# Terraces as a RUSLE2 Support Practice

Terraces are a conservation practice installed mainly to control gully erosion but can also reduce sheet and rill erosion losses. Terraces reduce the length of slope exposed to sheet and rill erosion and can trap sediment at the end of a slope segment. All broad-base terraces increase the slope between the terrace ridge to the next terrace trough while a steep back slope and a narrow base terrace will generally decrease the land slope. To properly account for the benefit of terraces as a conservation treatment in the Revised Universal Soil Loss Equation, Version 2 (RUSLE2), follow the instructions below:

1) When terraces are being planned but have not yet been installed, calculate the soil loss before construction of the terrace in RUSLE2 by:
   A) Determine and record the dominant critical slope during a field visit. Measure slope steepness (percent) and slope length (feet) for the RUSLE2 slope (from the point where runoff begins to the point where deposition or concentrated flow occurs). Also, measure the slope grade of the crop rows that cross the dominant critical slope.
   B) Open the RUSLE2 computer program and load the database for the desired Missouri County at S:\Service_Center\NRCS\RUSLE2; TSPs will need to load all data from the official website. Once the county database is loaded, the name of the active database will be displayed in the lower right-hand corner of the RUSLE2 screen.
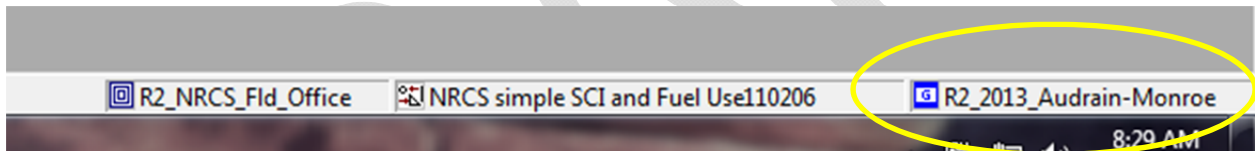

   C) Open a Profile (icon resembles a slanted green line). Within the Profile view, complete **Step 1: Choose location to set climate**. Click on the dropdown arrow, then i) double click on "USA"; ii) double click on "Missouri"; and iii) double click on the county name to select county climate data.
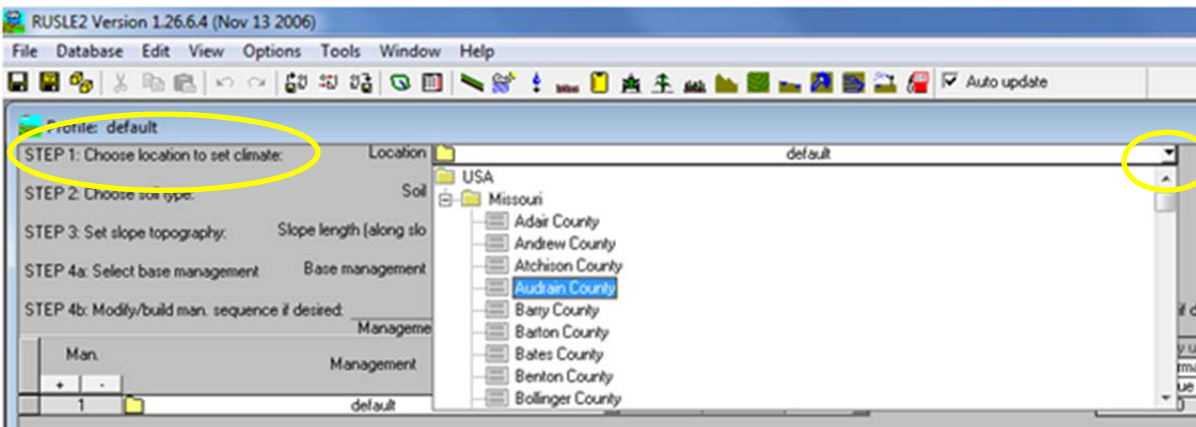
D) Complete **Step 2: Soil**. Click on the dropdown arrow then i) double click the county name; ii) double click on soil number and map unit name at the dominant critical slope; and iii) double click on the primary soil component name to make your soil selection.
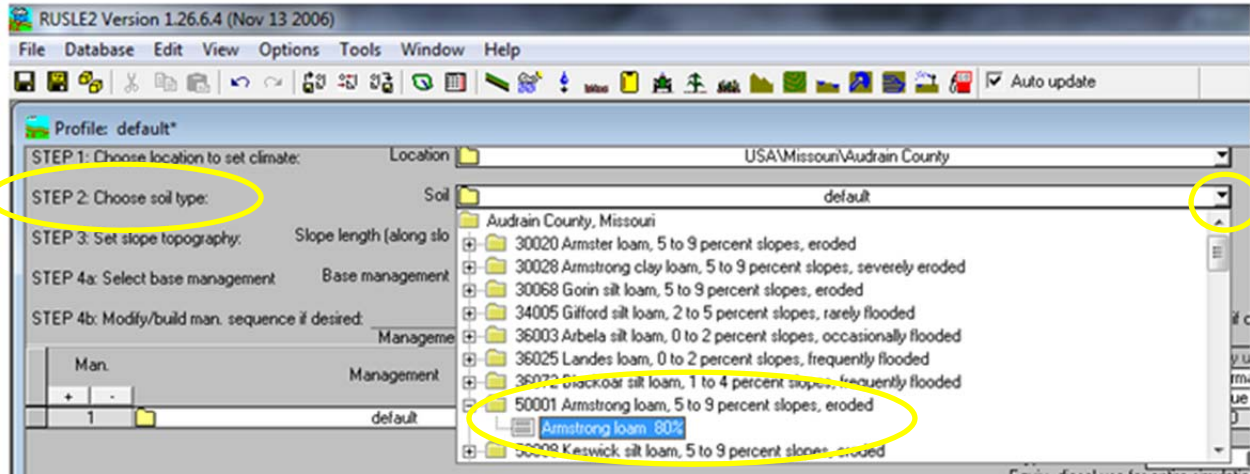

