

General

In this lab, we will focus on an active landslide in the Plotterkill Preserve, Rotterdam, NY. Our field trip will involve: i) the acquisition of slope data needed to construct a longitudinal profile of the slide, ii) the measurement of the amount of rotation of steel rods that were placed in the slide in April, 1995, iii) a comparison of the material that is sliding with the bedrock geology of the Plotterkill, and iv) a consideration of the relationship between the landslide and the fluvial geomorphology of the Plotterkill. By comparison with data acquired by previous Geomorphology classes, we will document the amount of landslide movement that has occurred over the last several years.

Tools Needed:

- field notebooks
- brunton compasses
- meter sticks
- measuring tape
- survey tape and stakes

Objectives

- 1) to classify the landslide according to the classification scheme in Ritter et al. (2002)
- 2) to construct a longitudinal profile of the landslide
- 3) to measure the angle of tilt of steel rods that were placed in the slide in April, 1995
- 4) to establish the material within which the sliding is occurring
- 5) to consider the probable cause(s) of hillslope instability in the Preserve

Part I. Measurement of the Longitudinal Profile of the Slide

We will divide into 4 teams, each with a brunton compass and a meter stick. Three of the four teams will measure a separate segment of the longitudinal profile of the slide. The combined data will be used to plot the profile of the slide. One member of the team will record the data; **write legibly so that we will all be able to use your data.**

Important: As you measure the profile take notes as to the presence of any surficial features that might be related to sliding; i.e. cracks, water emanating from the hillslope, scarplets separating slide blocks, the presence or absence of vegetation, etc. Record these features in a separate column at the appropriate increment. Your data table should look something like the following table:

Table 1
Longitudinal Profile Data

Length of Rod	Slope Angle	<u>Observations</u> (e.g., "tension cracks are present at this increment of the profile"; "springs present"; "vegetation present")

Part II. Measurement of the tilt angle of steel rods

Surface deformation can be documented by measuring the tilt angle of steel rods placed in the surface of a landslide. Mass wasting by earth flow will commonly rotate these stakes in a down-slope direction, so that they have an upslope plunge. In April 1995, Paul S. Hays, an illustrious Union graduate, pounded dozens of steel rods into the slide surface to provide a baseline for monitoring the movement of this landslide. We will remeasure his *left vertical* row of stakes. Along this row, Paul placed 28 stakes vertically into the slide. The spacing between the stakes was 2 meters. The fourth team will remeasure the distance between stakes and the tilt angle of the stakes with the aid of brunton compasses and tape measures. Record your data in the following manner:

Table 2
Stake Distance and Tilt Angle

Stake Number (note: start at the edge of the creek and number consecutively upslope)	Distance upslope to next stake (meters)	Angle of stake from horizontal (degrees)	Direction of Plunge (e.g., upslope = positive and downslope= negative)

Part III. Lithology of the Slide material

Here we want to determine whether or not the hillslopes in this part of the valley are composed primarily of the Schenectady formation or of glacial till deposited ca. 15 ka to address the question of *what material is sliding?* Because glacial till contains abundant clasts from up-ice regions, such as the Adirondacks, the Canadian Shield and the St. Lawrence Valley as well as locally-derived material such as the Schenectady Formation, we can estimate the origin of the hillslope material by counting “exotic” clasts. Let’s count the number of exotic clasts on the slide and compare this data with data from cobble counts in the creek immediately below the slide and in a reach upvalley from the slide. The lithology of clasts in the stream bed upvalley from the slide should reflect the “average” lithology of the drainage basin upvalley from the slide. The lithology of the creek directly below the slide should reveal the contribution of slide material to the bed load of the creek and should fall somewhere between the slide lithology and that of the creek upvalley from the slide. So as not to have to cover the whole hillside and creek bed, we will standardize our procedure by limiting our counting to 2 minutes at each locality. Include all clasts larger than a golf ball and be sure to separate yourselves so that you are not counting the same clasts.

Table 3
Number Of Exotic Clasts From A 2 Minute Clast-Lithology Count

	Landslide Surface	Creek Bed Upstream from Slide	Creek Bed Downstream from Slide
Number of Exotic Clasts			

Data Reduction and Graphing (on your own):

- Using EXCEL, enter all of slope data that the three teams compiled into our common worksheet, which will be saved on a zip disk and left in the classroom. Team 4, you will enter your stake-angle data in the appropriate labelled columns *also on the common worksheet*. Once the data is all compiled, each of you can copy the worksheet onto your floppy disks so that you can each (*individually*) process the data and make your plots. For hillslope data, enter data in order starting at the bottom of the slide; thus, the lowest team enters their data, then the second team and finally the third team. Enter the slope angle, and in COLUMN B enter length of the meter stick used.
- (*ON YOUR OWN*) Using simple trigonometry, you can calculate an X and Y coordinate for the starting and ending points of each measurement and a cumulative slope profile. Note that early versions of EXCEL only work in radians so you may need to convert degrees to radians (radians= degrees x $\pi/180$). Combine your data with the data that were collected in previous classes, which will be on our common worksheet. Plot a longitudinal profile (X axis = horizontal; Y axis= vertical) for the data sets on the same graph. We will go over this in class.
- Using EXCEL, calculate an average slope of the Plotterkill landslide. Employing the INIFINITE SLOPE MODEL and this average slope value along with the default settings for porosity, cohesion, density, and regolith thickness, estimate whether or not this hillslope *should* be stable at field capacity (10%), and, if so, how much cumulative rain it would take to destabilize this hillslope. If the hillslope is already unstable according to the model, determine the slope angle for which this hillslope would be stable. The INIFINITE SLOPE MODEL will be on the common use zip disk.

4. Using EXCEL, plot the angle of tilt (plunge) of the steel rods with distance up the slide surface. Be sure to consider the sign (+ or -) of the tilt (see Table 2, above). Place tilt angle on the Y axis and distance up slope on the X axis.
5. Finally, using the Table Command in WORD, tabulate *your* lithology counts as in Table 3 (above), and include this table in the body of your text.

Report (Due Friday 10/31):

A \leq 6 page report that addresses the following questions:

- How would you classify this mass wasting feature? Explain.
- How much has the slide moved in the the last year?
- By what processes (e.g., sliding, flowing, creep) has this movement occurred?
- Integrating this lab with the last two labs, what do you think is the ultimate cause of this landslide?
- Why did the landslide occur where it did in the valley?
- How has the landslide affected the course of the Plotterkill?
- If you were hired as a consulting geologist, how would you recommend stabilizing this landslide?

Figures and Table:

Your report should have at least two tables and at least two figures. Mandatory tables and figures are:

- Table 1 will be the raw data on EXCEL; this will be placed after the figure(s) in your report
- Table 2 will be the WORD table that summarizes your clast lithology data, and will be placed in the body of the text
- Figure 1 will be your longitudinal profile-*BE SURE TO SKETCH IN A SUBSURFACE SLIDE PLANE THAT IS CONSISTENT WITH YOUR STAKE ROTATION DATA.*
- Figure 2 will be your plot of stake rotation