What will be covered in Session I:

Introduction to Nutrient Management Lessons

LESSON 1: Nutrient Management
LESSON 2: Navigating the Course Binder
LESSON 3: Maps and Soil Fact Sheets
LESSON 4: Soil Sampling
LESSON 5: Soil Erosion, RUSLE2, and Choosing a Rotation

Terms to Learn

- nutrient management plan
- NRCS 590 Nutrient Management Standard
- Farm Service Agency land tract and field numbers
- T or tolerable soil loss
- RUSLE2

Exercises

1. Farm Information Worksheet
2. Map and Soil Fact Sheets Checklist
3. Soil Test Schedule
4. Organizing Your Soil Test Results
5. Choosing Rotations that Meet T
6. Field Inventory Worksheet
7. Manure Application Schedule
8. Checklist
You are here to develop a sound nutrient management plan (NMP) for your farm. Nutrient management planning is a mixture of best management practices that aim to optimize crop yield and quality, minimize fertilizer input costs, and protect soil and water. The basic principles of nutrient management are to apply the right amount of fertilizer in the right form, in the right place, and at the right time. If these principles are followed, crops will be productive, production costs will be minimized, and water resources will be protected. At the end of this course, you will have a NMP that satisfies state and federal regulations as dictated by the NRCS 590 Nutrient Management Standard. In addition to meeting regulations, nutrient management plans can provide many benefits to both your farm and the environment.

Nutrient Management Can Save Your Farm Money

A NMP can save you money. By accurately accounting for the nutrients from your manure applications and from legume crops in your rotation, you can reduce the amount of commercial fertilizer you need to purchase. Often this reduction is significant. The bottom line is that following a NMP often saves farmers money.

The amount of the savings depends on your current level of nutrient crediting. See the sidebar to the right for an example of the nitrogen (N) fertilizer value of the manure and legumes generated on a 100 cow dairy farm.

Nutrient Management Can Protect the Environment

A well-developed NMP will help you to farm within the needs and limitations of the environment. The driving force behind regulatory nutrient management programs is environmental concerns — specifically, water quality protection. Two of the most crucial nutrients in farming, nitrogen (N) and phosphorus (P), can be harmful to the environment if they are applied without a proper understanding of their potential impact on water resources. In addition, excessive nutrients occur in soil when they are applied to a crop beyond what is needed for optimum growth. The results of excessive nutrient application are not beneficial to the crop and can be detrimental to the environment through nutrient losses to air, surface water, and ground water. Nitrogen is a mobile nutrient and is not easily retained.
in soils. Nitrogen that is not utilized by plants or tied up in the soil (immobilized) can be lost to the air, lost to groundwater, or carried in runoff to lakes and streams. Nitrogen is readily lost to the air when it is changed from a liquid to a gas through the process of volatilization or denitrification. Nitrogen gaseous emissions from manure, fertilizers, and other sources are linked to ozone depletion and acid rain. The main concern with N losses is the leaching (downward movement) of nitrates through the soil into groundwater. This problem is amplified when N applications exceed crop removal rates. Excess nitrate in drinking water is a human health concern. Water high in nitrates can inhibit an infant’s ability to utilize oxygen. Livestock can also be adversely affected by elevated nitrate levels in drinking water. The health standard for drinking water is 10 ppm nitrate-N.

Phosphorus is the major nutrient promoting algae and aquatic weed growth in lakes and streams. Phosphorus bound to sediments and in surface water runoff can lead to algae blooms and oxygen depletion in freshwater environments, such as Lake Champlain. However, in salt water environments, such as the Gulf of Mexico, N in surface water runoff is the major concern with algae blooms and oxygen depletion.

**Nutrient Management Can Improve Public Relations**

Chances are, you have neighbors who don’t know much about agriculture. Farmers need to be concerned with the image of agriculture held by the non-farming public. A good NMP is the ideal jumping-off point for better public relations between your farm and the community. Efforts to do this will begin with good manure storage, handling, and application. Such efforts will help you spread manure to minimize odor, road spillage, and traffic hazards or delays. This also applies to water contamination from cattle standing in bodies of water.
By completing a NMP and implementing best management practices, you and your neighbors will know that your farm complies with state regulations and upholds the highest standards possible to keep the environment safe and clean.

**Following the Standard**

In this class we will develop our nutrient management plans based on the [NRCS 590 Nutrient Management Standard](#). What does this mean? This standard is a very specific set of rules developed by the USDA NRCS that outlines the information that must be included in a NMP. The "590" is a code number that NRCS has assigned to this collection of rules and requirements. When a farmer uses soil tests to make decisions about applying fertilizer he or she is practicing a nutrient management strategy. But the farmer may not be taking into account the many environmental factors that affect the transport of nutrients, such as soil type, slope, and distance to a nearby stream. A nutrient management plan meets the highest standard of excellence — the NRCS 590 Standard.

