

Understanding & Achieving “T”

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“[Resource management plans] shall include the following, as needed and based upon an individual on-farm assessment:...

A soil conservation plan that achieves a maximum soil loss rate of ‘T’, as defined by NRCS...”

Proposed Topics

- I. Erosion basics
- II. Intro to “T”
- III. Assessing erosion with RUSLE2
- IV. Planning to achieve T
- V. Bottom line - can VA farmers achieve T?
- VI. P.S: News from the north

I. EROSION BASICS



1. What is erosion?

- Process by which soil particles are:
 - **DETACHED** from land surface
 - **TRANSPORTED** and
 - **DEPOSITED** elsewhere
- Particles can be deposited
 - Near point of origin
 - Or very far away





2. Where in VA landscapes does erosion occur?

- Almost everywhere!
- But focus today is **VA FARM FIELDS:**
 - ***CROPLAND***
 - ***HAYLAND***
 - ***PASTURE***



3. What is “soil loss”?

- Any soil detached and transported more than a few feet is “lost”
- To be “lost”, soil does not need to leave
 - The slope
 - The field
 - The farm
- *No matter where it ends up, loss of soil from place of origin is itself a problem!*





But wait...

Isn't erosion a natural process?

4. Isn't erosion "natural"?

- Mountains and canyons shaped by erosion over GEOLOGIC time.
- "Natural" annual runoff & erosion rates on native VA landscapes were VERY LOW.
 - Ecosystem developed under this regime.
- Human activity in VA accelerated erosion.
 - Impaired soil, water, and ecosystem function.

5. What are primary agents of erosion on VA farmland?

- Water (+ gravity):
 - Dominant erosive agent statewide
 - Raindrop impact is key to detachment
 - Water running downhill key to transport
 - Intense rainstorms play major role
- Wind
 - Occasional issue in eastern VA
 - Only occurs when soil is dry



6. When & where do most intense storms occur in VA?

- On average:
 - During summer
 - In warmer parts of state
- During any given time period:
 - Highly variable timing and location
 - Impossible to predict

7. What are primary risk factors for water erosion on VA farmland?

- Climate:
 - Warmer location / time of year = higher risk
- Topography:
 - Steeper = higher risk
- Soil type:
 - Higher runoff rates = higher risk
 - Loamier soils = higher risk



7. What are primary risk factors for water erosion on farmland? (cont.)

- Farmer management:
 - More bare or disturbed soil = higher risk
 - Less crop residue/canopy to intercept raindrops = higher risk
 - Less crop roots to bind soil = higher risk
 - Less soil organic matter and life to maintain the soil sponge = higher risk
 - Etc.



8. What forms of water erosion occur on VA farmland?

- Sheet:
 - Removal of uniform sheet of soil across field
 - Usually invisible & impossible to measure
 - RUSLE2 model is used to estimate it
- Rill:
 - Random wash patterns on soil surface
 - Easily erased by tillage
 - Usually hard to see & impossible to measure
 - RUSLE2 model is used to estimate it











8. What forms of water erosion occur on VA farmland? (cont.)

- Gully:
 - Concentrated flow carves away soil from swale or drainage way.
 - Permanent / always reoccurs in same place
 - Usually easy to recognize
 - Can be measured in field
 - RUSLE2 does not estimate it







9. Why is erosion on VA farmland a problem?

- On-site effects
 - Less topsoil
 - Less infiltration
 - More runoff
 - Less crop yield
 - Less residue
 - Less roots
 - More erosion
 - More runoff
 - And so on...
- Off-site effects
 - More sediment in water
 - More sediment-bound nutrients/chemicals in water
 - More overall runoff
 - More flooding
 - More soluble nutrients/chemicals in water



II. INTRO TO “T”



10. What is “T”?

- Maximum rate of erosion that can occur and still allow crop productivity to be maintained economically.
- NRCS’ traditional performance target for sustainable soil management.

