Assignment 2

The exercises for Weeks 3 and 4 cover the essential skills: (1) compass use, (2) mapping, (3) slopes and clinometer use, and (4) soil texturing. These exercises are presented below by week. All of the exercises are mandatory to fulfill the requirements of certification for the Environmental Field Skills program.

In the interest of time, and to avoid spending too much time traveling rather than doing the activities, the activities described below are best done in the same general area and in one trip if you can make that work. The time spent in the field is not onerous as there is some work to be done at home as well as part of these activities.

Compass Use and Mapping

This week we will complete an exercise that integrates many skills into one activity. We'll geo-locate ourselves (using Google Earth), then survey a length of road or trail, including features, and then generate a scale map of the area we surveyed. This is intended to illustrate how the ability to geo-locate ourselves (Essential Skill #6) is used in conjunction with the compass (Essential Skill #5) and measuring distances (Essential Skill #3) to document a route, and then recreate it as a scale map (Essential Skill #4). This will also require careful and conscientious note-keeping (Essential Skill #2) and considerations of safety (Essential Skill 1).

Field Preparation:

For this week's field activities we'll need a clinometer, your field notebook, a 12-inch ruler, and a plastic bag to collect a small sample of soil. If you don't have or didn't purchase a clinometer, we'll discuss in the live session an app that will convert your cell phone to a clinometer. In this case, you'll be able to use your phone in place of the formal instrument.

The slopes exercise will be easier if you have someone in the field with you. It doesn't have to be a classmate; it could be a family member or a friend. Recall from the discussion of clinometers that you want to have somebody that you can shoot to a point on their body that's at your eye level; that's why we want someone else in the field with us for this exercise.

Field Work:

Before going out in the field, create a title page and data table in your field book for this assignment. For the contents of your title page, review Assignment 1 which lays out the title page and requirements.

The data table is to make collection of data easier and organize it in an easy to understand format. Below are two data tables you are to fill in during the activity. Copy these into your field book before going into the field to make your data collection simpler.

Data Table 1: Bearings, distances, and trail width of ten legs of survey.

Leg Number	Front bearing	Back bearing	Length of leg (m)	Width of trail (m)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Data Table 2: Bearings and distances to two features alongside trail to be mapped.

Feature	Front bearing	Distance to feature	Description of feature	Leg which feature is adjacent to
1				
2				

Go to a location with a natural environment such as a city park, or woodlot, or any area near you that has trees and a trail. Determine potential hazards. What potential hazards do you see upon looking around? What about things that could become hazards if you are onsite for several hours? Record these in your notes. If you are working with other people, discuss these with them so that everyone recognizes the same hazards.

We will be measuring distances using your pace length so if you have not yet determined your pace length, do so now as described in Assignment 1.

Find a trail or little-used road you can work safely on and access. We're looking for a section of trail or road that's not straight; the curvier the better. Select a starting point that's very prominent, such as where two trails or roads come together, a bridge, edge of parking lot, etc. We're looking for a feature we can later find on Google Earth.

1. Starting at that point of the trail, shoot a compass bearing as far as you can see down the trail. Record that bearing in your notes (Data Table 1). Then walk to the forward point that you shot on, measuring the distance from your starting location (counting paces). At two or three spots, stop and measure the width of the trail. Record all of these data (compass bearing, distance, widths of trail) in Data Table 1.
2. From the forward position, shoot back on your original position with the compass to generate a backsight. That's your first leg (Leg 1) of the survey and you should have in the table: a front bearing; a back bearing; distance between the two points (in paces; these distances can later be calculated into metres or feet); and two or three measurements of trail width.
3. Repeat this procedure 7 to 10 times to generate

data on 7 to 10 legs of a survey. Note: If your trail does not vary significantly in width as you go along, you don't have to repeatedly measure it as it's constant; in this case your first two or three measurements will suffice.