The NRCS 590 Standard requires information such as:

- Basic information about the farm, such as area, number of animals, and contact information
- Current soil and manure analyses
- Crop rotations, cover cropping, and yield goals
- Amount of manure produced and nutrient levels in that manure
- Manure and fertilizer application to each field (timing, amount, method)
- Characteristics of the soils present on the farm
- Detailed maps of environmentally sensitive areas
- Environmental factors that affect nutrient transport
- Field by field plan for meeting the nutrient needs of the crop while minimizing movement of nutrients from the field

This class will provide the tools for creating a plan that meets the NRCS 590 Standard. A complete copy of the NRCS 590 Standard can be found in your class materials. As we go through each session we will continually refer to the 590 Standard. You should take the time to read the standard. Plans meeting this stringent standard have taken into account many factors specific to a farm and demonstrate the highest level of stewardship of the environment.
In this class you have been provided with a course binder and computer workbook containing all the necessary pieces for creating your very own NMP. The binder is divided into sections to help you navigate through the class and keep things organized. There is a wealth of information contained in this binder, but in order to use it successfully it will be helpful to familiarize yourself with where different information is located. Let’s go through each section of the binder and describe what pieces of information you will find there. During the five sessions you will be filling out each worksheet on the computer. A blank copy is provided in the binder in case you prefer to fill it out by hand first.

**Binder Sections**

**Farm Information.** This first sheet is where you will enter all of the background information about your farm.

**Maps.** Here you will place the six types of maps created for your farm fields. Take a minute to look through the maps to make sure that they are all there and to organize them in a way that makes sense to you.

**Soil Information.** Behind this tab you will place the soil fact sheets describing each of the soil types that are present on your farm.

**Soil Analysis.** Your soil test results go here. In addition, there are instructions for taking a good soil sample, a soil test interpretation worksheet, and a soil test schedule.

**Manure Production.** This section contains information on using manure as a nutrient source on your farm. In addition, there are animal waste management system overview, manure production information, and manure application schedule worksheets. If you export or import manure, you will need to fill out a special form in this section.

**Manure Analysis.** This is where you will find everything relating to manure nutrients. There are instructions on how to sample manure for analysis, instructions for calibrating your manure spreader, and worksheets that will help you calculate the nutrients that are in your farm’s manure.

**Field Information.** In this section, you will list your crop rotations and yield goals, and calculate crop nutrient removal rates.

**Risk Assessment.** By using the Vermont Phosphorus Index and completing the environmental concerns risk assessment, you will be determining the risk for nutrient loss to groundwater and surface water.

**Field by Field Planning.** Using your soil test results, you will be determining nutrient needs for your crops and planning how to meet those nutrient needs with manure or fertilizer. Through this process, you will allocate all of the manure produced on your farm to your farm fields.

**Recordkeeping.** An important part of a NMP is keeping records of what happens on your farm, including manure spreading, fertilizer applications, yields, and any unexpected changes that you had to make to your plan.

**References.** Here you’ll find a checklist of all the components necessary for completing your NMP.
The first step in creating your NMP is to complete the farm information worksheet (page 13). The goal of this worksheet is to help you describe your farming operation, capturing herd inventory, land use characteristics, agronomic practices, and farm goals. Here you will provide some basic information about your farm, like in the example. The yellow boxes on the form will clarify what you need to fill out. Fill out the information to reflect the management practices on your farm.

EXERCISE I-1

Farm Information Worksheet

As you can see, there is a lot to be done in the next five weeks. This process may seem overwhelming at first because there is so much information and paperwork, but don’t worry. We will be taking it one step at a time. More than eighty farmers have already gone through this class and 99% of them have completed their plans. You can do it too!
**Getting Started / 13**

### Fill in the year for the next growing season.

- **Fill in the year for the next growing season.**

**Talk about any anticipated major changes such as changes to herd size, structures being built or additional acreage being bought. If you anticipate that things will stay the same, then say so.**

----------

#### Farm Information

<table>
<thead>
<tr>
<th>Farm Name</th>
<th>Plan Date</th>
<th>Crop Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Green Valley Farm</strong></td>
<td>1/1/2009</td>
<td>(2009)</td>
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</tbody>
</table>

- **Producer/Farm Manager**
- **Nutrient Management Planner**
- **Joe Farmer**
- **Joe Farmer**

