# **Automating Soils Information (SSURGO) into Conservation Planning Activities**

Jason Nemecek; National Soil Data Applications Scientist (National Technical Soil Leader for Conservation)

Contributors:

Laura Morton; Data Scientist (National Soil Survey Center)

Richard Reid; Regional Soil Scientist (Central National Technology Support Center)

A screenshot of a map

Description automatically generated

*Photo: Image of Soil Sensitivity for Nutrient Runuoff in Conservation Desktop*

Since the early days of the Soil Conservation Service, we have been using soils information to help the conservation planners and producers. Soils information is the foundation for decisions about land management, including those operations that must be combined for satisfactory soil performance. For example, soil survey information is useful in planning, designing, and implementing an irrigation system for a farm. A knowledge of the characteristics of the soil helps in determining the run length, water application rate, soil amendment needs, leaching conditions, general drainage requirements, and field practices needed to maintain optimal soil conditions for plant growth. Sandy soils will indicate weaker aggregate stability or steeper slopes might indicate a greater chance of organic matter depletion. Therefore, conservation planning might require more practices for those land units that show those resource concerns.

## Conservation Assessment Ranking Tool (CART)

## Assessment

With the advent of CART, we had the challenge and opportunity to rapidly accelerate soil data delivery into the conservation planning and ranking process. Many of our soil interpretations and the methods we use to create them fit well with the concepts of resource concerns on a field and the limitations or assumptions that CART uses.

During the planning and assessment process, the conservationists select the resource concerns that they want to assess with the producers. CART assessments operate on a “most limiting factor” assumption for conservation treatment needs, which aligns with our soil interpretations and limitations algorithms. A field can be designated high risk if a significant extent of the spatial boundary (the planning land unit (PLU), boundary drawn by the conservationists) has a limiting factor for the resource concern being evaluated by the conservationist.

Aligning the soil map units and the fields (PLUs) spatially to make consistent determinations takes some geospatial processing. Since fields are rarely comprised of a single soil map unit with uniform topography, the “dominant critical” area and most limiting factor needs to be identified and rated. The soil data automation scripts perform three steps:

1. Disaggregate the map unit components
2. Assign them to the PLU
3. Determine a rating for that PLU

The soils data scripts essentially disaggregate the components in a map unit and put them in a giant bucket (planned land unit). It then makes a determination on that planned land unit. The aggregation is different from how we normally aggregate data such as dominant condition, weighted average, or dominant component. For CART, what we have been doing is a “dominant critical” aggregation because fields rarely are comprised of a single soil map unit with uniform topography. To ensure that the planned system is adequate for the significant parts of the field or conservation management unit, the “dominant critical” area needs to be identified. The “dominant critical” area is the area of the field that is used to represent the entire field or PLU) for conservation plan development on that field or PLU. The “dominant critical” area is determined at 10% of the area that meets the most limiting factor for the planned land unit. A PLU but that doesn’t mean that the entire PLU needs the same uniform level of treatment. For example, you plan for a terrace or the grassed waterway in the impacted area and not for the entire field.

## Conservation Desktop (CD)

# There is a module in Conservation Desktop that conservationists use in the pre-planning process working with producers on their land. They can run scenarios and help scope the conservation plan and the options for the producers based on their soils and land capabilities and limitations.

# One new tool that we developed for the conservation planners is the Nutrient Sensitive Areas Analysis - Soil Sensitivity (Nutrient Runoff) pre-planning tool (photo above). This model provides a science-based methodology, a tool and visualization for the conservationists to use with clients in Conservation Desktop. Conservationists can use this pre-planning tool and map to assist clients with a plan to reduce nutrient runoff from their operations. Conservation planners will be able to select practices and fields to run the sensitivity analysis to help with planning alternatives. Results of the sensitivity analysis will be stored for future use within the CART assessment and ranking process. The Conservation Products module will retrieve the results and develop a map and report and to provide to the client with information for planning practices on their operation.

# We are planning to have some technical training for the soil scientists on this tool and the details involved in the ratings to ensure the conservationists on the ground have local support for this exciting, useful new tool. Stay tuned for more information on this and more updates on automating the soils data into CD and CART for conservation planning.

