APPENDIX I
HOW WE CAN GROW SMARTER
LAND COVER CHANGE PROBLEM:
MUC-A-Thon and Δ NDVI-A-Thon Planning Guide

The **MUC-A-Thon and Δ NDVI-A-Thon** is a way to coordinate a number of classes or schools in an area to collect a large amount of data in a short amount of time. The concept can be used for a number of protocols in the GLOBE Program.

Pre-MUC-A-Thon and Δ NDVI-A-Thon Preparation

Teams should then attempt to collect as many sites around their schools and towns that they are able. Attempt to collect a number of different land cover types determined by the unsupervised clustering of the Landsat images. It is their belief that student-generated land cover data can be used to make more accurate maps than have been previously possible and also identify areas of changed land cover located through the Δ NDVI image.

PLANNING NOTE: Please use your Landsat images to plot your data collection to get as many land cover types as possible. Because the Landsat images are a few years old, it may be possible to find areas that are shown as woodland or forest and have since been developed. It is important to map those sites. This will provide a better model to determine land use changes and the possible effects on climate change. I would encourage you to seek out areas of new development around your schools. These areas will show up as white on the Δ NDVI image.

Also, please try to vary the types of land cover you are reporting. This means do not do all parking lots and buildings just because they are easily accessible. The MUC-A-Thon is a way of collecting useful scientific data. It is not a race or a competition to get the most sites. Sloppy data is detrimental to the project. You also must be sure to be as close to the center of a homogeneous 90m x 90m area as possible. Be sure to secure owner permission if a site is located on private property, preferably in advance.

When using a Geographic Information System package, such as MapInfo or Arc view in conjunction with field collection, we recommend that you print sections of the maps around the prospective or sites. By using the label tool in MapInfo or the auto label feature in Arc view, you will be able to label access roads to a potential site. The ruler tool or measure tool will enable you to determine the distance from a known point or crossroads. We recommend that you use the MapInfo latitude and longitude coordinates as well as distance from a known point to guide you to a site to do the MUC coding. This last point is not possible with Arc View to the same detail, the latitude and longitude coordinates are displayed only to the minute units.

SCALE: A mass data collection can be run on a number of scales ranging from several teachers in a single school to a regional effort, such as ours. Before undertaking a mass data collection, it is important to do a little preparation. To efficiently coordinate your

team leaders, get a list of email addresses for each teacher. This can be obtained from the GLOBE server or from your local franchise-training site.

PROTOCOLS: Provide each team leader with a clear set of expectations and directions for the data collection. Be sure each team has a copy of the latest version of the GLOBE protocols appropriate to the project. These can be downloaded from the GLOBE server as PDF (Portable Document Files) that may be printed and disseminated. Also, copy the appropriate forms, such as the included, for each team.

The Δ NDVI image ground truthing is a GLOBE land-cover protocol extension that also provides valuable data for the Global Land Cover Facility at the University of Maryland, College Park.

REFRESH: Arrange to have your teachers and team leaders meet for a refresher training to go over all of the protocols and skills needed for your data collection. Consider this to be a "shakedown" to take inventory and determine what is needed. For our MUC-A-Thon, we reviewed GPS skills, map and compass, use of pace to determine distance, plant identification, and MultiSpec protocols. We made sure each teacher had all of the necessary forms and that each one had a one-use camera and batteries for GPS receiver, etc. Grant money helped pay for such supplies.

Condensed MUC Codes: The one piece of preparation that proved most valuable for our MUC-A-Thon was taking the full set of MUC codes and condensing them to the few potential types to be found in your area. This may require the assistance of a biologist or ecologist familiar with your local flora. Check with your local college, university, or high school to find an appropriate individual. For our collection, I was able to cut the multipage list of 178 land cover types and glossary down to a two-page list of 34 potential types. I also integrated the glossary definitions into the sheet so that everything would be simple and compact.

MEETING SPACE AND COMPUTER ENTRY FACILITIES: Arrange for a place to gather post collection to have a chance to eat and share "adventure stories." Food and drink should be supplied to your field teams. We got a few cases of soda and a couple of 6-foot submarine sandwiches.

It is prudent to have a site where each team can have use a computer with Internet access to enter the data. This may be available at your local high school or university.

MUC-A-Thon Equipment for the Collection Day: (per team)

Note: files required are on this for download from this web site.