4. On your survey, take note of two 'permanent' features off of the trail but reasonably close (e.g., wildlife tree, wetland, rock outcrop, etc.). From the position that you're taking your regular compass bearing (that is, where one leg ends an the next begins), shoot a bearing on this feature. Measure the distance to it from this location. Record these in your notes (Data Table 2). Photograph the feature. Note which 'station' or leg you're shooting the bearing from and record in your notes.
5. As you proceed along your survey, sketch the route you are taking in your notebook and include any features you see you think noteworthy. Estimate the distances from your position to any features of interest. Record these feature and distance in your notes. That is, you are drawing a sketch map while in the field of your area. Include the required parts of a map – title, legend, approximate scale, north arrow. Label the features of the area you want the reader to notice.
6. Photo-documentation: Photograph those features you have identified that you think important. Record the photograph information in your notes, whether it is photo number or a description of the photo. What are you showing in the photograph? What do you want to convey to the class? Photograph any unusual observations (e.g., bones, skulls, tracks, …).

Office work:

Back at home, determine the latitude and longitude coordinates, or US National Grid if you prefer, of the point you started your survey. You can use Google Earth for this as long as you can identify your starting point.

We are now going to create a scale map of the short route that you walked. To do so:

1. Take a clean sheet of paper and mark a north arrow pointing to the top of the page.
2. You know from your compass bearings the general direction you were travelling and from your distances the approximate total distance. We need this information to determine how to fit our route onto a single page.
    - Add up your total distance walked as this will be the maximum distance you walked. Of course, your actual distance is less than this as the trail twisted and curved; you did not walk a straight line. For example, I might add up my distance and get 350 m total distance. That means I have to fit 350 m onto a single piece of paper.
    - We need to determine an appropriate map scale to fit our ground distance onto the page. We want the map to take up most of the page, but not drift off of it. The long dimension of a standard page is 28 cm (11 inches), so I need to fit 350 m ground distance onto 28 cm map distance. To determine my scale, I:
        - ◊ Convert my ground distance from metres to centimetres so it matches my page units. So 350 m = 35,000 cm
        - ◊ Divide my ground distance by the length of page I want to fit my map on. That is, 35,000 cm / 28 cm = 1,250. So my map scale is 1:1,250. Your initial calculation may not be so neat and round number but instead something like 1,053. For ease of calculation, round up to a more convenient number. If I had a scale of 1:1,053 I would round up to 1:1,100 or even 1:1,200. Always round up as that will shrink the map on the page and ensure that it fits.
        - ◊ Write down you calculated scale on the page where you will make the map so you can easily find it.
    - Now you need to determine where to start your map on the page. Estimate your general overall direction (from your compass bearings), and start your map in a corner of the page allowing lots of space to go in that direction. For example, if my general route was to the northeast, I would start my map in the lower-left corner (southwest) of the page so I have lots of page to the "northeast" to draw my map. If

my general direction had been westward, then my initial starting point would be on the right edge of the page so there is lots of room to the ”west” (left side)
- If your general direction was north-south use the ‘profile’ layout of the page (long edge pointing up and down); if general direction east-west use ‘landscape’ layout of page (long edge pointing left to right).

3. Make a mark on the page at your starting point.
4. Now, using a mathematical compass or regular compass, place the compass directly on the spot you marked, and make a mark on the page at the appropriate bearing as recorded in your field notes Be sure the mathematical compass is aligned properly if using it or, if using a regular compass, the needle pivot point is placed on your mark. This represents on the page the true direction from your starting point. You can then draw a line from your starting point along this bearing… but you need to know how long to make the line.
5. To determine the length of this first leg on the page, use the map scale to convert your measured ground distance of Leg 1 to a map distance. Then using a ruler, measure a line of that length connecting your starting point, through the mark you made to show the bearing. End the line at the proper map distance from the starting point. This end represents the end of Leg 1 and beginning of Leg 2.
6. Place the compass on the new point where leg 1 ends and leg 2 begins and repeat the plotting of the bearing and map distance for Leg 2. Then continue for each leg of the route that you walked.

7. Using the same method, determine the bearing and distance to your two features of interest. Plot those on the page.
8. Now fill in the rest of the map from the sketch map you made in your field book, including those features you placed on the sketch map but did not measure or take bearings to. When finished you should have a map of the area that you walked with the key features included and the route that you walked to scale.
9. Provide the latitude and longitude or National grid reference for your starting point. Also be sure to include the standard map requirements: (1) Title; (2) scale; (3) north arrow; and (4) labels of features or a legend if there are many features and labels would clutter the map.
10. If you would like, redraw the map as a good copy by tracing over your working map.

