What we do...
Agriculture is the #1 industry in New York and SWCDs have programs and services designed to enhance and preserve this resource. SWCDs implement programs that provide incentives to keep agricultural lands in agricultural production. Better land use is achieved through erosion and sediment control, flood prevention, irrigation, land drainage, and water quality management practices. With a growing concern for manure management, SWCDs have the expertise to assist in the development of nutrient management plans.
Erosion Control

- Prevention of soil erosion is a priority of SWCDs. Sediment from erosion pollutes streams, rivers, lakes and clogs storm sewers. Erosion contributes to poor water quality, reduction of agricultural productivity and is harmful to wildlife habitat. SWCDs provide technical assistance in planning, designing, and constructing conservation measures to reduce the effects of erosion through strip-cropping, conservation tillage, diversions, terraces, stream bank protection and critical area planting.
Stream Stabilization

- Water is a very powerful and potentially destructive force. In rivers, streams and road ditches the most serious consequence of unprotected banks is soil erosion.

- There are many practical, proven ways to protect stream and road banks including seedings, rock riprap, and gabion baskets. SWCDs can provide assistance to protect property and improve water quality.
Water Quality Management

- Protecting and improving water quality is a primary goal of SWCDs.
- Non-point pollution sources include urban stormwater, construction operations, agricultural and silvicultural operations.
- SWCDs provide technical assistance by planning, designing, and constructing erosion control measures, nutrient management systems and storm water management practices.
The Importance of Soil

- What is Soil?
- What makes good soil?
- What is Soil Health
- Practical Management of Soil Fertility Productivity and Soil Health
What is Soil?

- Consists of 5 components
Mineral Matter

- Mineral Solids: The large majority of the solids (in most soils) are the mineral parts, consisting of stone fragments, sand, silt, and clay. These particles are defined by their sizes, although they differ in the way they influence soil functioning beyond simply their size-related effects.
- The relative proportions of sand, silt and clay determine a soil's texture and textural class.
Sand, Silt & Clay
Organic Matter

- plant and animal residues at various stages of decomposition, cells and tissues of soil organisms, and substances synthesized by soil organisms
- serves as a reservoir of nutrients and water in the soil, aids in reducing compaction and surface crusting, and increases water infiltration into the soil
- 1 percent organic matter in the soil would weigh about 20,000 pounds per acre
Benefits of Soil Organic Matter

- **Nutrient Supply**
  - Each percent of organic matter in the soil releases 20 to 30 pounds of nitrogen, 4.5 to 6.6 pounds of $P_2O_5$, and 2 to 3 pounds of sulfur per year.

- **Water-Holding Capacity**
  - Organic matter behaves somewhat like a sponge,
  - Organic matter will release most of the water that it absorbs to plants. In contrast, clay holds great quantities of water, but much of it is unavailable to plants.

- **Soil Structure Aggregation**
  - Organic matter causes soil to clump and form soil aggregates, which improves soil structure. With better soil structure, permeability (infiltration of water through the soil) improves, in turn improving the soil's ability to take up and hold water.

- **Erosion Prevention**
Soil Organic Matter

- How Can I Maintain or Improve Soil Organic Matter Levels?
  - Reduce or Eliminate Tillage
  - Reduce Erosion
  - Soil-Test and Fertilize Properly
  - Cover Crops

- Keep in mind…it will take 100 tons of organic material applied or returned to the soil to add 1% of stable organic matter to the soil.
Biota

- all the organisms that spend a significant portion of their life cycle within a soil profile, or at the soil-litter interface.
- include earthworms, nematodes, protozoa, fungi, bacteria and different arthropods.
- they act as decomposers that break down organic materials
Filling the Spaces?

- **Water**
  - Partially fills the spaces between the solid soil particles
  - Water is the medium that facilitates nutrient transport through the soil and enables plant nutrient uptake.
  - It also allows microbes such as nematodes and bacteria to move through the soil

- **Air**
  - Partially fills the spaces between the solid soil particles
  - Constantly moving into and out of the soil, providing oxygen required for cell functioning in aerobic organisms including plant roots
What makes good Soil?

- Good soil tilth
  - Soil tilth refers to the overall physical character of the soil in the context of its suitability for crop production. Soil with good tilth is crumbly, well structured, dark with organic matter, and has no large and hard clods.

- Sufficient depth
  - Sufficient depth refers to the extent of the soil profile through which roots are able to grow to find water and nutrients. A soil with a shallow depth as a result of a compaction layer or past erosion is more susceptible to damage in extreme weather fluctuations, thus predisposing the crop to flooding, pathogen, or drought stress.

- Good water storage and good drainage
- Sufficient supply, but not excess of nutrients
What makes good Soil?

- Small population of plant pathogens and insect pests
- Large population of beneficial organisms
- Low weed pressure
- Free of chemicals and toxins that may harm the crop
- Resistant to degradation
- Resilience when unfavorable conditions occur
What Limits your Soil?

- Compaction
  - Traffic or tillage when wet
  - Heavy traffic
- Poor aggregation
  - Too much tillage
  - Too little organic matter
- Low water and nutrient retention
  - Low organic matter
  - Excessive tillage
- Poor Drainage
Why didn’t a “farmer” buy your land?

- Poor Drainage is a limiting factor on many Clinton County soils
  - Major reason for abandoned farm land

- Soil Type/Soil Fertility
  - Not the same, but related
  - You can’t change the type and improving fertility can take a long time
Where to start?

- What is your soil type?
  - NRCS Web Soil Survey

- Soil Nutrient Analysis

- Soil Health Testing
  - [http://soilhealth.cals.cornell.edu/](http://soilhealth.cals.cornell.edu/)
Practical Soil Management

- Inventory your resources
  - Soil type, fertility, pH, drainage, organic matter,

- You can’t do anything about the soil type, however, you may improve drainage, alter pH and contribute to the soil fertility levels
Drainage

- If soil type and fertility are good, drainage can improve crop yields and soil health
- “Tile” is installed 3-4 feet underground to lower the water table
- Improves aeration, reduces compaction, reduces erosion and nutrient loss
- Larger farms routinely install subsurface drainage
  - Costs about $1000 per acre installed
  - Smaller fields will cost more
Fertility

- Depleted soils have been mined of nutrients and organic matter
- pH is usually low
- Restoring fertility will take time and 
  - Add lime to raise pH- it takes a couple of years
- Add nutrients to maximize crop yield
  - Commercial fertilizer can be expensive
  - Manure has been used as fertilizer since the dawn of agriculture
  - It reduces the need for purchased nutrients
  - It returns organic matter to the soil
Primary Macro Nutrients

- **Nitrogen**
  - is often the most limiting nutrient in crop production and easily lost from the soil system.

- **Phosphorus**
  - Phosphorus is involved in many plant processes, including:
    - Energy transfer reactions
    - Development of reproductive structures
    - Crop maturity
    - Root growth
    - Protein synthesis

- **Potassium**
  - Involved in many enzymatic reactions
  - Functions in the synthesis of the energy compounds
  - Required for translocation of carbohydrates within the plant
  - Involved regulating gas exchange and water relations during transpiration
4R Nutrient Stewardship

- right fertilizer source,
- at the right rate,
- at the right time,
- with the right placement.

Start by testing your soil and developing a plan for managing your soil fertility and soil health

And remember...
It is going to take TIME and effort

Questions?
Clinton County SWCD

• Peter Hagar, District Manager

• David Wilfore, District Technician

Susan Passino, District Clerk