FRST121 – Mapping and Photogrammetry

Fall 2011

Topography and Slope

References: Map Use and Analysis, Campbell pg. 130 - 141

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Outline

- Three ways to describe slope
- Calculating slope, horizontal and vertical distances
- Creating topographic profiles
- Plotting a constant grade

Topography/ Terrain

- It's the **shape of the ground**
- the vertical and horizontal dimensions of the land surface
- Topography is more commonly used term

Ways to describe terrain

1. Spot Height
2. Bench Mark with Elev.
3. Shading

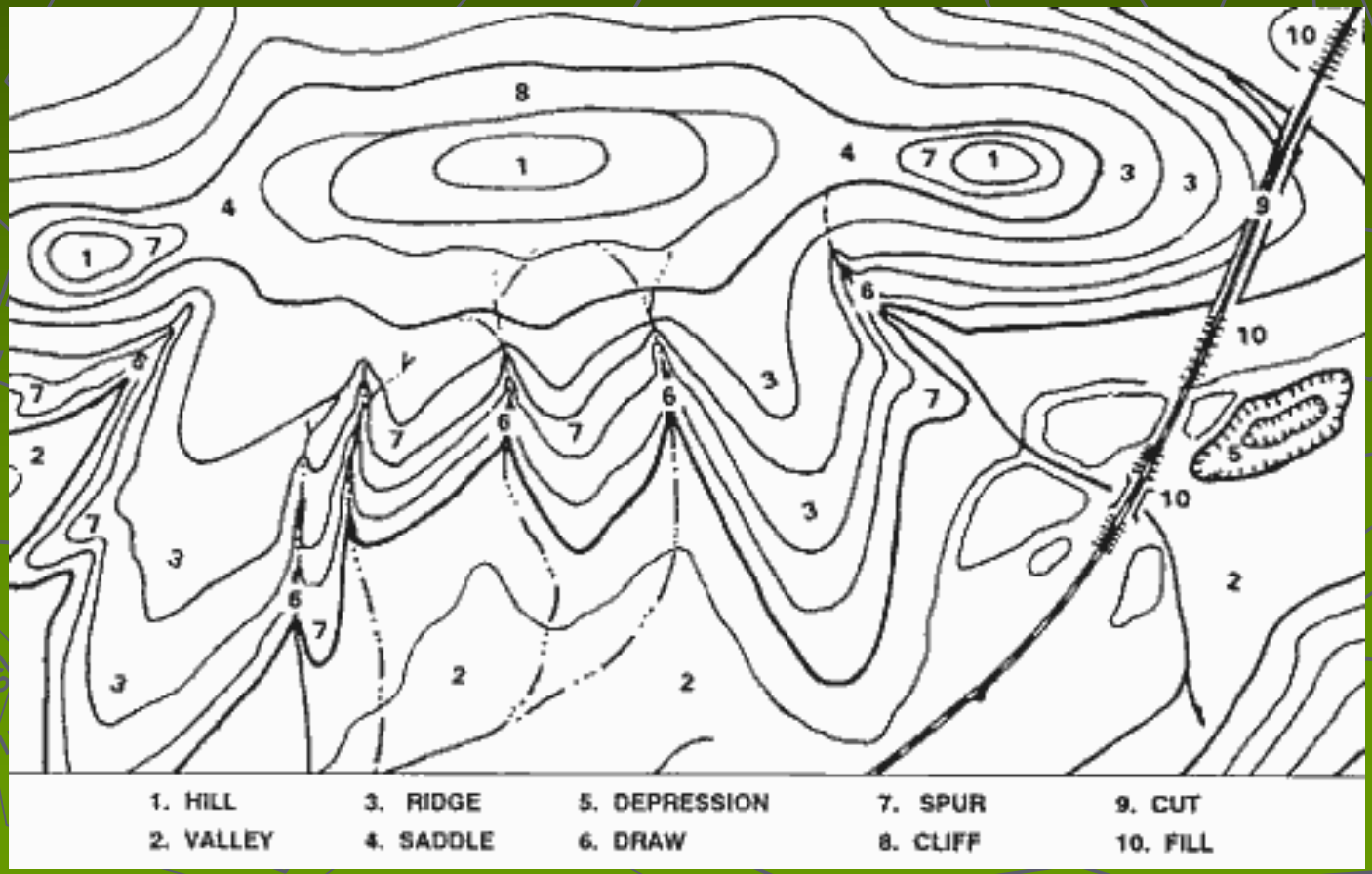
.224

△ 187.8

Shading is visually effective but you can't measure it

Ways to describe terrain

- Contour - imaginary line connecting points of equal elevation
- Max slope is at right angles to a contour
- catchment area?