<table>
<thead>
<tr>
<th>Farm Address</th>
<th>Phone No.</th>
<th>Email</th>
<th>County</th>
<th>Years Farm</th>
</tr>
</thead>
<tbody>
<tr>
<td>123 Green Valley Drive</td>
<td>111-2222</td>
<td><a href="mailto:greenvalley@sover.net">greenvalley@sover.net</a></td>
<td>Franklin</td>
<td>25</td>
</tr>
</tbody>
</table>

**Describe your farm and plans for the future**

- **We plan to maintain our current herd size in the future, but to work on improving milk quality.**

- **Talk about any anticipated major changes such as changes to herd size, structures being built or additional acreage being bought. If you anticipate that things will stay the same, then say so.**

#### Type of Information

<table>
<thead>
<tr>
<th>Acres Owned Total</th>
<th>Acres Rented Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>290</td>
<td>50</td>
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</tbody>
</table>

- **Tillable**
- **Permanent Hayland**
- **Pasture**
- **Woodland**

<table>
<thead>
<tr>
<th>Type of Information</th>
<th>Acres Owned Total</th>
<th>Acres Rented Total</th>
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</thead>
<tbody>
<tr>
<td>Tillable</td>
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<td>50</td>
</tr>
<tr>
<td>Permanent Hayland</td>
<td>130</td>
<td>-</td>
</tr>
<tr>
<td>Pasture</td>
<td>60</td>
<td>-</td>
</tr>
<tr>
<td>Woodland</td>
<td>45</td>
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</table>

**Typical Rotation (crops and sequence)**

- **3 years corn, 4 years hay**

- **If you don’t have a typical rotation, use a general one (5–7 years corn, 3–6 years hay) or fill this part out after completing your plan.**

**Tillage Operation/Equipment (Type, timing, depth, and sequence)**

- **Fall moldboard plow (8 inch depth), cultivate & disc in spring**

- **“Continuously stocked” = animals on pasture. Fill in “number of paddocks” if you rotationally graze.**

#### Livestock Enterprises/Livestock Inventory

<table>
<thead>
<tr>
<th>Rolling Herd Average</th>
<th>Holstein &amp; Holstein/Jersey crosses</th>
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<tbody>
<tr>
<td>Age</td>
<td>Number</td>
</tr>
<tr>
<td>Calves</td>
<td>1-4 mo.</td>
</tr>
<tr>
<td>Heifers</td>
<td>5-22 mo</td>
</tr>
<tr>
<td>Cows</td>
<td>22 mo +</td>
</tr>
</tbody>
</table>

- **Continuously Stocked**

#### Confinement/Pasture Information

<table>
<thead>
<tr>
<th>Date Confined</th>
<th>Continuously Stocked</th>
<th># of Paddocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calves</td>
<td>always</td>
<td></td>
</tr>
<tr>
<td>Heifers</td>
<td>May-Oct</td>
<td>Meats</td>
</tr>
<tr>
<td>Milkers</td>
<td>always</td>
<td></td>
</tr>
<tr>
<td>Dry Cows</td>
<td>May-Oct</td>
<td></td>
</tr>
</tbody>
</table>

**Manure Information**

- **Solid Manure**: yes
- **Liquid Manure**: yes
- **Compost Manure**: no
- **Calibrated Spreader**: yes
- **Custom Manure Application**: yes

<table>
<thead>
<tr>
<th>Timing of Application</th>
<th>Time to Incorporation</th>
</tr>
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<tbody>
<tr>
<td>Spring/Summer/Fall</td>
<td>Days</td>
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<td></td>
<td>4</td>
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</table>

**Watershed Information**

<table>
<thead>
<tr>
<th>Watershed</th>
<th>Hydrologic Unit &amp; Code</th>
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</thead>
<tbody>
<tr>
<td>Saint Albans Bay</td>
<td>20100081210</td>
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</table>

- **Impaired Watershed**: yes
- **Impairment Reason**: runoff

*Each watershed has a name and a code assigned to it. Ask your NRCS office for the code for your watershed.*
Here are some examples of the six types of maps that are required for your NMP. You should have each of these types of maps for all land that is rented or owned. Your maps may have been made by a land treatment planner, NRCS, UVM Extension, or a private consultant. Keep in mind that your maps may look different than these examples, as each map maker has an individual style. The information on them, however, should be the same. Be sure to refer to the legends on your own maps to make sure you understand them.

**Proximity Map**

This map shows the location of all tracts of land included in the farm in relation to the town and road system. The farmstead and headquarters are pinpointed on the map.
Conservation Plan Map

All farms that are involved in federal programs have been provided Farm Service Agency (FSA) land tract and field numbers. The designations must be used throughout the plan. If erodibility or wetland determinations have been made on your farm, the fields will be marked with those designations.