E) Enter the measured slope length and slope steepness of the dominant critical slope in **Step 3: Set slope topography** to represent the actual field conditions you documented during conservation planning with the producer.
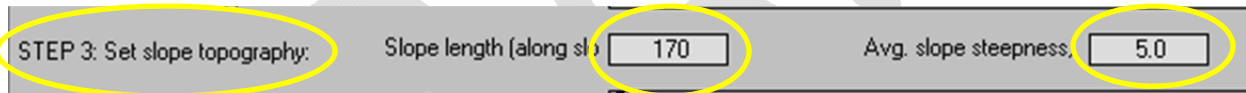

F) Move to **Step 4a: Select Base Management** to choose the combination of tillage and crop rotation that fits the planned farm operations and management. Select the correct Crop Management Zone, either CMZ16 for Northern Missouri or CMZ17 for Southern Missouri. Within the data files under each specific CMZ, you will find:
  a. Single Year/Single Crop Templates (building blocks for any rotation)
  b. Multi-year Rotation Templates (common rotations and tillage for the region)
  c. Other Local Mgt. (Management) Records (locally built and saved rotations)
 d. Construction Site Templates
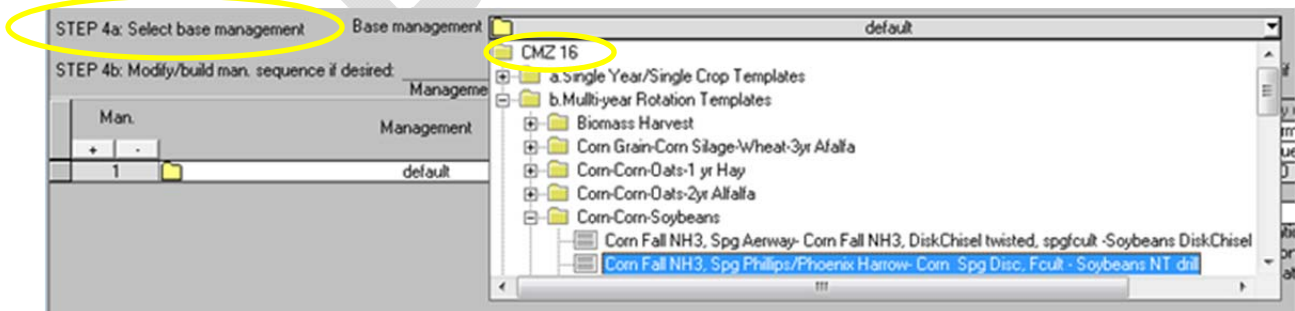
Scan through the files available and select the file that best fits the crop rotation and tillage system you are trying to create. Click on the "yellow file folder" icon to open the management file and see the details of the rotation you selected. You may edit this file but you must save the changes to "Local Mgt. Records" with a new and unique file name.
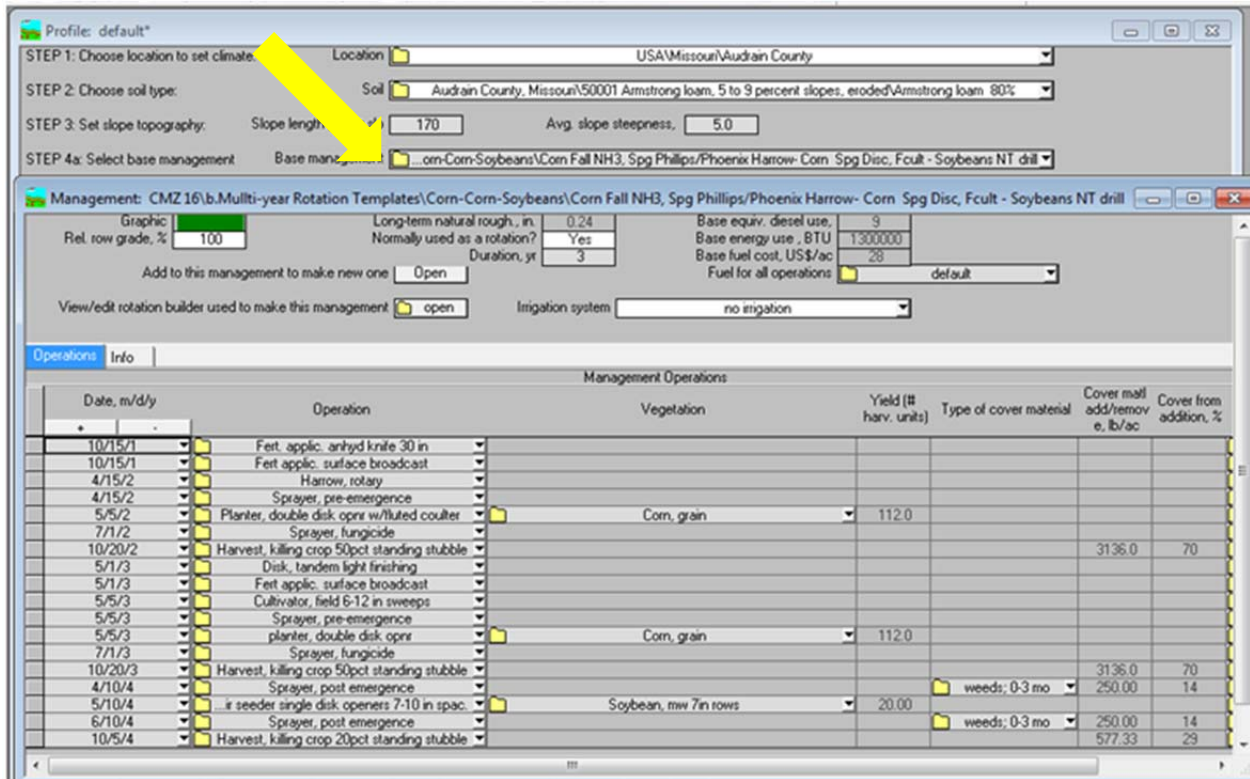

You may use **Step 4b: Modify/build man. sequence if desired** to add more crops to the rotation or **Step 4c: Adjust management inputs if desired** to enter local conditions. You have choices that can be made to model the producer's conservation system by selecting the correct dates, sequence of operations, vegetation files for the actual crops grown, proven yield data, external residue additions, and even surface rock cover. Important Note: Click on the "apply" radio button if entries are made in Step 4b to force the RUSLE2 program to update and recalculate.

