Effects of Topographic Feedback on Erosion and Deposition Prediction

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RUSLE2 computes sheet and rill erosion, not concentrated flow erosion
Ephemeral gully channels end RUSLE2 hillslopes (AH 703)
To make use of LiDAR topotraphic sources a 2-D version of RUSLE2:

- RUSLE2 runoff event sequences
- Slope length calculated from runoff ratios
- GIS tools to identify raster flow network and channel locations
- Linkage with a concentrated flow (ephemeral gully) erosion model
RUSLE2 Version 2.0.4.0 (Jul 23 2010)

Profile: Highly disturbed land base Columbia, MO

Slope length (horiz, m) 30.5
Avg. slope steepness, % 6.0

USLE/RUSLE1 factor values

Detachment on slope, Mg/ha/yr
Soil loss at mid-contour, Mg/ha/yr
Soil loss at end-contour, Mg/ha/yr
Sediment delivery, Mg/ha/yr

Profile:

- Use single-storm calculations? Yes
- Use Distributed approach to get storms? Yes
- Use interpolated areas? Yes

Stream sequence:

- Year 1
Enhancing RUSLE to include runoff-driven phenomena

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Shell GIS program combines cells into profiles that end at channels

- **RUSLE2 Simulation Units**
  - One Simulation Unit ("Profile") for each Channel Cell
  - Defined based on drainage patterns (flow directions)
  - Input Layers: Flow Directions and Channel Cells

Shell program:
- sequences cells
- calls RUSLE2 DLL

Cell sequencing algorithm:
- Start from channel cell
- Find cells draining into current cell
- If a contributing cell was found, move analysis to that cell and repeat search
- ID No-Inflow cells; assign number
- Inspect cells in downslope direction
- Save cell connectivity in auxiliary data structure
Slope length calculated as ratio of runoff leaving to runoff generated within cell

Rusle2 tracks runoff and erosion from cell to cell. Sediment loads and characteristics leaving each cell are stored and used in the sediment transport computations of the subsequent cell.
HISTORY

- CT 1975-1997
- Hedges established starting 1992
- NT 1997-2002
Scenarios to be Presented

- Profile 2 vs measured runoff and sediment yield
- Distributed erosion predictions
  - with initial channels and topography
  - with initial channels but steepness reflecting 50 years of tillage and water erosion
  - with channels and steepness reflecting 50 years of tillage and water erosion
A
47 Mg ha\(^{-1}\) y\(^{-1}\)

B
48 Mg ha\(^{-1}\) y\(^{-1}\)

C
22 Mg ha\(^{-1}\) y\(^{-1}\)

D
0.86 Mg ha\(^{-1}\) y\(^{-1}\)
Summary

- RUSLE2 is a hybrid field-scale conservation planning tool
- RUSLE2 is being optimized to create distributed erosion estimates based on LiDAR data
- Representative runoff event sequence outputs are suitable for linkage with an ephemeral gully model
- Improved GIS tools are needed before feedback will create realistic topographic patterns
Questions?
y = 8.5253ln(x) + 14.038
R² = 0.9988

y = 7.1507ln(x) + 16.293
R² = 0.9997