HOW TO READ A CONSERVATION PLAN MAP

- **Field name farmer uses**
- **FSA field number**
- **FSA acreage**

If a community crop has been grown recently on a field it will be designated as either highly erodible land (HEL), non-highly erodible land (NHEL), or not determined (ND or blank).
Nitrate Leaching Map

Some soils are very prone to losing N (in the form of nitrate) into groundwater. This is usually a problem in sandier soils. Each type of soil has been rated low, moderate, or high on the Nitrate Leaching Index. The higher the index, the more likely it is that nitrates will leach through the soil into the groundwater. The level of N management on the field will be based on the leaching index. This tool will help you determine the appropriate practices to minimize N leaching. This is important from both environmental and crop nutrient perspectives. You want N to be taken up by your crops—not moving into groundwater.

Later in the class you will use the legend to determine the dominant Nitrate Leaching Index for each field.

0–2 LOW
2–10 MODERATE
>10 HIGH
Topographic Map

This type of map is familiar to many people. It contains contour lines that show the elevation of the area (in feet above sea level). The closer the contour lines are together, the steeper the slope.
Environmental Concerns Map

Environmentally sensitive areas are shown on this map. The map is used to highlight areas that could be threatened by pollution. This map shows the location of designated sensitive areas or resources and the associated nutrient management restrictions such as buffers or setbacks. In the example below, surface waters are shown with a blue line and the required 25-foot buffers are shown with green hash marks. Other sensitive areas such as wetlands, important wildlife habitat, wells, and buffers required around wells will be shown on this map.

**NUTRIENT APPLICATION SETBACKS AND RESTRICTIONS**

Surface waters (i.e. lakes, streams, rivers, ditches) are usually shown in blue.

A 25-foot perennial vegetative buffer must exist at the top of the bank of surface water. These buffers may be harvested and treated with commercial fertilizer during the growing season. No manure can be applied in the buffer area.

When a public well is present, no agricultural activities, including nutrient applications, can occur within 200 feet of the area.

When a private well is present, no manure or nitrogen fertilizer may be applied within 50 feet of the area. However, other commercial fertilizers (with the exception of nitrogen) can be applied during the growing season.
Soils Map

There are more than 180 types of soil in the state of Vermont. Each soil type has its own characteristics, which we'll be talking about next. Each soil type is identified by a two letter code. Sometimes there is a third letter that indicates the slope. For example, that for the soil marked “EnA” below, “En” stands for Enosburg soil and “A” means that there is a 0 to 3% slope. Note that the boundaries between soil types usually don’t follow field boundaries, so it is common to have more than one type of soil in a field.
Soil Fact Sheets

There is a soil fact sheet that describes each of the 180 distinct soil types found in Vermont. The fact sheet describes the formation of the soil, depth to water table, and how susceptible the soil is to erosion. We will only be using part of the information on the soil fact sheet, which is highlighted in the example below. You should have a soil fact sheet for each soil type on your farm.

Vermont Soil Fact Sheet

**Munson silt loam, 3 to 8 percent slopes**

MUNSON SOILS formed in loamy over clayey glaciolacustrine deposits on lake plains. They are very deep to bedrock and somewhat poorly drained. These soils have a perched water table at depths of 0.5 to 2.0 feet below the surface from late Fall through early Summer. Permeability is moderate in the surface layer, moderately slow to moderate in the subsoil and slow in the substratum.

This map unit is suited to cultivated crops. It is well suited to hay and pasture. Erosion is a hazard. A seasonal high water table may inhibit the establishment of some crops.

**Important farmland classification:** Statewide  
**Land capability:** 3 w  
**Vermont Agricultural Value Group:** 4d

**Vermont Residential Wastewater Disposal - Group and Subgroup:**

IIIc.- This unit is marginally suited as a site for soil-based residential wastewater disposal systems, based on a review by the Natural Resources Conservation Service of criteria set forth in the Vermont 2007 Environmental Protection Rules. The depth to the seasonal high water table in association with the minimal slope is the major limitation. A detailed, site-specific analysis is generally required. On-site groundwater level monitoring and determination of induced groundwater mounding is often necessary to establish the suitability of this unit. Curtain drains may help lower the water table to an acceptable level, however, the minimal slope may prevent their use in many areas.
Before you go any further, it is important to make sure that you have all of the maps and soil fact sheets that you will need for the class. Arrange them in your binder in an order that makes sense to you (maps: by tract number; soil fact sheets: alphabetically) so that you will be able to easily locate them. Put checkmarks in the table below to verify that you have all of your maps.

Now look at the soil map for each of your fields and make sure that you have a soil fact sheet for each type of soil that is on your farm. You can use the table below to keep track.

If you are missing any fact sheets, please contact your course instructor, NRCS, or UVM Extension.

