- Choose an object (or partner) that is in line with your azimuth and pace toward it. This allows you to walk without looking down at your compass, thus creating a straighter path.

Carbon Cycle Site Set-up - Student Field Guide

Perimeter Team

1. Start one corner of the schoolyard. Give your starting corner an identifiable name, such as East St and 24th St.
2. Select a data recorder.
3. Select one person to stand at the corner with the compass. Turn your body clockwise until you are facing the nearest schoolyard corner. Turn the compass housing so “red is in the shed”. Report the bearing to your data recorder.
4. The third group member should pace along the azimuth toward the nearest schoolyard corner. Record the total number of paces.
5. Repeat steps 1-4 until all sides of the sample site have been measured. (Keep in mind this task may be divided among several groups.)



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Photography Team

1. Stand at the site center.

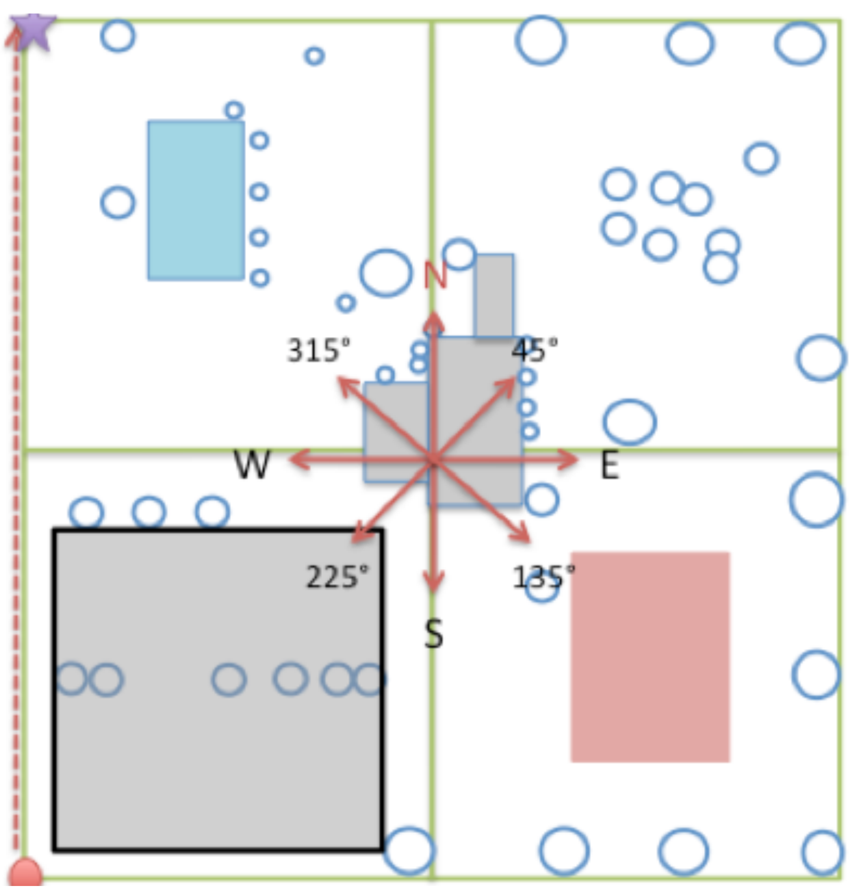
   a. **Note:** If here is a building or some other obstruction at the site center, select somewhere else in the site as the permanent photo location. This point should allow for photos that are representative of the site as a whole. Make a note of the photo location with a flag, permanent post, or GPS point.

2. To begin the photography measurements, check to make sure the date and time in the camera are correct.

3. Use a compass to orient your team and take one photo in each of 9 directions, the cardinal directions (N,S,E,W), their intermediates and up at the sky.

4. Work with the Data Recording Team to record the digital number of the photo for each of the photos taken on the *Site Set-up Data Sheet*, so you can identify them later.

5. If there is extra time, walk the site area and take other relevant photos, such as dead or downed trees (to note their change in decay from year to year), and other student teams performing site set-up tasks.



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Data Recording Team

1. Record the appropriate site location information on the *Site Set-up Data Sheet*.
2. To complete the vegetation analysis each team member should independently estimate percent cover of shrubs/saplings and herbaceous cover. If your site is much larger than 30m x 30m you may need an aerial image such as one from Google Earth to assist you. Record all estimates on the *Site Set-up Data Sheet* and find the average. (While on a Non-Standard site you will measure <u>all</u> of the vegetation if that type is present -shrubs or herbaceous, making a percent cover determination will assist you in determining your MUC classification and begin making estimates about total biomass and carbon storage by vegetation type.)
3. Work with the Photography Team to record the 9 photo numbers on the bottom of the *Site Set-up Data Sheet*.
4. Provide any additional important information in the Metadata section of the Data Sheet. Walk the site to identify key features of your site, such as the MUC land-cover classification, dominant vegetative species present, availability of water, and other notes that people who use your data might want to know about your location.

Carbon Cycle Site Set-up - Student Field Guide

GPS Team

Task
Measure the latitude, longitude, and elevation of your school or a GLOBE study site.

Materials
- ❑ GPS receiver
- ❑ Watch
- ❑ GPS Data Sheet
- ❑ Pen or pencil

Procedure
1. Take the GPS receiver to site center (or the exact location you would like to determine latitude, longitude, and elevation).
2. Turn on the receiver, making sure that you are holding it vertical and you are not blocking the antenna's view of the sky. In most receivers the antenna is internal and is located at the top of the receiver.
3. After an introduction message, the receiver will start to search for satellites. Some receivers may display the previous latitude, longitude, and elevation values while it is locking onto satellite signals.
4. Wait for the receiver to indicate that at least four satellites have been acquired and that a good measurement is available. In most receivers, this is indicated by the appearance of a "3-D" message.
5. At one minute intervals and without moving the receiver more than one meter, make five recordings on a copy of the GPS Investigation Data Sheet of all digits and symbols for the following displayed values:
   a) Latitude
   b) Longitude
   c) Elevation
   d) Time
   e) Number of satellites
   f) "2-D' or "3-D" status icons
6. Turn off the receiver.
7. Average all five latitudes, longitudes, and elevations.
8. Confirm for yourself that your results make sense. You should be able to get a rough estimate of your latitude and longitude by looking at a globe or local map.