Slopes and Clinometer Use, and Soil Texturing

Field Work:

Slopes and Clinometer Use:

For this activity you’ll need a slope that you can walk up and down; this can be a gentle rise or a steep hill, whatever you have in your neighborhood. We’re going to determine our slope angle and slope distance, and from those calculate the horizontal distance.
To start:

Determine your eye level on your partner. This is the point you’ll be looking at on that person when using the clinometer. If you’re working by yourself, go to the top of the hill and tie a ribbon or something obvious in a tree at your eye height so you know where to shoot at eye-height when looking through the clinometer.

Recalling what was discussed online about (i) knowing where on your partner’s body to look that’s at equal height to your eye above the ground, and (ii) that you want to be standing at the break of the slope at the top and the toe of the slope at the bottom, **position yourself and your partner, one at the bottom and one at the top of the slope.** Be sure you have a clear sightline to your partner. Raise the clinometer to your eye and you’ll see a horizontal line in the center of the field of view through the middle of the instrument. A spinning wheel will be noticeable passing by that line. The wheel spins when you move the instrument upward or downward.

Line up the horizontal line with the spot on your partner that's at your eye level and hold the clinometer steady. The spinning wheel will stop. Read the scale on the right-hand side; that's the side with percentages. On the left is degrees. Finally note that there's a positive (+) and a negative (-) sign. The wheel will show positive when we're looking uphill, telling us this is a positive slope, and will show negative when pointed downhill. This way we can record in our notes if we measured looking uphill (+) or downhill (-). Determine the slope angle, in percentage, of the slope between yourself and your partner. Record that in your field notes.

Now **walk up the slope to your partner**, measuring or pacing the distance between where you shot on that person and where they're standing – this is the slope distance. Record that in your notes. One final thing to add: if you have a compass with you, determine the compass bearing that the slope is facing. In other words stand on the slope with your back to the top so you're facing the same direction as the slope is facing outward and determine the compass bearing that you're facing. This is called the aspect of the slope and is important in vegetation and wildlife surveys.

Have your partner do the same exercise using a different slope or a different part of the slope where the angle is different.

Practice using the clinometer by measuring slopes and slope distances of three to five different hills, and shooting both uphill and downhill. Have your partner take three steps back from the break of the slope and shoot on that new position. Does it change the measured slope angle if they aren't standing right on the break of the slope?

We will be calculating horizontal distance from slope distance but that will be done at home (see "Office Work", below).

Soil Texturing

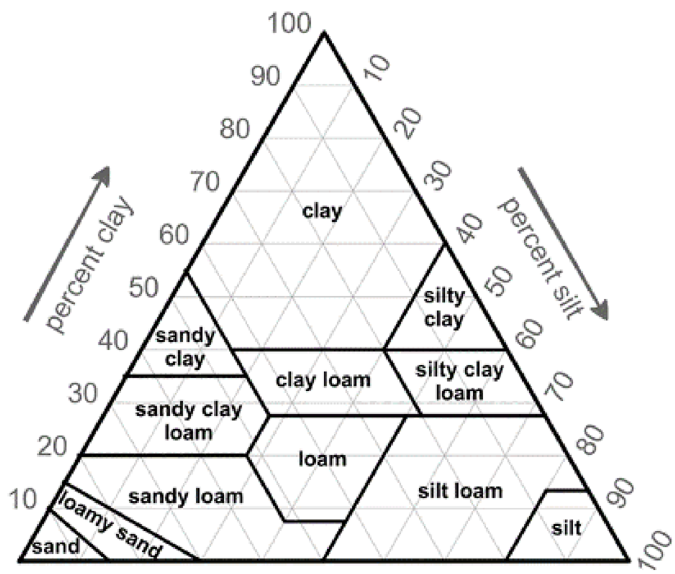
While in the field try to find a place with a cutbank or eroding bank where the soils are well exposed. Examples may include where a road has cut through a hillside, or a stream has eroded the outside of a bend. Or, if you don't have such a place near to you, dig a shallow soil pit in your back yard. Make it shallow, just enough to see soil horizons if they're present; you don't want to disturb your yard too much. If you can't do either of these, locate a pile of soil that you can get to safely and without needing permission – examples are along ditchlines, where a tree has blown over and has been uprooted exposing the soils, or in a neighbors garden. You may have to use your imagination to find a place with exposed soil but find a spot where you can clearly see the soil.