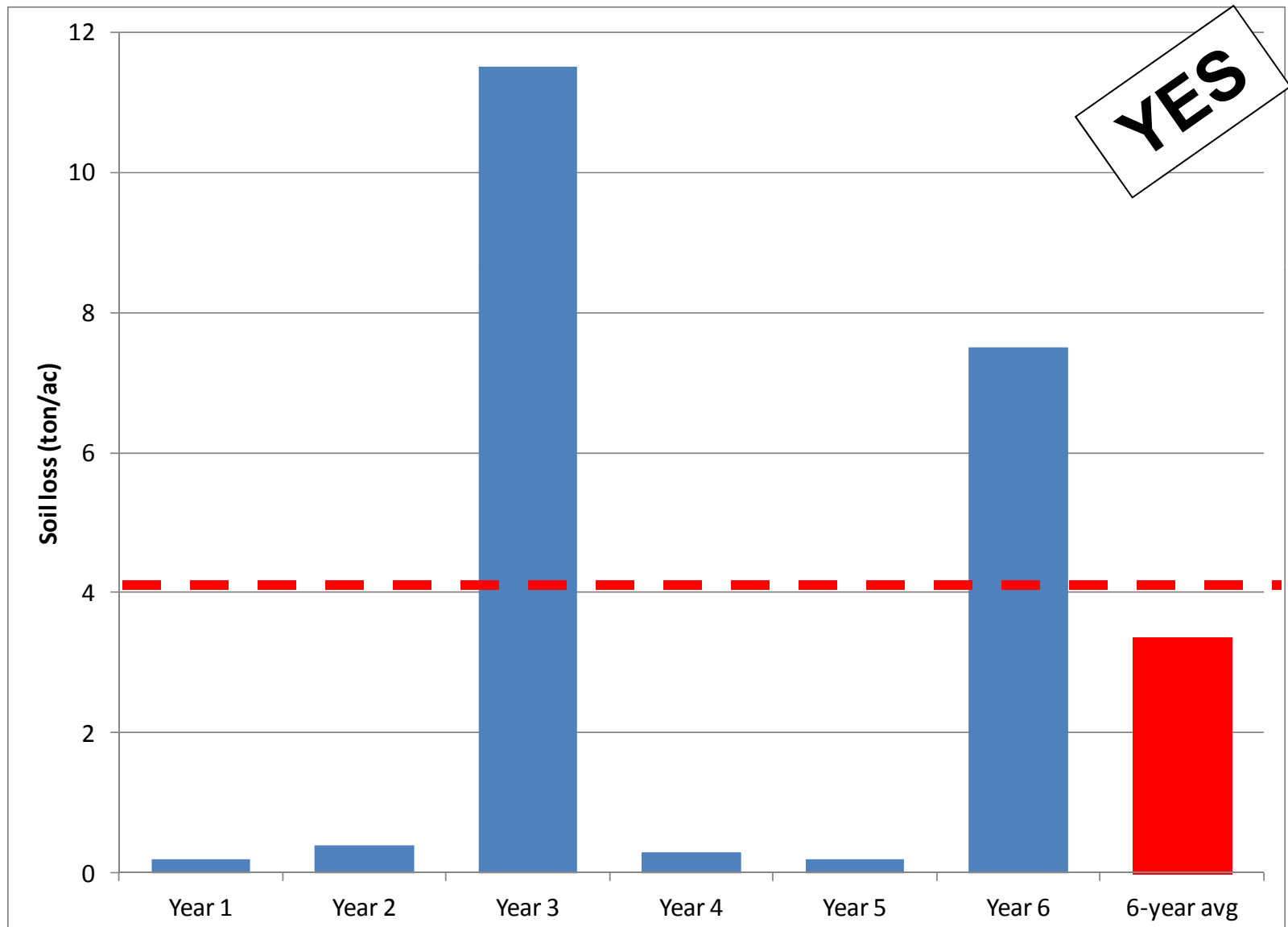


11. How are “T” values expressed?

- Tons per acre per year
 - Long-term average rate of tolerable soil loss
- Each soil type is assigned a T value based on soil characteristics.
- T values range from 1 to 5 ton/ac/year
 - What is depth of 5 ton soil spread over 1 ac?

Results of six-year natural rainfall erosion study from NC.

Was the T value of 4 achieved over experimental period?



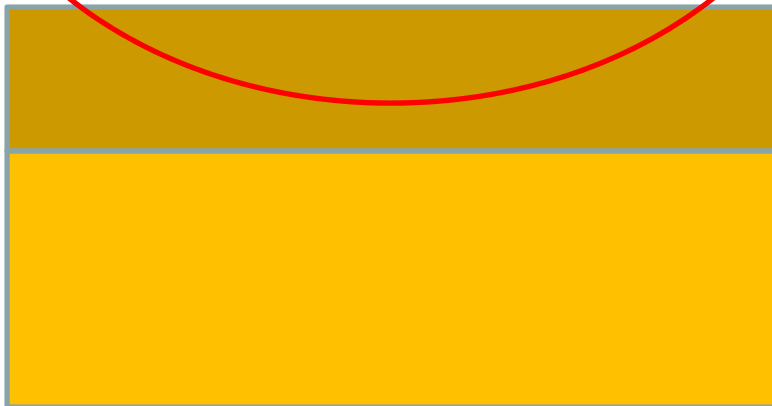
12. How and when were “T” values established?