Applications:

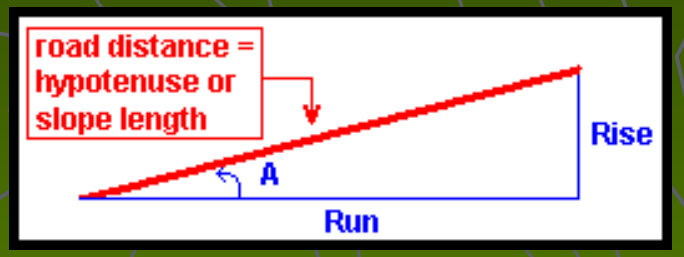
- Elevation estimates - interpolation
- Reservoir Capacity - $V=i[A_1/2+A_2+A_3....+A_n]$
- Flood Zone Maps -

<u>Forestry</u>

- Catchment Basins - Hydrology
- Slope Profiles
  - Intervisibility (viewpoints)
  - Harvest Method projections
  - Road Projections

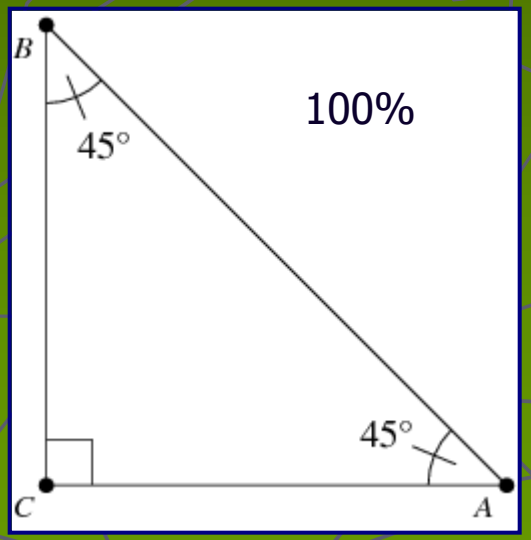
Review of FRST 111 -Measurement of slope

1. As a Ratio
   - Of the rise to the run
   - Example: 1 in 20, or 1:20
   - Means a rise of 1m every 20m



2. As an Angle
   - In degrees
   - Example: 10°
   - Maximum is 90° (straight up)

3. As a Percentage
   - Also called the "grade"
   - Calculated as the rise/run x 100 = %
   - 45° is 100% slope



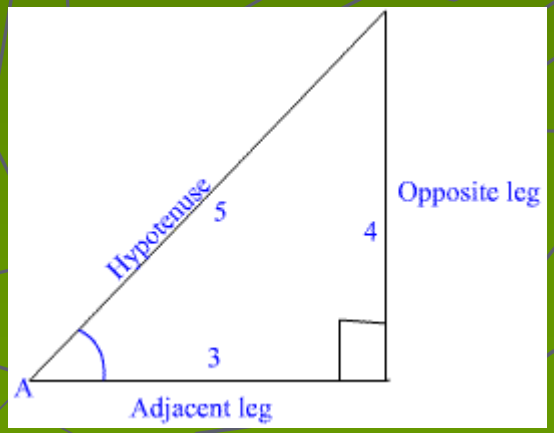
Review of FRST 111 - trig functions

Sine (sin), cosine (cos), tangent (tan)

