Procedure to Calculate the Soil Conditioning Index for Histolsols Using RUSLE2, February 2006

Introduction

The procedure to determine a Soil Conditioning Index (SCI) for Histolsols (Organic Soils) will differ from the procedure for mineral soils due to the subsidence that takes place as a result of drainage (lowering of the water table). Organic soils subside when drained: by shrinkage from drying, loss of groundwater buoyancy, compaction, wind erosion, burning, and biochemical oxidation.[1]

To properly determine the SCI one must take into account the tons of soil lost via subsidence, water erosion, and wind erosion.

Density of Histolsols

Histolsols weigh much less per unit of volume than do mineral soils. For example, a Carlisle Muck in Huron County, Ohio has a bulk density of 0.13-0.23 g/cc. This would translate to 10 – 18 lbs/ft^3. Mineral soils may have a bulk density generally in the range of 1.2 – 1.5 g/cc that would translate to 93 to 116 lbs/ft^3.

Subsidence Rates

The rate of subsidence for Histolsols will vary based on climate, soil disturbance, depth to which the water table is lowered by drainage, crops (biomass produced and returned to the soil) produced, rate of sheet and rill erosion, and rate of wind erosion.

In the Everglades of Florida (USA), the arable organic soils have an average subsidence rate, after initial settlement, of 1 inch (3.05 cm) per year. In the organic soils of the Sacramento-San Joaquin Delta of California (USA), average rate of subsidence is reported as slightly over 3 inches (7.6 cm) a year[2]. These soils are tule-reed peats.

In Michigan (USA), average losses in surface elevation on organic soils measured over 5-year period at 13 sites were 0.30 ft. (9.16 cm)[3] (0.72 inches/year). Near Hennepin County, Minnesota, the total settling varied from 0.5 ft. (15.1 cm) to about 1.1 ft. (33.6 cm) with subsidence approximately proportionate to water-table depths.

Management to reduce subsidence can be implemented by reducing soil disturbance and raising the water table; however, once Histolsols are drained and farmed they are essentially non-sustainable.

Minimum Subsidence Value for SCI Purposes

The minimum subsidence value to use is 0.75 inches/year or 21 tons/acre/year. Higher rates may occur on soils with very intense tillage systems and in the warmer climates. The higher rates should be used if they can be documented.

Subsidence Rate and Tons/Acre*

Subsidence inches/year	Tons/Acre/Year		Subsidence inches/year	Tons/Acre/Year
0.25	7		2.25	63
0.5	14		2.5	70
0.75	21		2.75	77
1.0	28		3.0	84
1.25	35		3.25	91
1.5	42		3.5	98
1.75	49		3.75	105
2.0	56		4.0	112

*The values in the table were calculated as follows:
1 acre foot of muck soil with a average bulk density of 15.4 lbs/ft^3 weighs 670,824 pounds (15.4lbs x 43560 ft^2 =670,824 lbs.) 1 acre inch of muck soil therefore weighs 55,902 pounds (670,924/12=55,902) or 28 tons (55,902/2000 = 27.951 tons). Similar thicknesses are displayed in the table.

Updating the Soils Data used by RUSLE2

Soil component records converted and imported into RUSLE2 require a minimum dataset of values and properties. Histosols and soils with histic surface horizons do not have erodibility values assigned. In the past these soils were omitted by the initial NASIS to RUSLE2 soil import process. Therefore, in order for the RUSLE2 interface to be used to calculate soil loss and SCI output on histosols, the soils database must contain soil component records for histosols and soils with histic surface horizons and these records must be complete. The RUSLE2 NASIS to RUSLE2 import code has been modified to create soil component records for these soils by inserting default values for soil erodibility and clay content so that these soils can now be run.