### Map and Soil Fact Sheets Checklist

**EXERCISE I-2**

#### Map and Soil Fact Sheets Checklist

- **Before you go any further, it is important to make sure that you have all of the maps and soil fact sheets that you will need for the class. Arrange them in your binder in an order that makes sense to you (maps: by tract number; soil fact sheets: alphabetically) so that you will be able to easily locate them.**
- **Put checkmarks in the table below to verify that you have all of your maps.**
- **Now look at the soil map for each of your fields and make sure that you have a soil fact sheet for each type of soil that is on your farm. You can use the table below to keep track.**
- **If you are missing any fact sheets, please contact your course instructor, NRCS, or UVM Extension.**

#### MAP CHECKLIST

<table>
<thead>
<tr>
<th>Map Type</th>
<th>Tract(s)</th>
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<th>Tract(s)</th>
<th>Tract(s)</th>
<th>Tract(s)</th>
<th>Tract(s)</th>
<th>Tract(s)</th>
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<td>Proximity</td>
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<td></td>
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</tr>
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</tr>
<tr>
<td>Environmental Concerns</td>
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#### SOIL FACT CHECKLIST

<table>
<thead>
<tr>
<th>Soil Abbreviation</th>
<th>Fact Sheet?</th>
<th>Soil Abbreviation</th>
<th>Fact Sheet?</th>
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</table>
How to Take a Soil Sample

A soil test is the only practical way of telling how much fertilizer is needed in a given field. However, the reliability of a soil test is only as good as the sample you submit. The small amount of soil in the sample bag you send to the Agricultural Testing Lab must represent the entire area to be fertilized. Avoid unusual areas, such as those where fertilizer or lime has spilled. Take samples before lime, fertilizer, or manure are applied. Use only clean equipment for collecting soil samples.

1. In order to receive your recommendations early enough to use them for planning the next crop season, it is best to take samples in the fall.

2. Use a sampling probe or auger, available from mail order catalogs and garden or farm supply outlets, is the best tool for sampling and is a necessity if sampling large numbers of fields. You may be able to borrow a probe from your local NRCS office.

3. The area to be sampled should be as uniform as possible in terms of soil type and cropping and fertilizing history. For practical purposes it should be an area you expect to fertilize as a unit. Take at least 15 soil cores or borings for each composite sample on a field of a maximum of 20 acres. If a field is more than 20 acres, take two complete samples.

4. Insert the probe or auger into the soil to plow depth or at least 6 inches for hay and other perennial crops. Insert probe to the plow depth (usually 6-10 inches) for annual crops such as corn. In general, do not sample any area of a field that varies widely from the rest of the field in color, fertility, slope, texture, drainage, or productivity.

5. Discard any plant material and mix soil cores in a clean plastic bucket. Be sure to mix samples well.

6. Take about 1 cup of the mixed soil cores and place it in a plastic bag.

7. Identify the bag with your name, field name, and sample number.

8. Record the field, sample location, and date in your records.

9. Fill out the soil test questionnaire and place it in an envelope with the plastic bag along with a check. If submitting multiple samples, include one check for total being tested. The sample can be taken directly to the UVM lab or sent to the address below. If you need a copy of the soil test form, it can be found at the following website: http://pss.uvm.edu/ag_testing

The University of Vermont
Agricultural & Environmental Testing Lab
Hills Science Building
Burlington, VT 05405

Results are normally returned in two weeks.
n important part of developing and maintaining a NMP is to regularly test your soil. Soil testing is required for each field a minimum of once every three years. Fall is usually the best time for testing, especially if you are rotating to a different crop the next year. Soil testing in the fall will ensure that you have all the necessary parts to complete your NMP during the winter. Remember that when a field is larger than 20 acres, you should be taking two separate tests (for example, a field called “Oak Tree” could be split into “Oak Tree North” and “Oak Tree South” for the purposes of soil testing). If the results are substantially different, the sections should be treated as separate fields in the NMP.

Completing the Soil Test Schedule worksheet will provide an easy reference for you to remember which fields to test when soil sampling season comes along. Some people prefer to soil sample all fields at once and others like to be on a rotation so they only sample some of their fields each year. Choose the option that works best for you, given your management style.

Writing a NMP involves a lot of paper shuffling and good organization is necessary. In order to minimize confusion, you should first write the FSA land tract and field number on each soil test. Do this even if you usually use familiar names (such as “Back Field”) rather than FSA tract and field numbers (such as “556-14”). For your NMP, you will get used to using tract and field numbers in addition to your regular field names. Next, organize all of your soil sample results in a manner that makes sense for the farm. For example, some farms put all corn fields first, followed by hay fields. Other farms put owned fields first, followed by rented fields.