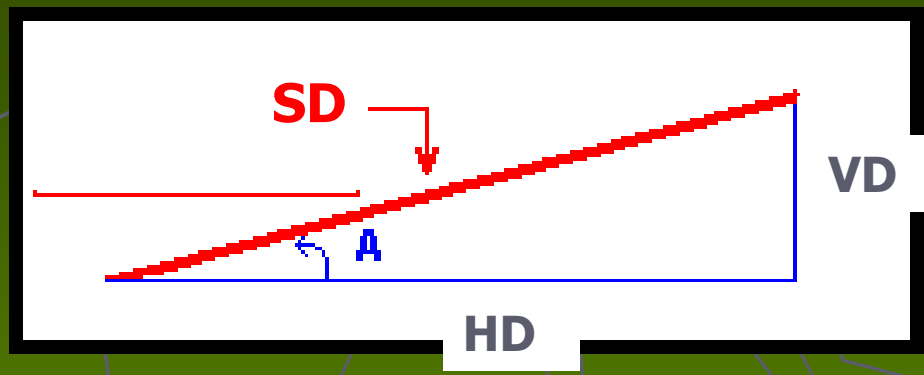
sin A = opposite side / hypotenuse

cos A = adjacent side / hypotenuse

tan A = opposite / adjacent = rise / run



Calculate VD and HD given Slope in % and SD



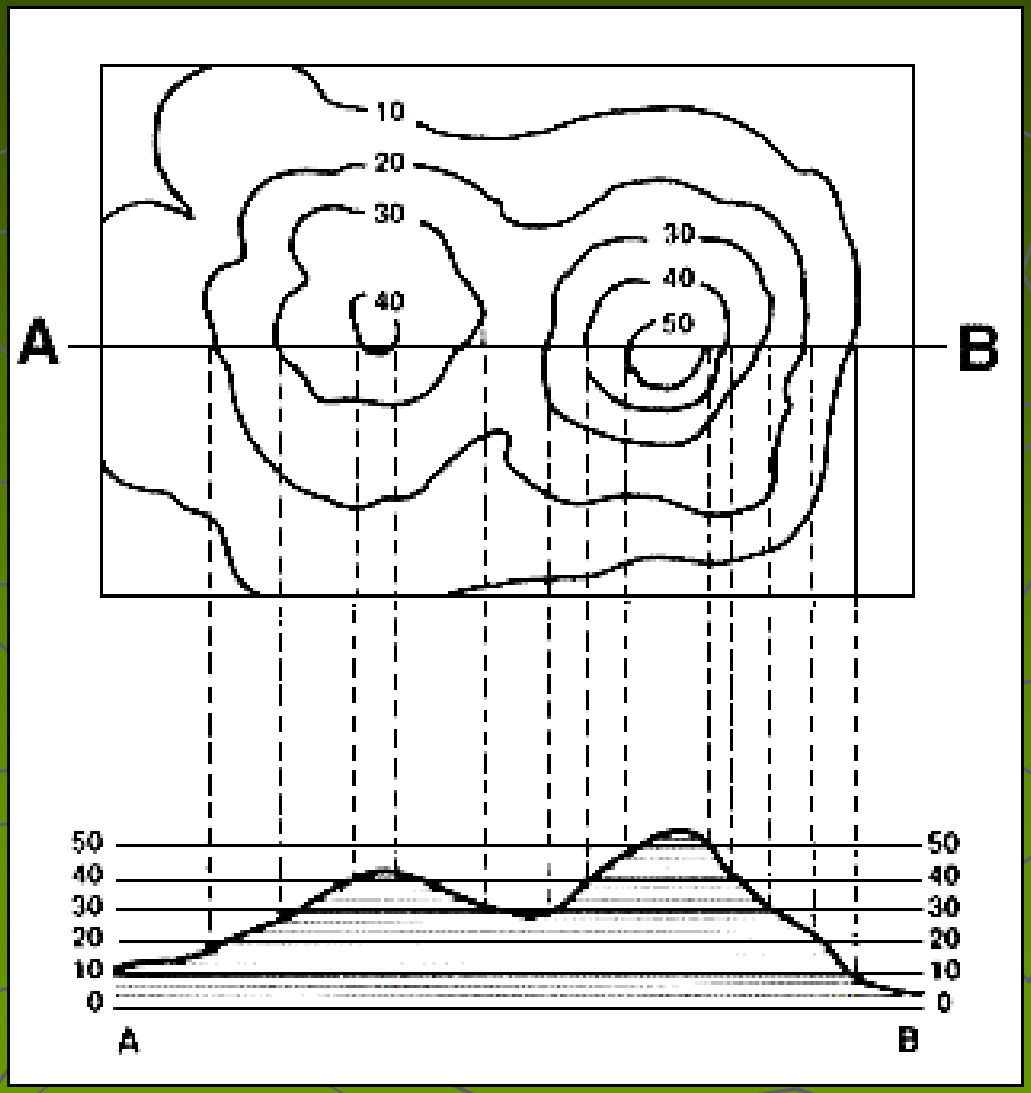
HD = SD * cos A°

- For slope in %....then
- A° = $\tan^{-1}$ [slope (decimal, 30%=0.30)]

VD = SD * sin A°

- For slope in %....then
- VD = HD * slope (decimal)