- Clipboards—1-2 per field team
- Pencils/ ball point pens—2-3 per team
- Copies of the most recent GLOBE Qualitative Land Cover protocols and the glossary of MUC terms. (1-2 per team)
- MUC code sheets (1-2 per team)--this is an abbreviated version of the full MUC system. I went through the codes to simplify the list to those that could be found in our area. This made the process far less intimidating.
- MUC Site data recording sheets (1 per site)
- Cumulative site data sheet—2-3 per team
- forms for signs (4 per site)--We used a laminated copy and a dry erase marker for each team, rather than using all of the paper at each site. I recommend this if plastic lamination is available. This is also beneficial if working in a wet/damp environment.

- magic markers (to mark photo signs, wider is better to show up in photo images)—2-3 per team
- one-use cameras or camera and film (enough for 4 images per MUC site)
- compass--to determine cardinal directions for photos or in conjunction with
- Measuring tape--to do GPS offset (often not necessary with 12 channel GPS receivers) or to determine sites using a map and compass if GPS not available.
- Handheld GPS (optional)—When using the GPS be sure to program the coordinates to Lat/Long with Degrees and Minutes (not Deg/min/sec). Also make sure the time setting is UT (universal time). This will make it easier to input to the GLOBE server.

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MUC-A-Thon and Δ NDVI-A-Thon October 11th, 13th, and 15th 1999

The first MUC-A-Thon and Δ NDVI-A-Thon will be October 11th, 13th, and 15th 1999. Approximately 4 teams of students and teachers from area middle school will participate in a three day-long activity.

Schedule : October 11th, 13th, and 15th 1999
8:10 AM Start - Teams of students and teachers will meet and gather all material, get last minute instructions and review the data collection plan.

8:45 – 2:30 Data Collection - Teams travel together by bus along a pre-determined route in their 15 kilometer square areas. Along the route, they stop at locations that they have, or will identify as being at least 90 meters X 90 meters consisting of the same usage or foliage (using their MultiSPEC images...3 pixels by 3 pixels..). The site they will MUC will be the representative 30m x 30m area. Exact distances to stopping points can be made from easily identifiable landmarks such as road interactions.

Each pre-selected location will have a minimum of 4 possible selected data points that are collected in a fan direction from the centralized location of the bus. Each team should select a 90 x 90-meter area of homogenous land cover according to the MUC codes and collect the data.
Participants then carry out the following tasks in the manner described in GLOBE protocols:

- Move from the automobile to the data collection spot, recording both the distance, using pace or measuring tape and the compass direction from recognizable landmarks.

- Carry out the MUC code protocols using procedure which results in a 4-digit identification using our revised MUC codes which narrow the 178 possible codes to the 34 potential codes Prince George's county.

Carry out the location procedure either with a GPS instrument following the GPS change-a-thon protocol with or without the Landsat image with road net overprint, or both processes. Mark on the MUC site data-recording sheet and on the cumulative site data sheet.

- GLOBE needs photos of each site in each of the cardinal directions (N, E, S, and W). Students may hold signs, but faces should not be in pictures to avoid publicity/liability problems with distribution via the Internet. Please label each photo by holding the legibly written photo form with the following information in the lower left-hand corner of the photo:

Information on Data Sheet	Example
School Initials-Team Letter (if multiples):	**QAS 81**
Date and Time using Universal Time units	**1999 17:56 UT**
GPS coordinates (if available)	**Lat: 38◦ 52' 588**
	Lon: 76° 45' 384
Altitude/Elevation	**Altitude 52 m**
MUC Code	**MUC Code 0231**
Camera number and exposure	**Photo F.N. #16**
Cardinal direction of photograph	**N (North)**

- Take four pictures: North, East, South and West at the location **(in that order),** holding the clipboard in the picture. We have found that the data sheet, in order to be visible in the finished photo, should take up the bottom left quarter of the viewfinder. This will allow the information to be visible. To avoid problems with release forms, etc., avoid having student faces in the pictures. NOTE: the clipboard should be about 10 ft from camera and tilted at 30 degrees downward.... In the fall the sun washed out the writing on the clipboards so we had a difficult time identifying the sites. Please make sure you document your data carefully and properly using big magic markers. The recorder should also verify GPS readings for center of site

From our experience, we believe teams using GPS receivers can collect data at a rate of two points per hour (travel time + 15 minute GPS readings + photos). Others using geo-referenced Landsat images, will be able to operate at a rate of three of 4 sites per hour, depending upon the distance between points and the distance from car to sampling location. This is due to the resolution and accuracy of the computer referencing.
Our expectation is that each team will collect data a minimum of 6 locations. We also believe teams may be able to collect as many as 12 points through careful planning and efficient data collection.