Once you've found your location, complete the following soil survey to the best of your ability and as the local conditions allow. If you have a large cutbank, such as along a highway cut, use your clinometer to determine the slope angle of the cutbank.

While in the field, complete the following three tests on the soil to get a sense of what the dominant components are, whether they are sands, silts, or clays.

- **The graininess test:** Rub the soil between your fingers. If sand is present, it will feel 'grainy'.
- **The moist cast test:** Compress moist soil in your hand by squeezing it with your fist. If the soil holds together, in a 'cast', toss it gently from hand to hand. The longer the cast holds together, the more clay is present. If you can't form a cast or if it falls apart quickly, there's little clay present. Importantly, the soil must be moist, even if you have to sprinkle some of you drinking water on it.
- **The worm test:** Roll some moist soil between the palms of your hands and try to flatten it out into a 'worm'. You likely did this with clay or putty as a young child; we're doing the same thing now. The longer and thinner you can make the worm, the more clay it holds. If you can't make a worm, there's little clay present.

From these three simple tests, can you then use the soil triangle (below) to classify the soil type? What do you estimate your soil type to be for your sample? These field tests are one way of identifying the soil texture. Another, more accurate though time consuming, way of doing it is with the 'Jar Test'. To do this, you'll need to take a small sample of soil home with you. Place a few handfuls of soil into a plastic bag that you can seal and take it home with you. The Jar Test is described below under Office Work.



Soil Horizons

If you are fortunate to have a clean slice through the soil such as a soil pit or cutbank:

The LFH Layer:

Start with the LFH layer. At this cutbank or exposed soil, can you identify the LFH layer? Does it appear as Mor, Moder, or Mull? How thick is it? Measure it. To help you assess this, what type of vegetation cover is along the top of the slope – deciduous or coniferous? Record the data in your field notebook.

The Horizons:

Do you see horizons in the soil below the LFH layer? If so can you identify them as A, B, or C horizons? If you have clear horizons, measure the depth of each horizon from the base of the LFH layer. Record these in your field notebook. Photograph the exposed soil.

Office Work:

Slopes and Clinometer Use:

We now have slope angles and slope distances for a small number of slopes. We need now to convert that slope distance to horizontal distance. We can use a slope correction table (see below) as shown in the online training. To convert slope distance to horizontal distance, multiply the slope distance that you measured in the field by the appropriate correction factor for the slope angle. So if I have a 25 m slope distance at a slope angle of 51%, my horizontal distance is:

Slope correction factor for 51% = 0.8908 (from table below)

25 m * 0.8908 = 22.27 m

For each of the slopes that you measured a slope angle and slope distance, calculate the horizontal distance.

Slope Correction table

Horizontal Distance = Slope Distance x Correction Factor
Slope Distance = Horizontal Distance ÷ Correction Factor

%	Corr Factor	%	Corr Factor	%	Corr Factor	%	Corr Factor
1	1.0000	26	0.9678	51	0.8908	76	0.7962
2	0.9998	27	0.9654	52	0.8872	77	0.7923
3	0.9996	28	0.9630	53	0.8836	78	0.7885
4	0.9992	29	0.9604	54	0.8799	79	0.7847
5	0.9988	30	0.9578	55	0.8762	80	0.7809
6	0.9982	31	0.9552	56	0.8725	81	0.7771
7	0.9976	32	0.9524	57	0.8688	82	0.7733
8	0.9968	33	0.9496	58	0.8650	83	0.7695
9	0.9960	34	0.9468	59	0.8613	84	0.7657
10	0.9950	35	0.9439	60	0.8575	85	0.7619
11	0.9940	36	0.9409	61	0.8537	86	0.7582
12	0.9929	37	0.9379	62	0.8499	87	0.7544
13	0.9917	38	0.9348	63	0.8461	88	0.7507
14	0.9903	39	0.9317	64	0.8423	89	0.7470
15	0.9889	40	0.9285	65	0.8384	90	0.7433
16	0.9874	41	0.9253	66	0.8346	91	0.7396
17	0.9859	42	0.9220	67	0.8308	92	0.7359
18	0.9842	43	0.9187	68	0.8269	93	0.7323
19	0.9824	44	0.9153	69	0.8231	94	0.7286
20	0.9806	45	0.9119	70	0.8192	95	0.7250
21	0.9787	46	0.9085	71	0.8154	96	0.7214
22	0.9766	47	0.9050	72	0.8115	97	0.7178
23	0.9746	48	0.9015	73	0.8077	98	0.7142
24	0.9724	49	0.8980	74	0.8038	99	0.7107
25	0.9701	50	0.8944	75	0.8000	100	0.7071