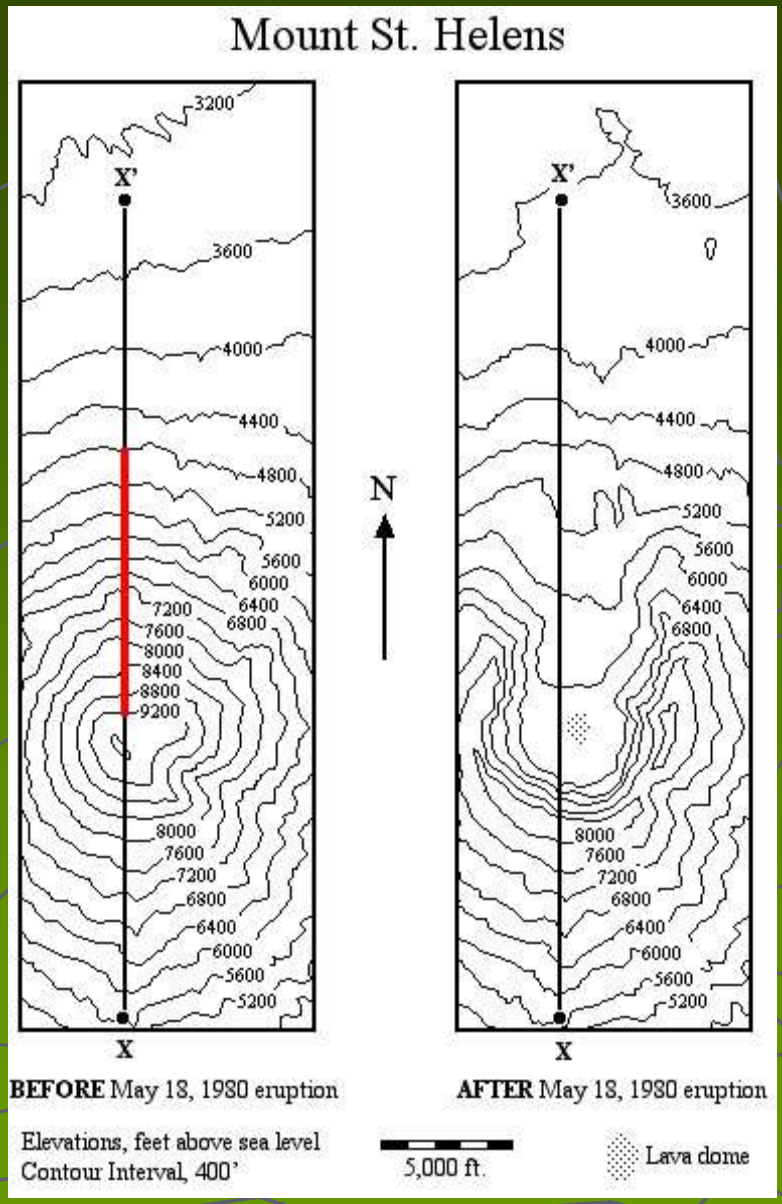
Topographic Profiles



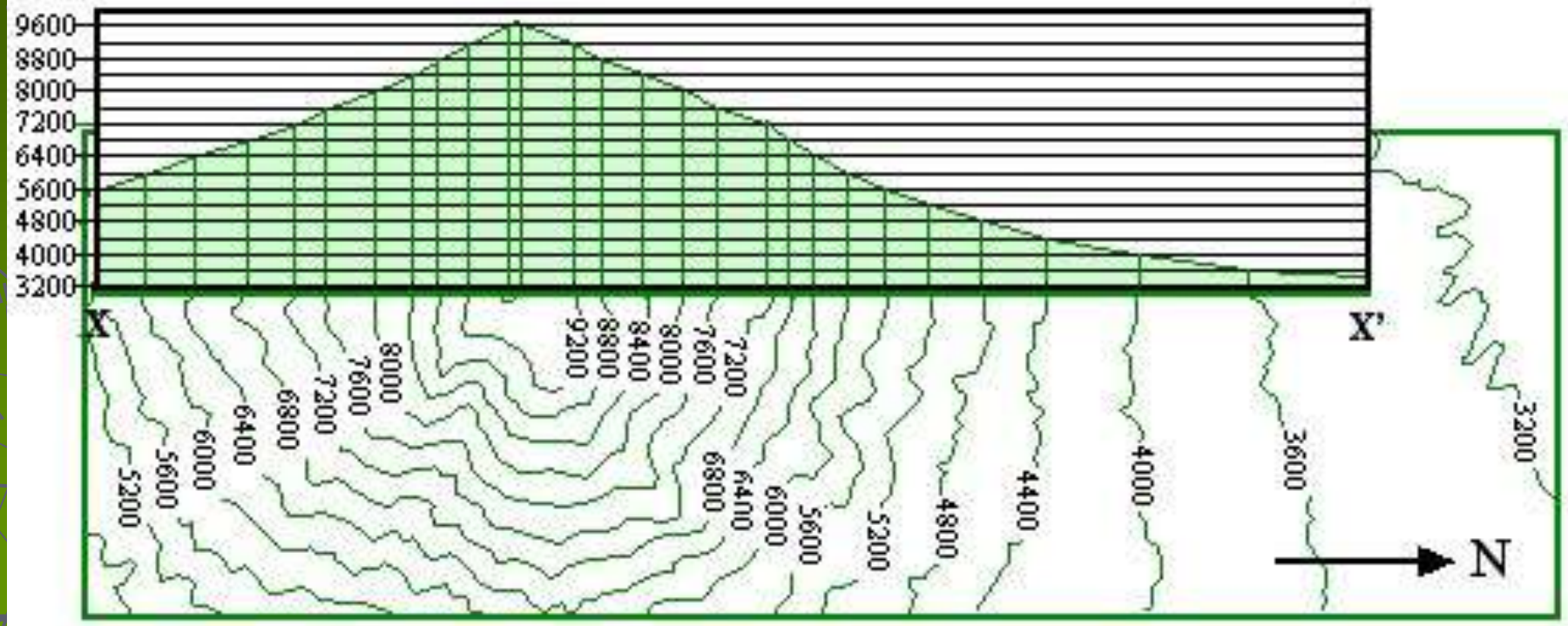
Creating Profiles

1. Determine cross section (cut line)
2. Determine vertical scale (Exaggerated 10X)
3. Use horizontal lines to correspond to elevation ranges
4. Determine horizontal scale
   - if same as map, transfer points directly
   - if different, calculate difference between contours, then plot
5. Pay attention to +/-