As you are organizing your soil tests you should start to identify trends on your farm. For example, do you have many fields that are excessive in phosphorus? Do you have fields that are low in potassium? Getting a feel for your soil test analysis will help you determine appropriate manure and fertilizer rates later in the class. Find the worksheet in your binder called Soil Test Interpretation and Planning Strategy and fill it out based on your results. Filling out this worksheet will help you figure out how to approach the rest of the NMP based on soil test trends.
After studying the soils map it becomes clear that soil is variable from farm to farm, field to field, and even within a field. Climate, soil type, and topography can result in a soil that is more or less susceptible to erosion than other soil types. Erosion happens when soil has lost its structure and travels from one place to another. It can be carried away by wind or rain and its effects can be devastating.

The dustbowl is an extraordinary example of erosion. In this example of very poor farming practices, the land was farmed without providing perennial soil cover. The prairie grasses that held the soil in place were replaced with year upon year of annual crops. The soil was over-utilized and developed poor structure to the point where the winds and rain of the prairies were able to carry the soil particles, in some cases, all the way to Vermont.

Three Basic Types of Erosion

**Sheet Erosion.** The removal of soil in a uniform sheet-like fashion, which occurs on bare soil and may not be visible.

**Rill Erosion.** This is a concentrated flow of water down small channels. These channels are too large to be smoothed over with normal tillage.

**Gulley Erosion.** This occurs when large channels form over time, usually beginning as rill erosion. These channels are too large to be smoothed over with normal tillage.

Some soils are naturally more erodible than other soils. Steep and long slopes produce more erosion than do short and flat slopes. Land use has a major effect on erosion. Exposing the soil to raindrops and surface runoff dramatically increases erosion. According to the NRCS 590 Standard, the goal is to minimize erosion to a tolerable level in all fields.
**What is T?**

Every soil has a soil fact sheet that explains the specific characteristics of that soil. One characteristic is the soil’s T value. T stands for **tolerable soil loss**. This is the amount of soil per acre per year that can be lost without impacting crop yields or production. For the soil in the example below, Munson silt loam, 3 to 8 percent slope, the T value is 2. This means you can lose up to two tons of soil per acre per year and this type of soil will be formed fast enough to replenish the soil lost to erosion. This is acceptable and considered “farming to T.” To comply with the NRCS 590 Standard, all fields on a farm must meet T. A soil loss value for an individual field has been calculated and can be found on the RUSLE2 sheet.

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**What is RUSLE2?**

RUSLE2 stands for Revised Universal Soil Loss Equation—Version 2. RUSLE2 is a computer model that estimates potential soil loss from rill and interrill erosion caused by rainfall and overland flow. It is a complex calculation that takes into account soil type, crops grown, tillage, slope, and

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**DEFINITION OF SOIL EROSION**

Soil erosion is a two-phase process:

1. Detachment of individual particles from soil aggregates.
2. Transport of particles by erosive agents — wind or water.

Particles are eventually deposited to form new soils or to fill lakes, reservoirs, or stream channels.

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**Vermont Soil Fact Sheet**

**Munson silt loam, 3 to 8 percent slopes**

MUNSON SOILS formed in loamy over clayey glaciolacustrine deposits on lake plains. They are very deep to bedrock and somewhat poorly drained. These soils have a perched water table at depths of 0.5 to 2.0 feet below the surface from late Fall through early Summer. Permeability is moderate in the surface layer, moderately slow to moderate in the subsoil and slow in the substratum.

This map unit is suited to cultivated crops. It is well suited to hay and pasture. Erosion is a hazard. A seasonal high water table may inhibit the establishment of some crops.

**Vermont Residential Wastewater Disposal - Group and Subgroup:**

IIIC.- This unit is marginally suited as a site for soil-based residential wastewater disposal systems, based on a review by the Natural Resources Conservation Service of criteria set forth in the Vermont 2007 Environmental Protection Rules. The depth to the seasonal high water table in association with the minimal slope is the major limitation. A detailed, site-specific analysis is generally required. On-site groundwater level monitoring and determination of induced groundwater mounding is often necessary to establish the suitability of this unit. Curtain drains may help lower the water table to an acceptable level, however, the minimal slope may prevent their use in many areas.

