Erosion Modeling Exercise

- RUSLE: the "Universal Soil Loss Equation"

$$EP = R \cdot K \cdot LS \cdot C \cdot P$$

Where: EP=erosion potential, R=rainfall factor, K=soil factor, LS=length slope factor, C=land cover factor, P=prevention factor (not necessary)

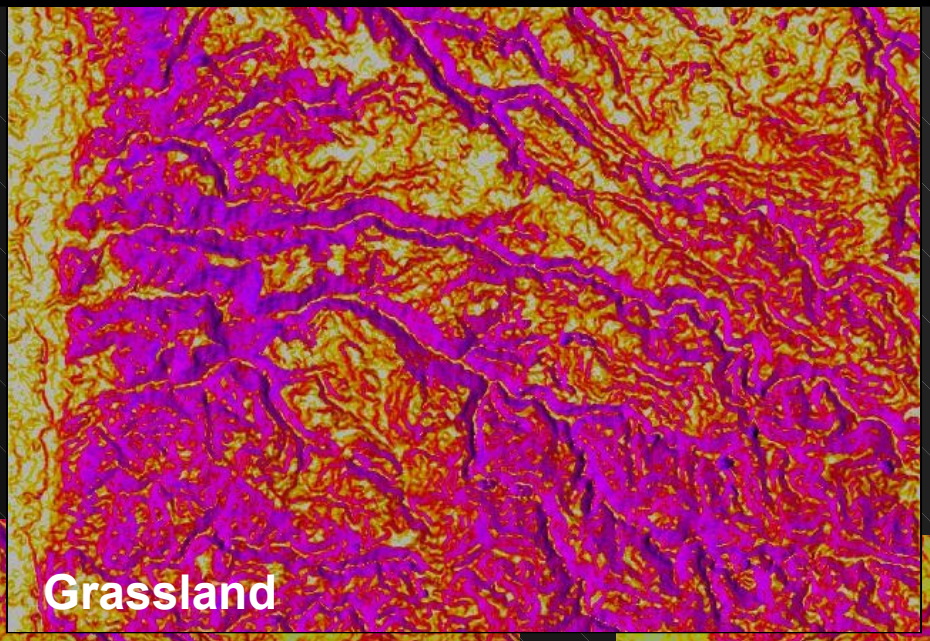
- EP is in units of Tons/Hectare•Year
- LS factor can be made directly from the DEM using r.watershed

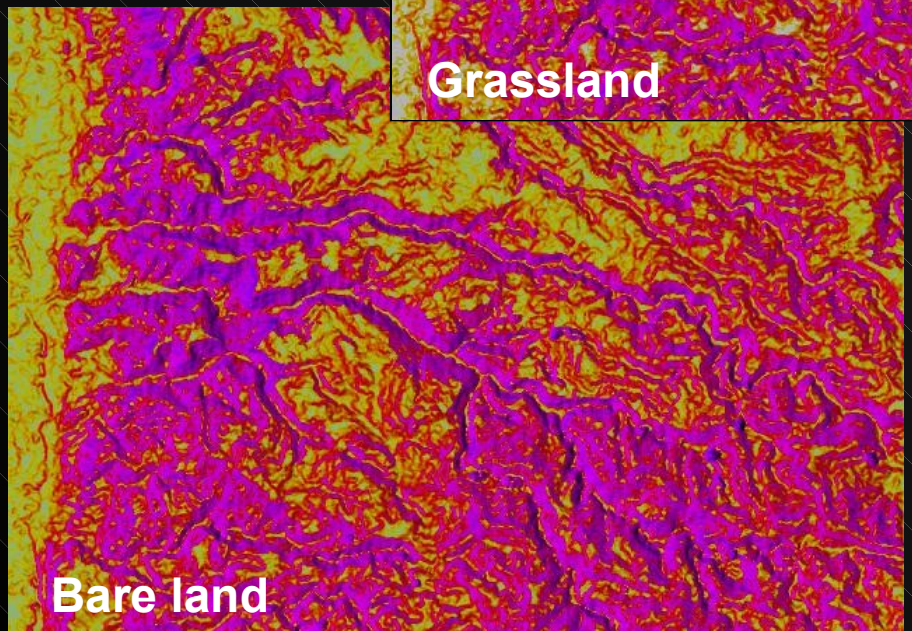
RUSLE factor values

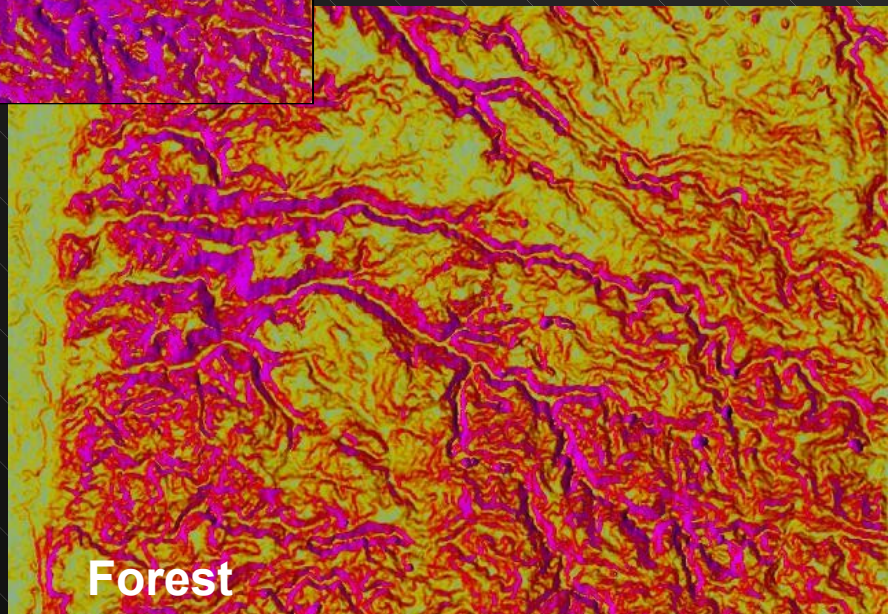
- We can recode vegetation maps with the C factor for each plant type, or use a constant for the entire area (one vegetation type).
  - Range: 0.1 to 0.001 (bare land to mature forest)
- We can also recode soil maps to K-factor, or use a constant (one soil type)
  - Range: 0.05 to 0.8 (clay to loam soils)
- Rainfall intensity (R factor) is basically constant at the watershed scale.
  - Range: 3 to 20 (very dry to very wet climates)

Erosion Potential Maps

Wadi Ziqlab







Rate conversion

- Change EP from T/Ha•Year to m/cell•Year
- First convert to T/cell•Year

  Multiply by (cell resolution/10000)
- Then convert to m/cell•Year

  Multiply by soil density

Surface Processes Based on Stream Power

- Calculate EP from RUSLE
  - RKC(P) only! Do not use LS factor.
- Calculate Erosion or Deposition through a differential equation
  - $ED = d(EP \cdot qsx)/dx + d(EP \cdot qsy)/dy$
  - ED is net potential erosion or deposition of sediment in any landscape cell
  - qsx and qsy are the sediment transport capacity coefficients in x and y directions (a function of slope, aspect, and flow accumulation) for a given surface process across the cell

Landscape Evolution

- Use the stream power equation
- Track regolith (loose sediment above bedrock)
- Add deposition, subtract erosion
- Use new DEM to start the process again
- GRASS addon module r.landscape.evol does it all for you and more! (written by yours truly!)