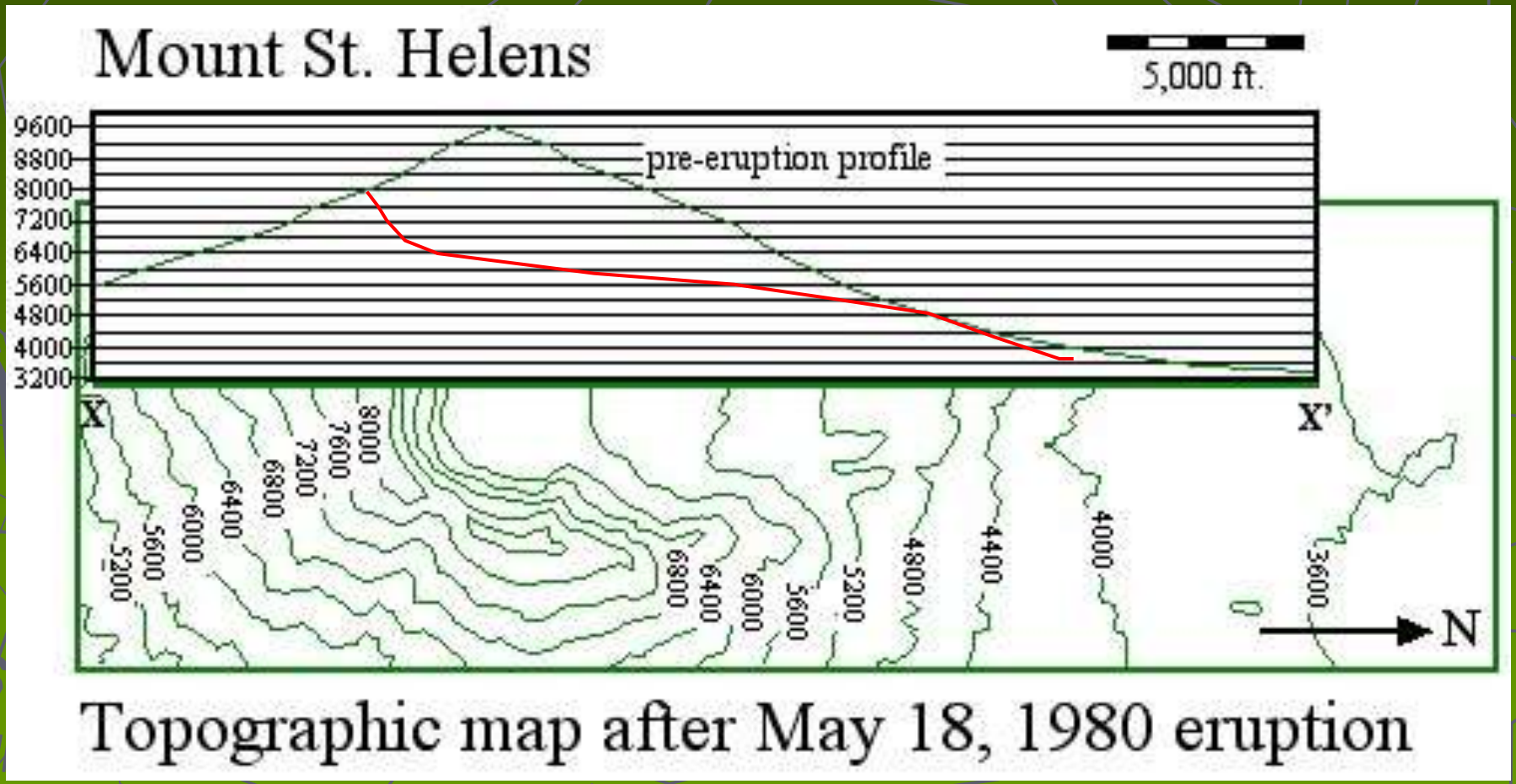
Mount St. Helens, WA



Mount St. Helens, Topographic Profile



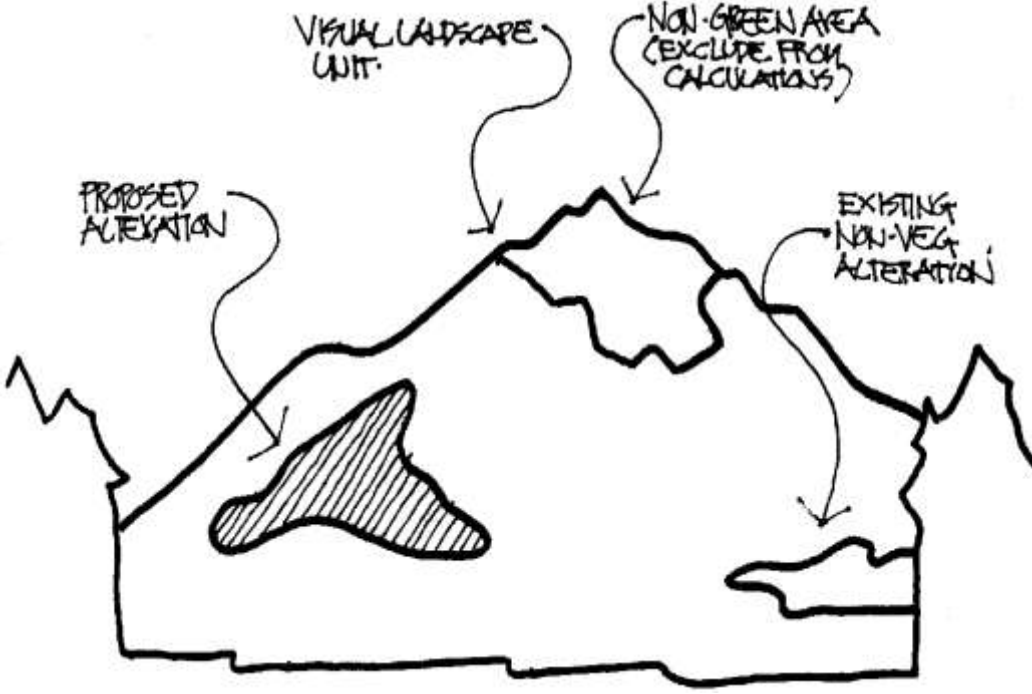
Before May 18, 1980 eruption

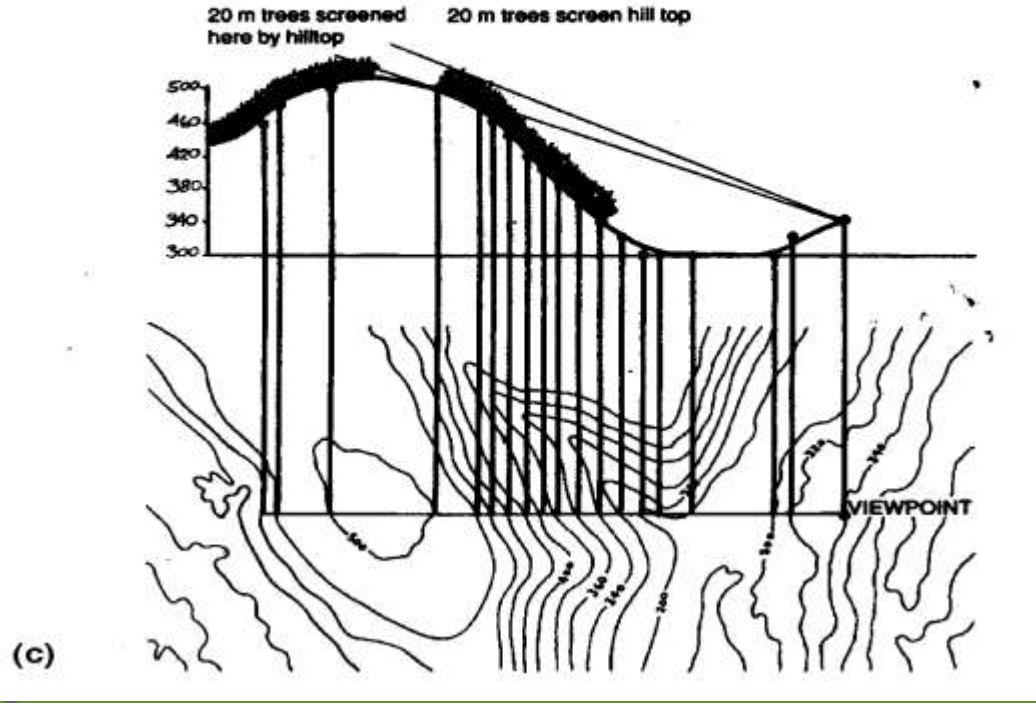


Topographic map after May 18, 1980 eruption

Visual analysis

Determining what will be seen from a particular view-point





Plotting a grade

Determine the most direct route without exceeding specified grade

- Figure out the minimum spacing between contours along the road
- Example: 15% max, 20m contours, 1:5000

- convert slope to rise/run: 15/100m
- equate to contours: 20m/ ? M
- ? = 133m
- convert to map distance 13300cm/5000= 2.7cm
- Locate points and connect