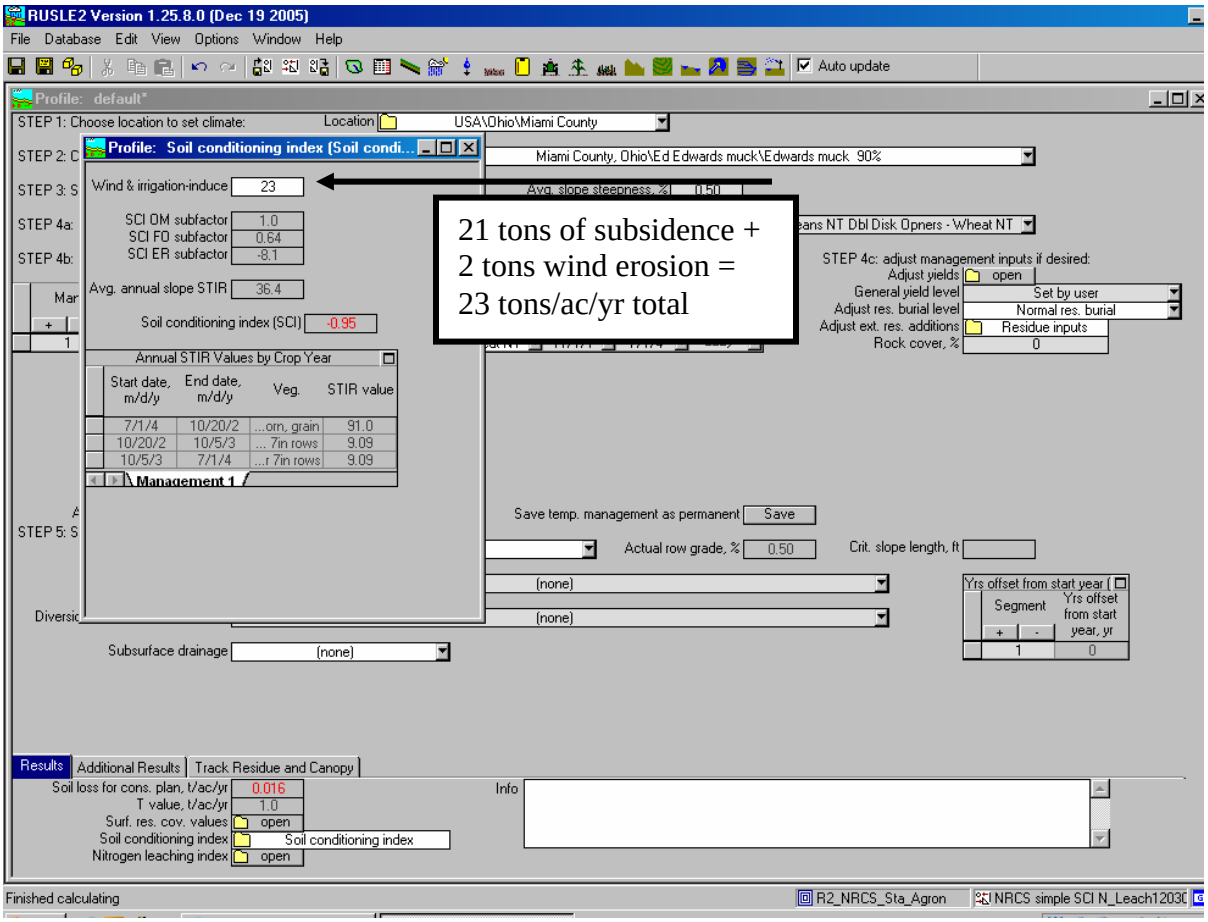
State Agronomists or the person with RUSLE2 responsibilities in each state should insure that all RUSLE2 soils data for counties or soil survey areas containing muck or peat soils (histosols) has been updated to include values for these soils. This is done by using versions of RUSLE2 beginning with 1.25.5.0 (October 19, 2005) to import the soils data from the NASIS download for each affected county or soil survey area. (Additional new RUSLE2 code dealing with importing soils with thin organic surface horizons that are typically destroyed or mixed by tillage and soil disturbance is contained in RUSLE2 version 1.25.8.0 to be released sometime in January 2006.)

If the local soil database in RUSLE2 doesn't contain soil component records for muck and peat soils that are known to exist and is dated prior to late October 2005, it cannot be used with this procedure and should be updated by the State Agronomist. Soil updates are then sent to the RUSLE2 database manager, Dave Lightle at NSSC for processing and posting to the official RUSLE2 website where they can be downloaded for use in updating the local RUSLE2 database.

Procedure to Calculate SCI for Muck (Histolsols) Soils using RUSLE2

1st. Calculate Wind Erosion (if appropriate) and record in tons/acre/year
2nd. Enter the Climate Location in RUSLE2
3rd. Enter the Organic Soil Component in RUSLE2
4th. Enter Slope and Length (Generally 0.1% and 200 feet)
5th. Enter the "Management" (Rotation/Tillage/Crops/Yields)
6th. Open the Soil Condition Index (SCI) folder and in the Wind & irrigation induced box enter the sum of the (Subsidence Value + Wind Erosion).

This will provide a calculated SCI that takes into consideration the soil loss from sheet and rill, wind (if appropriate), and subsidence loss.



1. *Subsidence of Organic Soils in the USA, John C. Stephens and William H. Speir*
2. *WEIR, Walter W. (1950): "Subsidence of peat lands of the Sacramento-San Joaquin Delta, California," Hilgardia. vol. 20, no. 3, pp. 37-55, Berkeley, Calif., June.*
3. DAVIS, J. F. and ENGBERG, C.A. (1955): (A Report of investigations of Subsidence of Organic Soils," Article 37-61, *Quarterly Bul.*, Michigan Agr. Expt. Sta., East Lansing, Mich., vol. 37, no. 4, pp. 498-505, May.

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