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**Physical and Chemical Properties**

<table>
<thead>
<tr>
<th>Soil name</th>
<th>Depth (In)</th>
<th>Typical texture</th>
<th>Clay (Pct)</th>
<th>Soil reaction (pH)</th>
<th>Permeability (In/Hr)</th>
<th>Organic matter (Pct)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Munson</td>
<td>0-8</td>
<td>SIL</td>
<td>3-10</td>
<td>5.6 - 6.5</td>
<td>0.6-2</td>
<td>3.0-10</td>
</tr>
<tr>
<td></td>
<td>8-14</td>
<td>SIL</td>
<td>3-16</td>
<td>5.6 - 6.5</td>
<td>0.2-2</td>
<td>0.5-3.0</td>
</tr>
<tr>
<td></td>
<td>14-40</td>
<td>SICL</td>
<td>35-60</td>
<td>5.6 - 7.3</td>
<td>0.0-0.2</td>
<td>0.0-1.0</td>
</tr>
</tbody>
</table>

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**Erosion Factors**

<table>
<thead>
<tr>
<th></th>
<th>Kw</th>
<th>Kf</th>
<th>T (Tolerable soil loss)</th>
</tr>
</thead>
</table>

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**Land Use Limitations**

<table>
<thead>
<tr>
<th>Soil name</th>
<th>Land use</th>
<th>Rating</th>
<th>Reason **</th>
</tr>
</thead>
<tbody>
<tr>
<td>Munson</td>
<td></td>
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</tr>
</tbody>
</table>

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**Agricultural Yield Data**

<table>
<thead>
<tr>
<th>Soil name</th>
<th>Crop name</th>
<th>Yield / acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Munson</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**Soil Features**

**Hydric soil?**

<table>
<thead>
<tr>
<th>Soil name</th>
<th>Depth to bedrock (range in inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Munson</td>
<td>No</td>
</tr>
</tbody>
</table>

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**Important farmland classification:**

<table>
<thead>
<tr>
<th>Vermont Agricultural Value Group:</th>
<th>Land capability:</th>
</tr>
</thead>
<tbody>
<tr>
<td>4d</td>
<td>3 **</td>
</tr>
</tbody>
</table>

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**Vermont Residential Wastewater Disposal - Group and Subgroup:**

IIIC.- This unit is marginally suited as a site for soil-based residential wastewater disposal systems, based on a review by the Natural Resources Conservation Service of criteria set forth in the Vermont 2007 Environmental Protection Rules. The depth to the seasonal high water table in association with the minimal slope is the major limitation. A detailed, site-specific analysis is generally required. On-site groundwater level monitoring and determination of induced groundwater mounding is often necessary to establish the suitability of this unit. Curtain drains may help lower the water table to an acceptable level, however, the minimal slope may prevent their use in many areas.
manure application over the course of the cropping cycle. RUSLE2 is a powerful tool for conservation planning, inventories, and estimating sediment production.

Let’s look at a sample RUSLE2 report. You should have something that looks like this for each of your fields. Notice that the soil type and T value are listed. There are three different management possibilities listed and the soil loss that would occur with each strategy. A rotation is acceptable if the soil loss is less than T. The two rotations shown in green have soil loss values of 1.7 and 1.6, which are less than T (2.0). The top rotation — continuous corn silage with spring chisel and manure — has a soil loss value of 3.9. Since this is greater than T, it is not an acceptable rotation for this field.

Do you have a problem with erosion on parts of your farm? Check in with your local NRCS representative to find out ways to address various types of erosion issues.

**EXERCISE 1-5**

Choosing Rotations that Meet T

You should have received RUSLE2 reports (calculating the potential soil erosion for different rotations) for each of your fields. For each field, select a rotation that meets T by placing an X next to it on your RUSLE2 report (as in lesson 1-5). The rotation should have a planned soil loss of equal to or less than the T value for the soil. Remember, this should be a rotation that will work for your farm system. If you would like to use rotations other than the ones listed on your report, talk to the person who did the calculations for you to add rotation options for your farm.
Next you will take an inventory of every field you own or rent. You will record the field name (the name you call it), the FSA tract and field number, acres, and soil type (you can find this on your soil map). The order in which you list the fields will be their order for the rest of the worksheets. Use the same order that you used for your soil tests and maps so that it is easy to find information when you need it later on.

In the column labeled “rotation plan,” you will be using the rotation that you chose for each field on the RUSLE2 report. Abbreviate the rotations using the list at the top of the page. For example, three years of corn silage followed by four years of grass hay would be abbreviated “3CS 4HG.” If you have a field in a continuous crop, use an abbreviation such as “cont HG” for continuous grass hay.

Under “Year in rotation,” if you are in your second year of corn silage enter “2CS.” If you have a continuous crop, leave this blank.