- By panels of experts between 1959 and '62
- Factors considered:
 - Soil depth, other properties affecting root development, soil organic matter, etc.
- *NRCS is planning to revise T values starting in 2012!*

Which soil will likely have a higher soil loss tolerance “T”?

**Soil
Type A**

**Thicker topsoil, deep
permeable subsoil**



**Soil
Type B**

**Thinner topsoil,
shallow to rock**



13. What is required by VA NRCS to achieve “T” in VA?

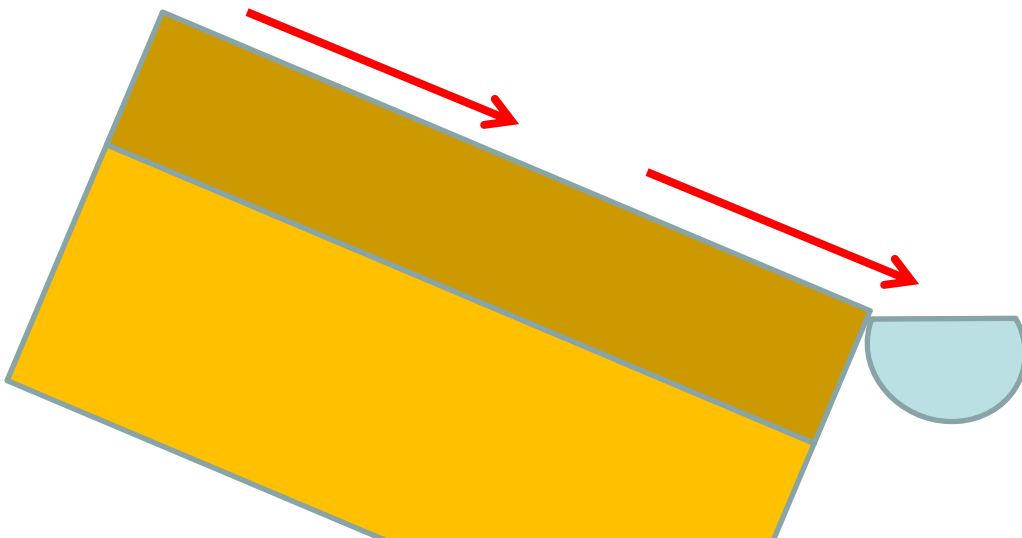
1. No active / visible gully erosion
 - Determined using field observation
2. Sum of sheet & rill erosion and wind erosion is less than T value
 1. Sheet & rill erosion estimated using RUSLE2
 2. NRCS wind erosion prediction tool not currently in use in VA – assume zero.

14. How does soil loss for T relate to sediment delivery to water?

- In general, less erosion in farm field = less sediment delivered to water.
- But can't correlate soil loss for T directly with amount of sediment reaching water.
- Depends largely on what opportunities for sediment deposition exist between eroding slope and water body.

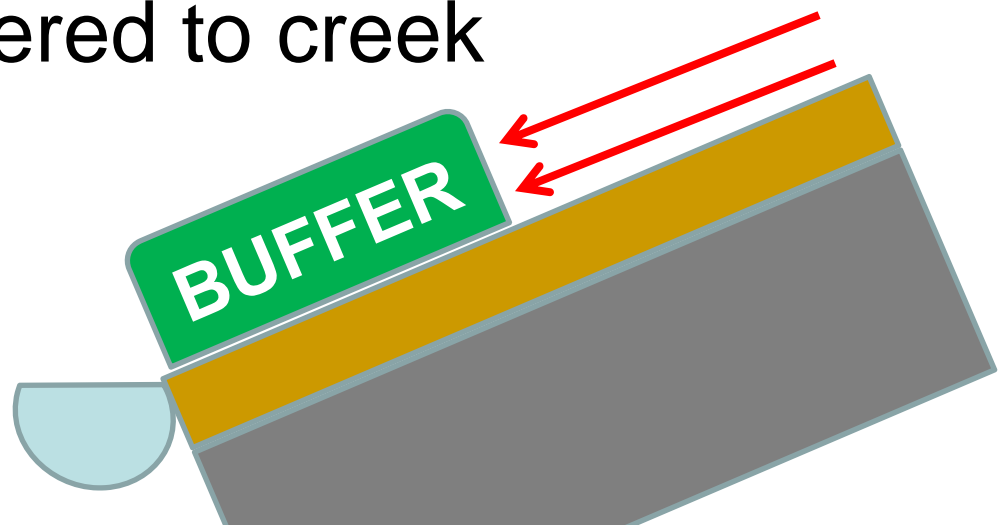
Example 1 – T achieved

- $T = 5 \text{ t/ac/yr}$
- Soil loss estimate = 3 t/ac/yr
- **T is achieved**
- But no deposition or buffer before creek
- All eroded soil delivered to creek



Example 2 – T not achieved

- $T = 3 \text{ t/ac/yr}$
- Soil loss estimate = 6 t/ac/yr
- ***T is not achieved***
- But runoff crosses significant deposition area or buffer before creek
- No sediment delivered to creek



15. Would achieving T on all VA farmland improve water quality?

- **YES!**
- But can't quantify by how much...

