

Pace-a-Pixel

Activity Guide



Overview

Participants will pace in four directions, recording the components of land cover along the way. Using the included data sheet, they will calculate the overall land cover classification and discuss how scientific measurements are taken at different scales.

Purpose

To make more detailed and quantitative measurements along four transects of a 50m by 50m square observation area (pixel) that can be compared with the percentages estimated using the GLOBE Observer: Land Cover tool and satellite-based maps.

Time

20-25 minutes total, including 10-15 minutes for an individual (or pair) to pace all four transects of a pixel, plus time for introduction and data summary/discussion. The overall process will take longer if the "[Find Your Pace](#)" activity is completed as a precursor, and could be shortened by having individuals or pairs simultaneously pace different directions of the same pixel.

Materials

- Data sheet: At least one per pixel to be measured, although more can be used if each transect direction is to be measured by different participants simultaneously. There are two versions, one for ground cover only, one for ground cover and canopy cover.
- Portable writing surfaces such as clipboards: one for each group of participants, or for each individual or pair if the simultaneous measurement technique is used.
- Pens or pencils
- If you will be measuring canopy cover: a [homemade densiometer](#)
- Flags, cones or other way to mark the center of each pixel. The end points of each transect can also be marked to facilitate pacing along a line.
- Smartphone or other device with the GLOBE Observer app loaded
- Calculators may be desired for summary calculations

Background

NASA scientists use a variety of satellite-based measurements to study our home planet and how it is changing. Satellites measure the amount of energy reflected by the Earth's surface in multiple regions of the electromagnetic spectrum, including regions beyond what the human eye can see. These data are recorded and converted into digital images composed of picture elements (pixels) arranged in columns and rows. Different satellites have different sizes of pixel. For example, the

pixels from Landsat satellite observations cover an area of about 30m by 30m of the Earth's surface, while the Moderate Resolution Imaging Spectroradiometer (MODIS) instrument on the Aqua and Terra satellites has a pixel of about 250m by 250m for measurements in the visible range of the spectrum. Both Landsat and MODIS data can be used to derive a satellite-based map of land cover. The GLOBE Observer: Land Cover tool (also known as Adopt-a-Pixel) provides ground-based comparison data for such land cover maps, among other purposes, through photographs taken with a smartphone or other device, as well as classifications by citizen science observers of the types of land cover they see in those images.

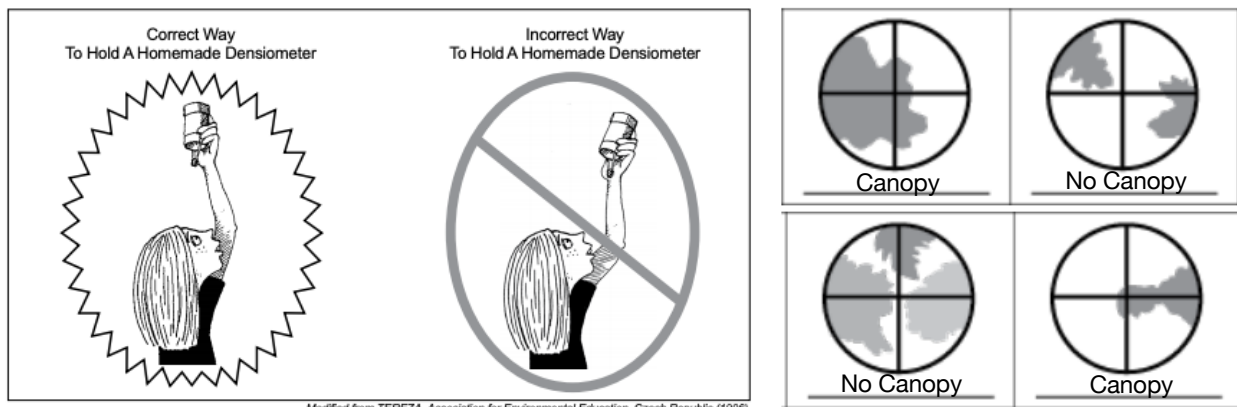
In this activity, you will have the opportunity to collect data that can verify on the ground what the satellite 'sees' from above, as well as compare a quantitative measurement of land cover types with the estimates completed as part of a GLOBE Observer: Land Cover observation. The technique of walking a transect (a systematic walk along a defined path) is one often used in biological and ecological studies as it provides a repeatable procedure for collecting data about a given area in a way that is comparable to other study areas. This also provides samples of data that are representative of larger areas (e.g. the whole pixel) and overall populations. Through the process, you will also be able to determine the makeup of the pixel in terms of its dominant land cover (e.g. forest, croplands, urban).