“Current year” is the coming crop season. For this example, written in January ’09:

Current year = 2009
Next year = 2010

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Tract &amp; Field #</th>
<th>Acres Owned</th>
<th>Acres Rented</th>
<th>Soil Type</th>
<th>Rotation Plan</th>
<th>Year in Rotation</th>
<th>Current</th>
<th>Last Year</th>
<th>2 Yrs Ago</th>
<th>Next Year’s Harvest</th>
<th>Yield Goal (T/A/Crop)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 back</td>
<td>345-11</td>
<td>15</td>
<td>MuB</td>
<td>3CS 4HG</td>
<td>2 CS</td>
<td>CS</td>
<td>CS</td>
<td>HG</td>
<td>HG</td>
<td>5,000</td>
<td>5,000</td>
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<tr>
<td>2 oak tree</td>
<td>345-12</td>
<td>26.0</td>
<td>FaC</td>
<td>cont. HG</td>
<td>HG</td>
<td>HG</td>
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<td>HG</td>
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<td>3 triangle</td>
<td>345-13</td>
<td>5</td>
<td>Le</td>
<td>4CS 2HL</td>
<td>1CS</td>
<td>CS</td>
<td>HL</td>
<td>HL</td>
<td>CS</td>
<td>2,500</td>
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<td>4 behind the barn</td>
<td>362-1</td>
<td>34</td>
<td>MuB</td>
<td>pasture</td>
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<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>0</td>
<td>0</td>
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<tr>
<td>5 across the road</td>
<td>362-3</td>
<td>25.5</td>
<td>MuB</td>
<td>3CS 4HG</td>
<td>3 CS</td>
<td>CS</td>
<td>CS</td>
<td>CS</td>
<td>HG</td>
<td>5,000</td>
<td>5,000</td>
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<tr>
<td>6 Johnny’s house</td>
<td>362-3</td>
<td>8</td>
<td>FaC</td>
<td>3CS 4HG</td>
<td>2 HG</td>
<td>HG</td>
<td>HG</td>
<td>CS</td>
<td>CS</td>
<td>5,000</td>
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</table>
Your yield goal is reported as tons per acre, and should be based on what your soils are capable of producing in a good year. Corn silage yields are reported at the harvested moisture. Hay and haylage should be reported as tons of dry matter per acre. Estimate manure spreading rate for each field for fall, spring, and summer of last year. Also, don’t forget to fill in the box at the bottom of the worksheet. How did you determine your yield goals? Soil fact sheets? Weighing loads at harvest?

### Field Inventory Sheet

The field inventory sheet provides a catalog of all your fields and their respective acreage and soil type. In addition, it provides information about the crop rotation and realistic yield goals for each crop.

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Tract &amp; Field #</th>
<th>Acres Owned</th>
<th>Acres Rented</th>
<th>Soil Type</th>
<th>Crop Information (Current Crop Year = 2009)</th>
<th>Est. Manure (last year) (gallons or tons)</th>
<th>Yield Goal (T/A/Crop)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>Rotation Plan</td>
<td>Year in Rotation</td>
<td>Current</td>
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</tbody>
</table>

**Example Abbreviations:**
- A: Alfalfa
- CS: Corn Silage
- CG: Corn Grain
- HG: Grass Hay
- SMG: Small Grain
- SB: Soybean
- HL: Legume Hay
- SS: Sorghum/sudangrass

**Total Acres:**
- 95: 87.5
- 96: 26.8

Describe How Yield Goals were Determined:

We weighed one load of corn silage and then multiplied by the number of loads per acre.

<table>
<thead>
<tr>
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</table>

**Total Acres:**
- 95: 87.5
- 96: 26.8

Describe How Yield Goals were Determined:

We weighed one load of corn silage and then multiplied by the number of loads per acre.
The Manure Application Schedule worksheet summarizes the time of year that you apply manure to various crops on the farm. Your answers in this section should reflect what you normally do on your farm. Remember, there is a winter spreading ban in Vermont from December 15th to April 1st, so no manure is allowed to be spread between those dates.

<table>
<thead>
<tr>
<th>CROP GROUP</th>
<th>Total Acres</th>
<th>Corn</th>
<th>Hay/Legume</th>
<th>Pasture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT NOV DEC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CORN</td>
<td>75</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>HAY/Legume</td>
<td>126</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Pasture</td>
<td>5</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**MANURE SPREADING RESTRICTIONS**

- Manure may not be spread:
  - Within intermittent ditches, diversions, grassed waterways, drainage ditches, or other areas of concentrated flow
  - Over bedrock outcrops
  - On frozen or snow-covered ground
  - Between December 15th and April 1st

From the NRCS 590 Standard
Here is a list of items that you should have completed before you go on to the next session. Those items found in the computer workbook are listed in blue.

**SESSION I**

- **Farm information worksheet**
- Maps (proximity, conservation plan, nitrate leaching, topographic, environmental concerns, soils)
- Soil fact sheets
- Soil test results organized
- Soil test interpretation and planning strategy
- **Soil test schedule**
- RUSLE2 (with your crop rotation indicated)
- **Field inventory**
- Manure application schedule