AWM101 – Conservation Practice Systems I: Unit 3

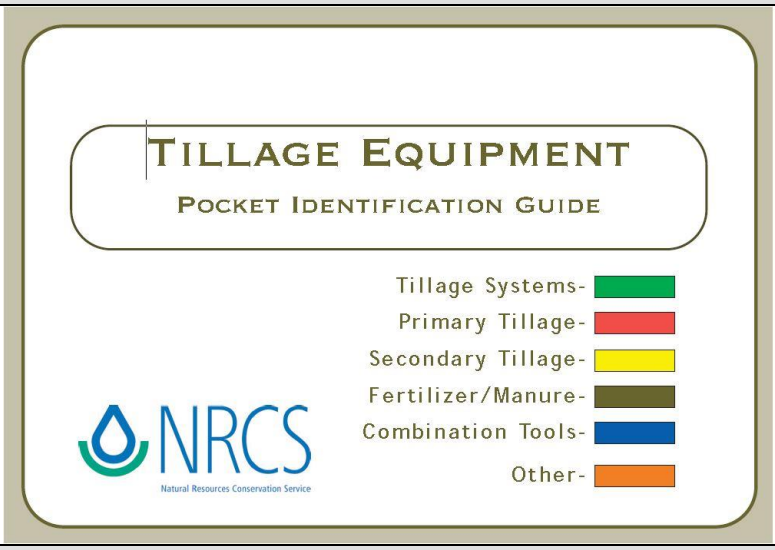
Unit 3
Introduction

Title	Strategies for a Tillage Reduction System
Image	 Cultivating after an early rain.
Content	**Tillage** is the agricultural preparation of soil by mechanical agitation of various types, such as digging, stirring, and overturning. Small-scale gardening and farming, for household food production or small business production, tends to use the smaller-scale methods above, whereas medium- to large-scale farming tends to use the larger-scale methods. There is a fluid continuum, however. Any type of gardening or farming, but especially larger-scale commercial types, may also use low-till or no-till methods as well.
Links/Uploads	https://en.wikipedia.org/wiki/Tillage
Attributions	Image and Content courtesy of Wikipedia – The Free Internet Encyclopedia

Unit 3
Lesson 1: Overview

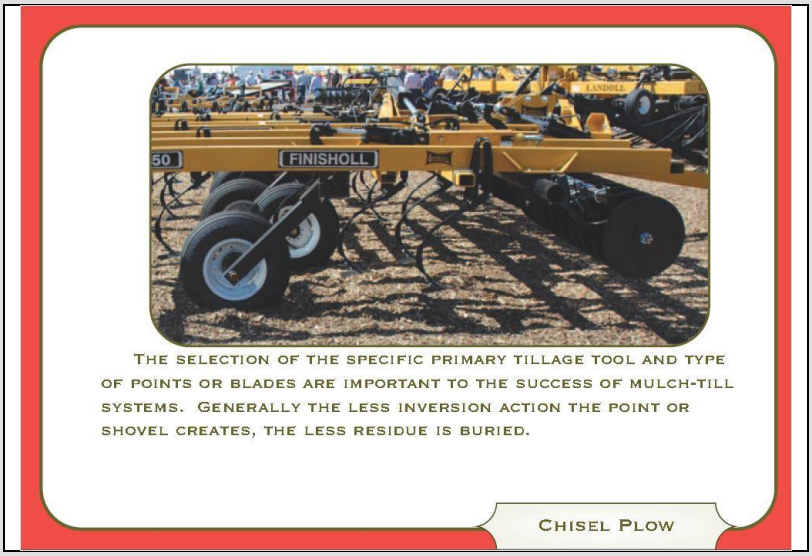
Title	Conventional, Zero-till and Strip-till Methods of Tillage Opportunities