Preparation

- Select your study site. Choosing the center of a Landsat or MODIS pixel can provide useful data to compare to satellite imagery, but that is not required. Other interesting sites, especially for repeat observations, may be places that have been recently disturbed and are recovering (such as from a fire or construction), or areas that are changing in other ways, such as ice melting. Areas with historic imagery available can also provide an interesting comparison when new photographs are taken. Flat areas or areas without difficult terrain are recommended, especially when starting out.
- Important: Always follow the laws of the area in which you will be walking. Before you begin, familiarize yourself with your environment and always collect data in a safe location and in a safe manner. Do not collect data on private land without permission where it is unlawful to do so, and do not trespass. Especially in remote or sensitive areas, be aware of the possibility of damaging the terrain – if your observation will cause damage, you may wish to choose a different site.
- Make copies of the data sheet provided, either for Ground Cover only or Ground Cover and Tree Canopy.
- If you will be making Tree Canopy observations, prepare the [densiometers](#).

Steps

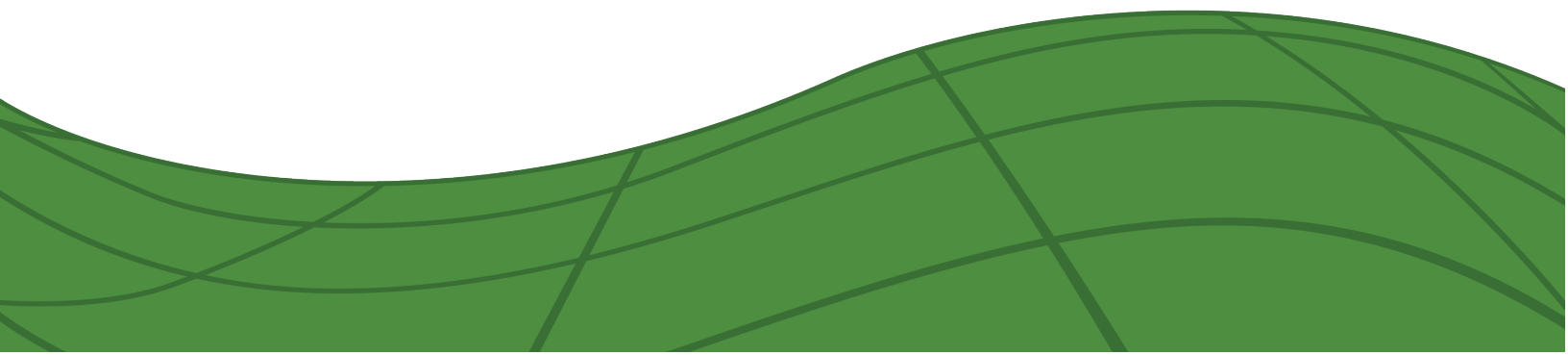
1. If participants don't already know their pace length, you can use the "[Find Your Pace](#)" activity to determine it. Then have each participant calculate how many paces it will take for them to walk 25 meters (half of the 50 square meter sample area).
2. Participants will begin at the center point of the pixel study area you have selected. Use a flag, cone or other object to mark your starting point. Take a GLOBE Observer: Land Cover observation from that point, and remember which way north, south, east and west are. It can be helpful to have people work in pairs, one person doing the pacing, the other making the tally marks on the data sheet. Each pair can pace all four directions, or you can have several pairs working on the same pixel, each walking one or two directions and combining data afterward (especially useful if time is limited.)
3. Beginning from the starting point, each individual or pair will pace 25 meters in each of the cardinal directions. At each pace (two steps), the pacer should look down at their feet to observe Ground Cover Type. Record a tally mark in the appropriate row of the table.
4. If you are using the variation that includes Tree Canopy, participants will also use the densiometer at each pace to look up. If vegetation, twigs or branches are touching the crosshair intersection, a tally mark should be recorded in the appropriate row of the table.



5. After walking the number of paces you calculated in Step 1, each individual or pair should return to the starting point and repeat Step 3 and Step 4 (if applicable) for the other three cardinal directions, or whichever directions they have been assigned.
6. Use the scale to assess the overall greenness/brownness of the ground vegetation.
7. Use the summary table to calculate the percentages for the overall sample area, using the totals column from your data table.
8. Ask your participants to discuss what they observed. Were the estimations provided by the app different from the estimations from the activity? If so, why do they think these differences occurred? What are some of the pros and cons of observing land cover from space (greater global coverage and higher frequency vs. less detail than ground-based observations and potential for cloud cover)?
9. Your data is valuable to scientists! If you are able, please scan or take a clear photo of your data sheet (both sides) and send it to globeobserverhelp@lists.nasa.gov. Our scientists are eager to compare the data they get from the satellites to the data you acquire on the ground.