Plotting a grade - slight variation

Calculate the precise grade between two points:

1. Determine the start and end elevation.
2. Determine the horizontal distance while following the topography
3. Grade = Rise/Run
4. Figure out the minimum spacing between contours along the road

- Example: going from 250m to 300m in 525m HD with 20m=CI
  - higher ele.v-lower elev. = 300-250=50m
  - 50/525 = 9.5 % = 9.5/100
  - equate to contours: 20m/ X m
  - X = 210m (if you can use your scale go no further)
    - convert to map distance
    - Locate points and connect

Reading contour maps

- Streams almost always cross contours at a right angle
- Streams, unless on very flat terrain, erode a gulley. This can be seen in the contours by a short bump upstream in the contour.
- Colour all your streams, lakes, swamps blue as soon as you get a map to help distinguish from contours
- On the moose lake map do you see 2 places where streams are likely?

Calculating an elevation between contours
What is the Elevation of ⋆ ?

- Create a ratio:

If A = 200m HD

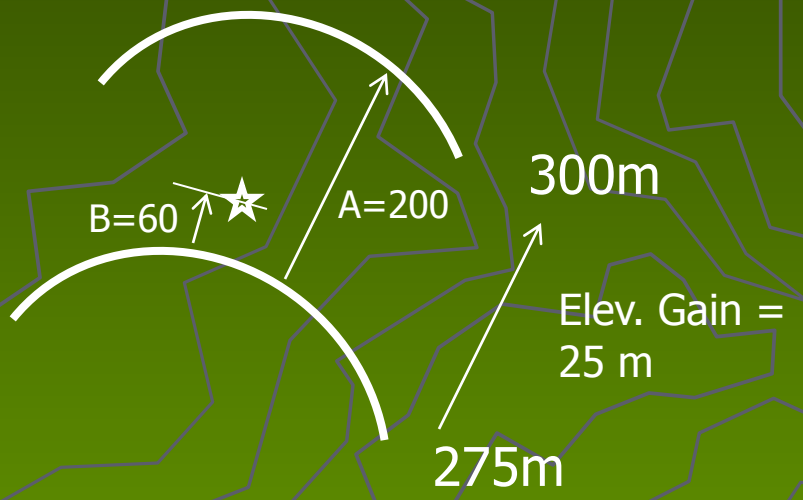
and B = 60m HD

and CI=25m

- 60/200 = X/25

  X= 7.5m

  = 7.5+275=282.5m



Review

- Three ways to describe slope are?
- **HD = cos [2nd F] tan [dec. slope] * SD**
- Create topographic profiles by transferring elevations from horizontal to vertical
- Plot a grade using rise/run and topographic map