	Image	
	Content	**Zero-till (No-till), Strip-till, Mulch-till, and Conventional Tillage** provide producers with most common methods for preparing the seedbed for planting. These 4 methods each determine the degree of soil disturbance, resilience of the soil, degree of erosion, and uniformity of practices which lead up to crop production. Each method provides the producer with a different economy for crop production. In addition, each method has a different relationship to nutrient loss reduction.
	Attributions	Image courtesy of Tillage Equipment Guide – NRCS. Content provided by Richard Lyons.
Unit 3 **Lesson 1: Objectives and To-Do List** This is a weekly task list for the student. Should include items like: *Read Chapter 15, Submit your Project, Respond to Discussion Board, Review Key Terms, etc.* Please include a short sentence and **point value** where appropriate. **Please include the Course To-Do List Docs or PDFs**	**Title**	**Lesson 1 To-Do List**
	Objective	By the end of this unit, you should be able to: • Compare the differences, including soil structure values, between the conventional, zero-till and strip-till methods • Define the soil profile microorganisms and root development present under conventional, zero-till, and strip-till systems • Understand how reduced tillage advances nutrient & sediment loss reduction strategies Conventional, Zero-till and Strip-till Methods
	Prepare	• Read NRCS Soil Health on NRCS website http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/soils/health/ • Read: Conservation Crops Systems Initiative – Indiana SWCDs http://ccsin.iaswcd.org/ http://ccsin.iaswcd.org/conservation-practices/
	Prepare	• Read: Economics of Conservation Tillage (PSU) http://extension.psu.edu/plants/crops/soil-

		management/conservation-tillage/economics-of-conservation-tillage
	Practice	Discussion Board I – How should economics be considered when reducing soil erosion is our goal – **OR** – What are the implications of differing tillage systems to long term soil health? (10-pts.) • Complete and Submit the discussion board Introduction Question; • Respond to peer's discussion board question;
	Perform	Lab Exercise #3 (25-pts.) - Measuring Crop Residue Amounts on a Field Scale
	Links/Uploads	NRCS Soil Health on NRCS website http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/soils/health/ Conservation Crops Systems Initiative – Indiana SWCDs http://ccsin.iaswcd.org/ http://ccsin.iaswcd.org/conservation-practices/ Conservation Tillage http://cornandsoybeandigest.com/tillage/conservation-tillage
Unit 3 **Lesson 1: Prepare**	**Title**	Reading and Audio-Visual Assignments
	Image	
	Sub-Title	Compare Tillage System Opportunities
	Content	About this guide.... The purpose of the guide is to help you identify commonly used farm equipment. Its color photos and line drawings

will help facilitate communication by providing common definitions and RUSLE2 terminology with NRCS and our clients. Revised Universal Soil Loss Equation, Version 2 (RUSLE2), was developed primarily to guide conservation planning, inventory erosion rates and estimate sediment delivery. Values computed by RUSLE2 are supported by accepted scientific knowledge and technical judgment, are consistent with sound principles of conservation planning, and result in good conservation plans. The different systems reviewed in this guide are color coded. The page border colors will group the different systems together: Tillage Systems-green. Primary Tillage-red. Secondary Tillage-yellow.
Fertilizer/Manure-brown. Combination Tools-blue. Other-orange.

Image



Video

Conservation Tillage
http://cornandsoybeandigest.com/tillage/conservation-tillage

Dave Legvold and Mike Peterson farm outside of Northfield, MN. Both farmers have switched from conventional tillage programs to conservation tillage using a zone-till method, allowing fewer passes as well as nutrient savings. Using zone-till also saves soil, a key to farming land with thin topsoil.

Links/Uploads

- Read NRCS Soil Health on NRCS website http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/soils/health/
- Read: Conservation Crops Systems Initiative – Indiana SWCDs http://ccsin.iaswcd.org/ http://ccsin.iaswcd.org/conservation-practices/
- Watch: Conservation Tillage http://cornandsoybeandigest.com/tillage/conservation-tillage

Attributions

Image and content courtesy of Natural Resources Conservation Service - USDA

Unit 3
Lesson 1: Prepare

Title

Reading and Audio-Visual Assignments

Image

Item	Conventional tillage ($/A)	Reduced tillage ($/A)	No-till ($/A)
Selected variable costs			
Seed	$23.30	$23.06	$24.41
Fertilizer	$44.22	$45.99	$40.03
Lime	$9.77	$8.37	$9.27
Herbicides	$18.16	$18.81	$26.67
Insecticides	$4.97	$6.90	$4.71
Machinery operating	$21.20	$21.50	$13.61
Custom hire	$6.65	$7.29	$13.30
Total variable costs	$154.13	$162.63	$158.39
Fixed costs			
Machinery ownership	$43.99	$40.69	$23.89
Total costs	$198.13	$203.32	$182.27
Return to land and management	$186.77	$187.12	$208.51
Yield (bu/A)	$149.5	$147.8	$149.8

Table 1. Tillage system cost of production and profitability, Pennsylvania Five Acre Corn Club, 1990-94.