Extensions

- Traditionally, the GLOBE Program site characterization activity had participants walk the diagonals of the pixel, rather than the cardinal directions. With the advent of the Land Cover tool in the GLOBE Observer app, it makes sense to match the pacing with the direction of the photographs taken during an observation. Comparing the percentages obtained from a diagonal pacing versus a cardinal direction pacing of the same pixels could be an interesting research project, and those comparisons would be highly valuable to the GLOBE Observer: Land Cover team.
- Examining satellite imagery of the study site and surrounding area can give participants a valuable experience of the importance of different ways to collect data. This can be especially true if satellite imagery from different timeframes that show change can be obtained. You can download Landsat imagery at <https://landsatlook.usgs.gov/>.
- If you are looking for a more hike-focused activity, with less detailed scientific observations, you might try the “[Land Cover Walk](#)” activity instead.



Data Sheet: Pace-a-Pixel (Ground Cover and Tree Canopy)

1. Calculate your pace length using the “[Find Your Pace](#)” activity, or use an estimate from the formula: $height \times 0.413 = pace\ length$. Then determine how many paces you will need to walk:

$$25\ m / \frac{\quad\quad\quad}{\text{pace length}}\ m = \quad\quad\quad \text{number of paces to take in each direction}$$

2. Take a GLOBE Observer: Land Cover observation from the center point of your pixel. Record the details of the observation below, and remember which way north, south, east and west are.

Date: _____ Time: _____ (local) _____ (UTC)

Site Name*: _____ Latitude: _____ Longitude: _____

3. Beginning from your starting point, walk 25 meters in each of the cardinal directions. At each pace (two steps), look down at your feet to observe Ground Cover Type and use a densiometer to look up and record Tree Canopy. Record a tally mark in the appropriate row of the table. After walking the number of paces calculated in Step 1, return to the starting point and repeat for the other three cardinal directions.

Look Down (at each pace)

Ground Cover	N	S	E	W	Total
Shrubs					
Herbaceous/ Grassland					
Barren (no cover)					
Wetlands					
Open Water					
Cultivated (crops, pastures, athletic fields, golf courses)					
Urban (road/ pavement)					

Look up (at each pace)

Tree Canopy	N	S	E	W	Total
No Canopy/Sky					
Evergreen					
Deciduous					

4. Assess the overall greenness/brownness of the ground vegetation (circle one).

Mostly Green

Mostly Brown

1

2

3

4

5

* This will be visible after your observation is sent to GLOBE by tapping the graph icon in the lower left of the app, and then tapping on “See My Data”

5. Use the summary tables below to calculate the percentages for the overall sample area, using the totals column from your data table.

Ground Cover	#	%
Shrubs		
Herbaceous/Grassland		
Barren (no cover)		
Wetlands		
Open Water		
Cultivated (crops, pastures, athletic fields, golf courses)		
Urban (road/pavement)		
Total		

Tree Canopy Cover	#	%
No Canopy/Sky		
Canopy (evergreen + deciduous)		
Total		

Tree Canopy Type	#	%
Evergreen		
Deciduous		
Total		

6. Your data is valuable to scientists! If you are able, please scan or take a clear photo of your data sheet (both sides) and send it to globeobserverhelp@lists.nasa.gov.

Data Sheet: Pace-a-Pixel (Ground Cover only)

- Calculate your pace length using the “[Find Your Pace](#)” activity, or use an estimate from the formula: $height \times 0.413 = pace\ length$. Then determine how many paces you will need to walk:

$$25\ m / \underset{\text{pace length}}{\hspace{1cm}}\ m = \hspace{1cm}\ \text{number of paces to take in each direction}$$

- Take a GLOBE Observer: Land Cover observation from the center point of your pixel. Record the details of the observation below, and remember which way north, south, east and west are.

Date: _____ Time: _____ (local) _____ (UTC)
 Site Name: _____ Latitude: _____ Longitude: _____

- Beginning from your starting point, walk 25 meters in each of the cardinal directions. At each pace (two steps), look down at your feet to observe Ground Cover Type and record a tally mark in the appropriate row of the table. After walking the number of paces calculated in Step 1, return to the starting point and repeat for the other three cardinal directions.

Look Down (at each pace)					
Ground Cover	N	S	E	W	Total
Shrubs					
Herbaceous/ Grassland					
Barren (no cover)					
Wetlands					
Open Water					
Cultivated (crops, pastures, athletic fields, golf courses)					
Urban (road/ pavement)					

- Assess the overall greenness/brownness of the ground vegetation (circle one).

Mostly Green

1

2

3

4

Mostly Brown

5

5. Use the summary table below to calculate the percentages for the overall sample area, using the totals column from your data table.

Ground Cover	#	%
Shrubs		
Herbaceous/Grassland		
Barren (no cover)		
Wetlands		
Open Water		
Cultivated (crops, pastures, athletic fields, golf courses)		
Urban (road/pavement)		
Total		

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