G) Move to **Step 5: Set supporting practices**. Enter the row grade across the dominant critical slope segment by selecting an appropriate row grade class from the drop-down choice list for **Contouring** (refer to RUSLE2 Instructions on "Contouring in RUSLE2"). Generally, the choices you will consider are "up and down hill" when farming the field without any concern for row grade direction or an absolute row grade based on the measured row grade of the dominant critical slope if farming on the contour. Any row grade steeper than 10 percent will be "up and down hill".
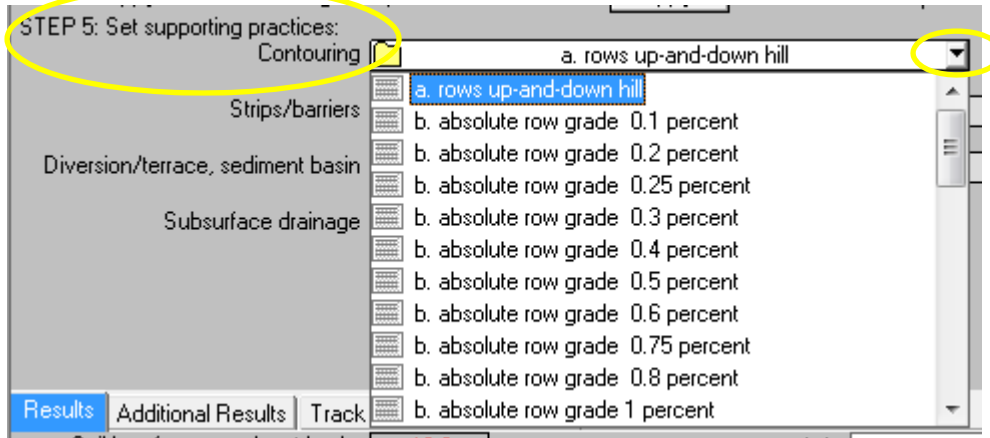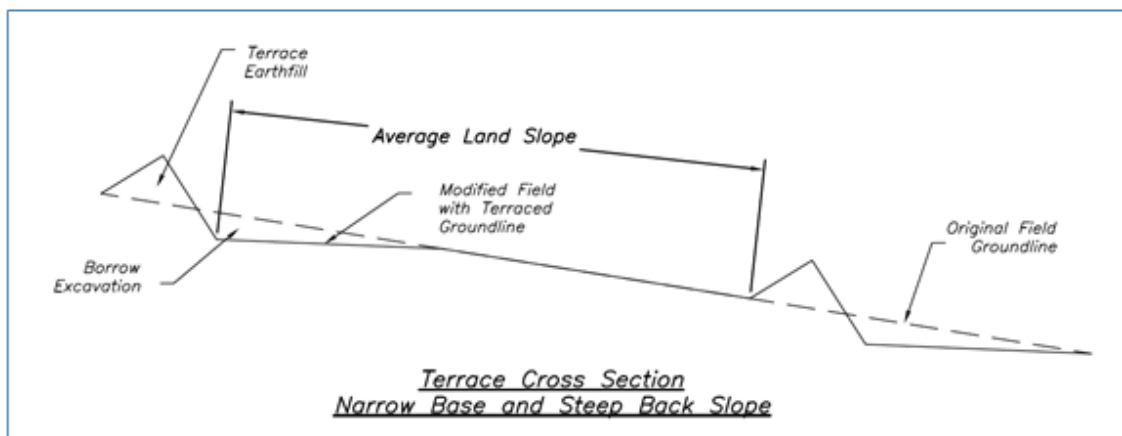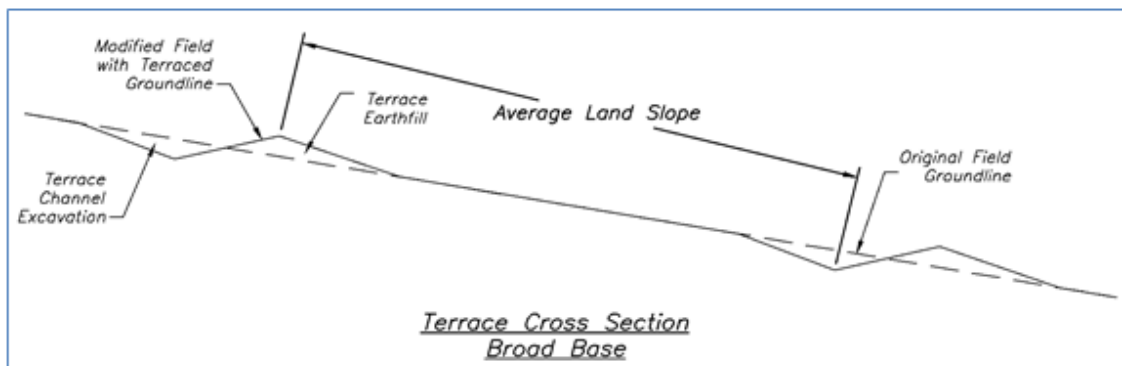
H) Open the drop-down list for **Diversion/terrace, sediment basin**. Select "(none)" if there are no structural practices installed on the dominant critical slope.
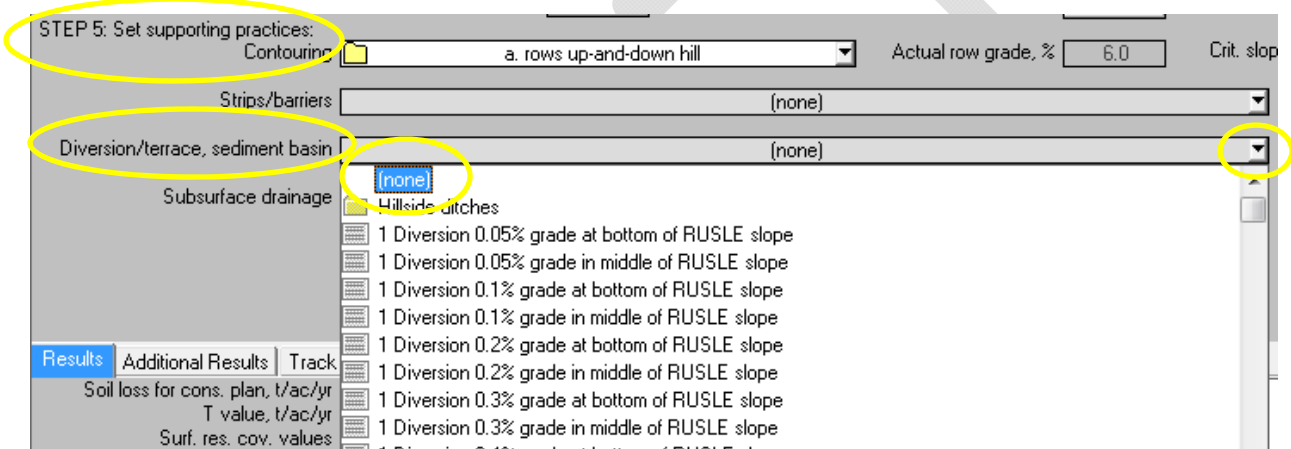
I) Save this profile as the "before terraces" condition by selecting "File", then "Save as". Use a file naming convention such as county name, tract number, and field number that allows you to locate this file again in Profiles.