Queen Anne school Computer lab: <u>Data Entry</u> to GLOBE Server Queen Anne school Computer Lab Room. A computer laboratory will be used for use to upload their data. Teachers need to be sure to bring your GLOBE Site IDs and Passwords to log the collected data to your school's data set. Be sure to proofread data entries before sending to GLOBE and be sure to enter latitude and longitude correctly.
Please turn in your cameras (labeled with team name and camera number) along with the cumulative site data sheet. This will allow us to process the photos afterwards and avoid problems with identifying sites. Each team should give their individual MUC site data recording sheets to their GLOBE teacher to be kept in a notebook with all of the raw data sheets used for GLOBE work.

GPS PROTOCOL

MUC-A-Thon and Δ NDVI-A-Thon

The following are a set of instructions that will speed up the Geographic Positioning Systems (GPS) measurements for the field data collection process of the **MUC-A-Thon and Δ NDVI-A-Thon.** The GPS measurement calculates the exact location of the land cover map validation points when field measurements are collected. At each validation location within each type of land cover, all the GLOBE Qualitative measurements need to be collected: GPS reading (15 reading averaged over 15 minutes), MUC code for the 90 x 90 meter homogenous land cover area, and four photographs of the cardinal directions (north, east, south, and west). Since the land cover map validation process requires significant data points per identified cluster to properly access the map accuracy, any step to speed up the process per site is beneficial. One step is to have the newer GPS unit auto average the validation sites position. Usually, the newer GPS units that are commercially available in the $120.00 range will perform this function and will give a +/- error of 15 meters. This is well within the GLOBE land cover protocols specifications.

INSTRUCTIONS

- Turn on the GPS unit by firmly pressing the power key/button.
- A status page will appear while the GPS unit acquires satellites.
- Once sufficient satellite signals have been acquired (3D navigation which usually means that at least 4 satellites have been locked onto, and the position is now being calculated in latitude, longitude and altitude or elevation), the status page will be replaced by the position page.
- Note: for GLOBE measurements make sure on the Navigation page of the set up menu the units are set to: METRIC. The two other options are usually STATUTE or NATUTICAL.

POSITION AVERAGING FUNCTION

- Press the **MARK** key/button, a new page will appear titled: MARK POSITION.
- Using the down arrow key/button highlight the **AERAGE?** text field and press ENTER.
- The "Figure of Merit" or value of error (+/-) field will display a value reflecting estimated accuracy of the averaged position. Note: once this function is selected the initial error will be quite large but will rapidly decrease and stabilize over a short time.
- The GPS unit will usually continue to average until the **SAVE?** text display is selected and the **ENTER** key/button is pressed.
- Enter the Latitude, Longitude, Elevation and Time in UTC on the Land Cover/ΔNDVI Investigation Qualitative Land Cover and Change Detection Sample Site - Field Data Work Sheet and on the Photo sign laminated sheet. Note: The time

data is derived from the GPS satellites and is displayed in UTC (Greenwich Mean Time) time.

- It is not necessary to SAVE the marked position. After the position is entered on the data sheets the GPS unit can be powered down by holding down the POWER key/button for about 2 seconds.

Land Cover Investigation

Qualitative Land Cover Sample Site - Field Data Work Sheet

Recorded By:

_____

Measurement Time: _____ _____ _____ _____

Year Month Day Hour (UT)

LOCATION

Site Name:

_____

City/State/Country:

_____

Locational Data: Source: ☐ GPS ☐ Other

For GPS data, record from *GPS Investigation Data Work Sheet* or *Offset Data Work Sheet*

Latitude	Longitude	Elevation
_____ _____ **degrees minutes**	_____ _____ **degrees minutes**	_____ **meters**
☐ North ☐ South	**☐ East ☐ West**	

MUC TO THE MOST DETAILED LEVEL

MUC Class: _____ _____ _____ _____

MUC Land Cover Type Name:

_____

ΔNDVI Pixel group number: _____

METADATA (COMMENTS)

_____
_____
_____
_____

PHOTO NUMBER & ORIENTATION

_____
_____
_____
_____
_____
_____
_____
_____

Sheet used to fill in and hold up during the photographs.

Team:QAS_____

1999 EDT: _____

Lat: Please provide as degrees and minutes with decimals of minutes N

Long: Please provide as degrees and minutes with decimals of minutes W

Elevation:_____m

Direction: N, S, E, W Circle the proper direction

MUC: _____

Photo indicate if multiple rolls (eg: 1-3 = first roll 3rd picture) #