III. Assessing Sheet & Rill Erosion with RUSLE2



16. What is RUSLE2?

- NRCS' official tool for estimating sheet & rill erosion.
 - Revised Universal Soil Loss Equation 2.
 - Latest version of USLE, which was first put into use in 1965

17. What info does the user input into RUSLE2?

- County:
 - This loads rainfall & climate data
- Soil type:
 - This loads data on soil runoff & erodibility characteristics
- Slope length (feet) & steepness (%)
 - Highly simplified representation of field's topography

17. What info does user input into RUSLE2? (cont.)

- Crop management details:
 - Duration of crop rotation
 - Dates of field operations
 - Types of field operations
 - Planting, tillage, harvest
 - Crop species grown
 - Expected crop yields
 - Manure applications

17. What info does user input into RUSLE2? (cont.)

- Support practice details:
 - Contouring
 - Contour buffer strips
 - Stripcropping
 - Etc.



18. Where does user get info to input into RUSLE2?

- County & soil type:
 - Soil survey, maps
- Slope length & steepness
 - Field visit
- Crop management & support practice details
 - Farmer interview
 - Field visit

19. What outputs come out of RUSLE2?

- Soil loss for conservation planning
 - Long-term estimate of sheet & rill erosion
 - Expressed as annual average soil loss
 - Tons per acre per year
 - **To compare directly with T!**

19. What outputs come out of RUSLE2? (cont.)

- Multiple other advanced outputs
 - Soil organic matter trend score (SCI)
 - Tillage intensity score and fuel use estimate
 - More detailed erosion-related outputs
 - Erosion by month, week, day erosion
 - Residue cover estimates.
 - Evaluation of sediment trapping in buffers
 - Etc.

20. RUSLE2: what are the pros?

- Powerful software – can rapidly calculate and compare soil loss for wide range of scenarios
- Outputs generally reliable and replicable.
- Advanced outputs can be very useful
 - E.G., soil organic matter score (SCI) complements T for more complete assessment of soil quality and sustainability.

21. RUSLE2: What are the cons?

- Cumbersome set-up & maintenance
- Software bugs
- Not well supported by NRCS nationally
 - Limited tech support / training / documents
 - State level leaders must fill gaps
- Too much detail, too many input choices
 - State level leaders must streamline/simplify

IV. Conservation Planning to Achieve T



22. What does NRCS do if farmer is not achieving T?

- Plan one or more management alternatives that meet T
- Encourage farmer to select and implement one of these alternatives

23. What practices will help farmer achieve T? (in R2)

- Conservation tillage
 - Mulch till, no-till/strip-till, continuous no-till
- Crop rotation
 - Rotation to perennials
 - Rotation to high residue crops
 - Cover crop

23. What practices will help farmer achieve T? (in R2 - cont.)

- Other
 - Anything that increases yield
 - Anything that adds organic matter
- Traditional support practices
 - Contouring
 - Strip cropping
 - Contour buffer strips

24. What practices will not help farmer achieve T? (in R2)

- Nutrient management
- Bottom of slope filter strips
- Edge of field buffers
- Etc.

V. The Bottom Line: Can Farmers Achieve T in VA?



One way to divide up all VA farmland acreage

1. ALREADY achieving T
2. WILL achieve T
 - Low cost options, high probability
3. MIGHT achieve T
 - Moderate cost options, moderate probability
4. WON'T achieve T
 - High cost options, low probability
5. CAN'T achieve T
 - No options

25. What's the good news?

- The majority of the acreage:
 - ALREADY achieving T
 - WILL achieve T
- Many farmers moving this way by choice
- The minority of the acreage (in descending order):
 - MIGHT achieve T
 - WON'T achieve T
 - CAN'T achieve T

26. What's the bad news?

- There will always be at least a few acres in these categories:
 - WON'T achieve T
 - CAN'T achieve T

VI. News from the north



27. What's happening in PA?

- PA state law has imposed similar mandate
- State agencies, land grant, and NRCS have been looking at different alternatives to streamline planning to T
- Can VA learn any lessons from them?

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