Note: When any data field in RUSLE2 is "grayed out", you will not be allowed the enter data in the block.

2) When terraces exist on the field (either existing terraces or new construction) and the dominant critical slope occurs within the terraced portion:

   A) Measure the slope steepness and slope length from the upper terrace ridge down to the next lower terrace trough. The slope steepness may be recorded as a compound slope or as an average of the fill slope segment, original land slope segment, and terrace channel excavation slope segment (measure the slope from the top of the terrace ridge to the bottom of the terrace trough). You may use the attached "Percent Land Slope Change with Terraces Installed" based on the constructed height of the terrace to estimate a change in the land slope due to the terrace installation when the slope prior to the terrace installation is fully documented in the case file.

   Modified Field
   with Terraced
   Groundline

   Terrace
   Earthfill   Average Land Slope

   Original Field
   Groundline

   Terrace
   Channel
   Excavation

   Terrace Cross Section
   Broad Base

   Terrace
   Earthfill

   Average Land Slope

   Modified Field
   with Terraced
   Groundline

   Original Field
   Groundline

   Borrow
   Excavation

   Terrace Cross Section
   Narrow Base and Steep Back Slope

   B) Also measure the slope grade of the crop rows that cross the slope profile that you just measured. The crop rows are often on the contour as the planting equipment follows the terrace grade.