Soil Texturing:
The Jar Test

1. Once at home, place some of the collected soil from the field into a glass or clear plastic jar. Put enough in the jar to fill it to about 1/3 of way to the top. Then almost fill the jar with water. Put a lid on the jar and shake vigorously. Place on a table or shelf.
2. After allowing the sample to sit for 60 seconds, use a marker to draw a line on the jar where material has settled out on the bottom. You want to mark the top of the material that has settled. These materials are your sands.
3. Now at two minutes, again mark with a marker the top of the material that has settled since making the first mark. These are your silts which have settled on top of the sands.
4. Now 24 hours after having put the soil into the water, make a mark on the jar at the top of the accumulated material. The material that accumulated from the top of the silts to this new mark are your clays.

To determine the percentage of sand, silt, and clay (which is needed to determine soil composition from the soil triangle), we measure the total height from the bottom of the jar to the top mark you made, which is the upper level of the clays. That height is our total deposited soil in 24 hours. Now also measure the height from the bottom of the jar to the top of the sands; that's our height of sand. Then measure from the top of the sand to the top of the silt; that will be from your first line to your second line. This is the height of silt that has accumulated. Finally measure from the top of the silts to the top of the clays; this is the height from your second line to the third line.

To calculate percentages of each of the sand, silt, and clay, we divide the height of each component by the total height of all of the material that has accumulated. For example, if I had 16 millimeters of sand and my total height of all material accumulated was 32 millimeters, then my percentage of sand is:

16 mm / 32 mm * 100 = 50%.

So my sand composition of this sample would be 50%. I then do the same for the silt – simply divide the height of the accumulated silt by the height of all of the accumulated material in the jar. And finally I do this for the clay as well. I now have measured percentages of each of these components in the soil. I can then compare those with the soil triangle to accurately classify my soil sample. Let's assume my sample had 50% sand, 25% silts, and 25% clay. From the soil triangle, my soil would be a Sandy Clay Loam.

You should have two estimates for your soil sample now, one from the field with the three hand tests, and one from the Jar Test. How did your measured percentages using the water jar compare with your estimated percentages using the three hand tests?

Information to be Submitted to NRTG

In this assignment we have introduced you to use of data tables, creation of a map from field data, and recording data in freeform (not using data tables). The submission requirements for these exercises are photographs of your data tables, scale map, and freeform data. Do not submit more than is requested (that is, do not submit the tile page or your sketch map or anything else not explicitly requested below)

When submitting photographs of field notes, please attach all photographs to a single email. Multiple emails risk being lost in the large number of emails we receive and so ensure all of your submission is attached to a single email.

Specifically, the submission requirements for the assignment of Weeks 3 and 4 are:

- Compass and mapping
    - Data Tables 1 and 2
    - Scale map with all requirements (title, north arrow, scale, etc.)

- Slopes and Clinometer Use
    - Your measured slope angles, slope distances, and calculated horizontal distances for 3 to 5 slopes.

- Soil Texturing
    - Results of the field hand test: how did you classify the soil texture in the field?
    - Results of the jar test: measured heights of sand, silt, and clay. Soil texture classification from the jar test;
    - A brief comment on the comparison of hand testing in the field to the jar test. Were the results close? Which do you think is more accurate?