# Where is Soils Information Used in CART and CD?

## CART – Assessment

## Sheet and Rill Erosion

## Wind Erosion

## Subsidence

## Compaction

## Organic Matter Depletion

## Concentration of Salts or Other Chemicals

## Soil Organism Habitat Loss or Degradation

## Aggregate Instability

## Ponding and Flooding

## Seasonal High-Water Table

## Seeps

## Emissions of Greenhouse Gases (GHGs)

## Nutrients Transported to Surface Water (field sediment, nutrient, and pathogen loss)

## Nutrients Transported to Groundwater (field loss)

## Nutrients Transported to Surface Water (storage and handling of pollutants)

## Nutrients Transported to Groundwater (storage and handling of pollutants)

## Pesticides Transported to Surface Water

## Pesticides Transported to Groundwater

## CART – Environmental Evaluation

Flagged for any area of the planned land unit for the following:

* Hydric Soils
* Farmland Classification (Prime, statewide importance, local importance, unique importance)
* Drainage Class (Poorly or Very Poorly Drained)

## CART – Easements

Must meet 50% or greater of the planned land unit for the following:

* Hydric Soils
* Farmland Classification (Prime, statewide importance, local importance, unique importance)
* Drainage Class (Poorly or Very Poorly Drained)

## CART – Ranking

* If a client is interested in financial assistance through an NRCS conservation program, the inventory and assessment information, along with client decisions related to conservation practice adoption, are directly and consistently transferred from the assessment portion of CART to the ranking portion of CART. Based on the transferred assessment information and the conservation practices proposed for implementation, CART identifies the appropriate program ranking pool(s).
* Statewide Ranking geospatial datasets can be created using SSURGO interpretive models as a basis OR can be created at a coarse resolution from partner input and SSSURGO interpretive models can provide finer resolution screening.

# How Soil Scientist Can Help Conservation Planning:

If there are questions, training and educational needs related to soils such as Compaction, Subsidence, Salts, Organic Matter Depletion, Aggregate Stability and Aerobic soil organisms please work with your State Soil Scientist and/or local soil scientist. A soil scientist is a person who is qualified to evaluate and interpret soils and soil-related data for the purpose of understanding soil resources as they contribute to not only agricultural production, but as they affect environmental quality.

“Few people, besides soil scientists, know enough about soils, and about the interactions among the many soil characteristics that define each kind of soil and the health of the soils, to do the job by themselves. Few others have interest in all the uses and interpretations. Once a kind of soil is defined and mapped, few besides the soil scientist are concerned with all the interpretations needed, the field and horticultural crops that can be grown; the erosion hazard; the native plants and their ecological successions; how the soil will serve as subgrade for roads or foundations for buildings; and so on. Experience shows that the soil scientist must take leadership in developing the interpretations. This leadership responsibility includes getting the assistance of others, who may develop all or part of certain interpretations. Commonly, the soil scientist prepares a draft for others to react to. Responsibility to see that their work is interpreted for use is inherent in the duties of every soil scientist in the Soil Survey.” –Kellogg

At the end of the day, the soils information is an invaluable tool to help a user plan. It can dramatically facilitate planning, preparation and help build a model in your head of what’s out there. It provides an irreplaceable tool for basic and objective based resource planning. However, the user cannot just rely on the output from a computer. They must verify and validate what is out there on the ground and plan.

# Things Soil Scientist Can Do to Provide Technical Assistance:

1. The soil scientist can provide this training. Planners also need to consider land variability for erosion and topographic features, differences in texture and organic matter content, and any potentially high-risk areas, such as areas where the water table is high or areas where the soils have a high infiltration rate and leaching hazard.
2. Soil scientists are trained in soil fertility and nutrient dynamics and can assist with sampling and with reviewing the analysis of samples from waste lagoons, manure, and soils. Proper sampling procedures for all sources should be communicated to planners and producers so that representative data are used for the comprehensive nutrient management plan.
3. *Farm and Ranch Inventory and Planning.* The soil scientist can work with planners to assist land users in the implementation of conservation systems and in complying with provisions affecting highly erodible land and wetlands. The purpose of conservation systems is to improve soil and water quality and improve cropland, pasture, and rangeland conditions for sustainable production.
4. During the inventory and planning steps, a trained soil scientist can identify resource concerns that another planner might not recognize. Indicators of poor infiltration, degraded structure, erosion, low content of organic matter, acidification, salinization, compaction, and evidence of a water table (saturation) are some of the characteristics that conservation planners can be trained to recognize. In some complex landscapes, field verification of the soils may be necessary to ensure that the correct soil property values are being used.
5. Soil scientists should play an integral part in soil quality determinations and in training field office personnel to identify soil health indicators and concerns and the management practices needed to address them.
6. The soil scientist can also aid in developing locally adapted conservation tools, such as (1) automated spreadsheets that will assist the planner in using soils information to make planting recommendations for grass (forage) and trees and (2) automated risk assessment tools for the development of comprehensive nutrient management plans using local soil legends and interpretations. Although automated spreadsheets can increase efficiency, the planner should have the knowledge and skills necessary for determining and describing the appropriate soil properties and characteristics.
7. A soil scientist understands use-dependent properties and how changes can occur in the soil with different management practices. Below-ground investigations of the soil food web, infiltration, compaction, and bulk density address some of the indicators that can be taught to field office personnel. Understanding and teaching dynamic soil properties and how they can be improved by management practices can be important roles for the soil scientist. The soil scientist needs to work with field offices to identify the need for any new interpretations or for revisions to existing interpretations.