C) Open the RUSLE2 computer program and open the profile saved as the "before terraces" condition. Where there was no "before terraces" profile created, you will need to complete **Step 1: Choose location to set climate; Step 2: Soil; and Step 4A: Select base Management** as explained under (1) C); (1) D); and (1) F) above.

D) Enter the measured slope length and adjusted slope steepness in **Step 3: Set slope topography**. Use a measured compound slope calculated as a weighted average or the original field slope modified with the correct multiplier from the attached table "Adjustment Factor for Land Slope Change with Installed Terraces". The slope length on a terraced field is measured from the top of a terrace to the trough of the next lower terrace on Broad Base Terraces and from the base of the Steep Back or Narrow Base Terrace to the trough of the next lower terrace. Record the modified slope as a whole number value in the "Avg. slope steepness" data entry block unless a precise measuring system was used to determine slope steepness of the actual segments in the field.

Example Calculation using Adjustment Factor from Table:
Original slope measure prior to terrace – Slope steepness 5%
Terrace Ridge Height of Broad Base Terrace – 1.3 feet
Multiplier from Table of Adjustment Factors – 1.36
Slope Adjustment Calculation – 5% X 1.36 = 6.8 rounded to 7%

E) Move to **Step 5: Set supporting practices**.
F) Enter the measured (absolute) row grade by selecting the best fit from the drop-down choice list under **Contouring** (refer to RUSLE2 Instructions on "Contouring in RUSLE2").
G) Open the drop-down list for **Diversion/terrace, sediment basin**. A large number of terrace and diversion options are listed. Review the list and select the slope and type of structure that best fits the terrace or diversion system for the field. Always select a terrace option with a "terrace at the bottom of the RUSLE2 slope"; do not select any "terrace in the middle of the RUSLE2 slope" except when multiple terraces were constructed within the original slope length; the original slope length must have been long enough to accommodate multiple terraces (one may occur in the middle of the RUSLE2 slope as long and the second or third terrace occurs at the bottom of the RUSLE2 slope).

H) Save this file as a Profile of the "after terraces" condition. Use a naming convention of county name, tract number, field number, and terraces that allows you to locate this file if ever needed again.

IMPORTANT NOTE:
The erosion estimates contained in the before terraces file and the after terraces file may be used to document the conservation benefit of terrace construction. This benefit is only obtained as long as the producer follows the cropping and tillage sequence used as a basis for the erosion estimates. The erosion and sediment collected in the terrace channel must be planned for and addressed in the operation and maintenance plan that is discussed with the producer. When the producer increases the level of tillage or decreases the number of high residue crops in the rotation, soil erosion will increase and the terraces will require additional maintenance.

RUSLE2 Version 2.5.2.11:
The primary terraces constructed in Missouri are Parallel Terraces with underground outlets. However, these options in the current version of RUSLE2 (2.5.2.11) contain a glitch in the calculations and should not be used. The substitution of graded outlet terraces is recommended in all cases until the model can be corrected to best simulate the effect of terraces on sheet and rill erosion control.

Table 1: Adjustment Factor for Land Slope Change with Installed Terraces

Terrace Ridge Height (feet)	Multiplier for Broad Base Terraces	Multiplier for Steep Back Terraces	Multiplier for Narrow Base Terraces
1.0	1.30	0.79	0.90
1.1	1.32	0.78	0.89
1.2	1.34	0.76	0.89
1.3	1.36	0.74	0.88
1.4	1.38	0.72	0.88
1.5	1.40	0.70	0.87
1.6	1.42	0.69	0.86
1.7	1.44	0.67	0.85
1.8	1.46	0.65	0.85
1.9	1.49	0.63	0.84
2.0	1.51	0.61	0.83
2.1	1.53	0.60	0.82
2.2	1.55	0.58	0.82
2.3	1.58	0.56	0.81
2.4	1.60	0.54	0.81
2.5	1.62	0.52	0.80
2.6	1.64	0.50	0.79
2.7	1.67	0.48	0.79
2.8	1.69	0.46	0.78
2.9	1.72	0.44	0.78
3.0	1.74	0.42	0.77