Sub-Title

Conservation Budgets, Inputs, and Equipment

Content

There are many potential economic advantages for reducing the number of tillage operations for crop enterprises.

Conservation Tillage Series Number Six

These include: 1) lower fuel costs due to fewer trips over the field, 2) reducing the amount of tillage equipment needed, which results in lower machinery investment, 3) lower labor requirements, which reduce hired labor costs or free up operator time for other farm operations, 4) reducing

soil loss from water and wind erosion, and 5) conserving soil moisture. In the late 1970s and early 1980s much of the interest in conservation tillage was sparked by increasing fuel costs, but today much more emphasis is being placed on conservation tillage as a means of reducing soil erosion.

Tillage Systems Overview: Pros and Cons

Tillage systems most commonly used in Pennsylvania include conventional, minimum, and no-till. In other parts of the country, ridge-till and mulch-till have gained some popularity, but to date have not found widespread usefulness here. General considerations of the first three systems are outlined below. It also is possible to rotate tillage strategies.

Image

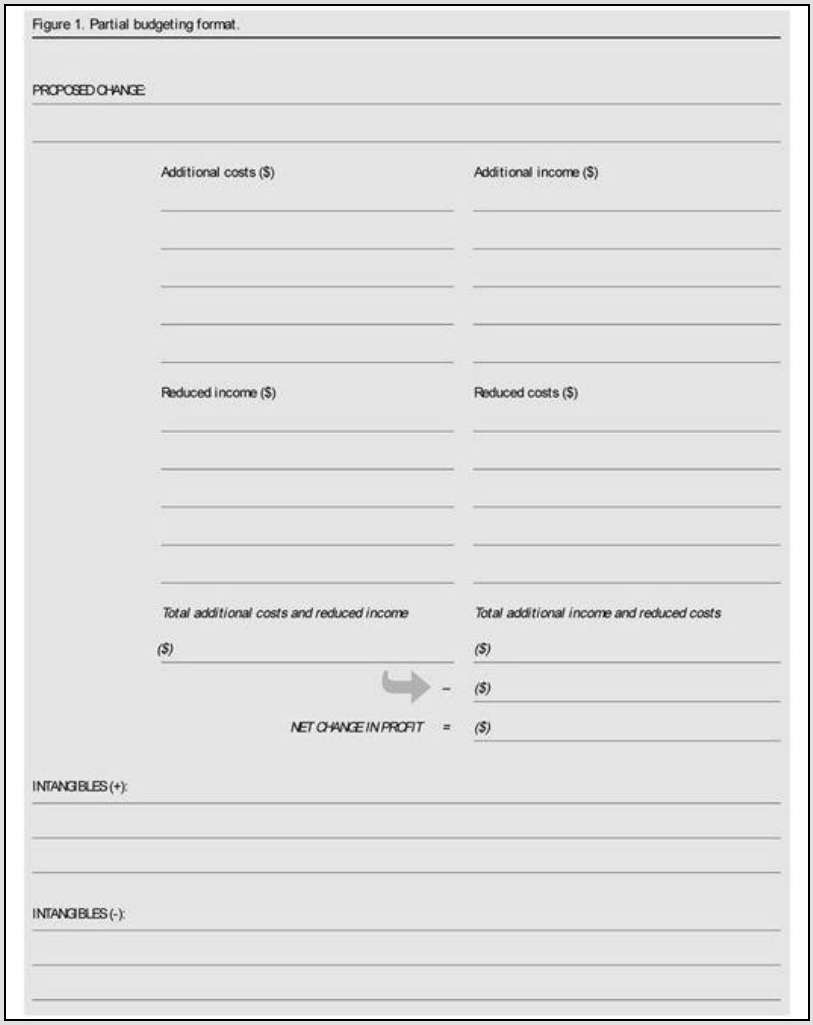


Figure 1. Partial budgeting format.

PROPOSED CHANGE:

Additional costs ($)	Additional income ($)
Reduced income ($)	**Reduced costs ($)**
Total additional costs and reduced income	*Total additional income and reduced costs*
($)	*($)*
	– *($)*
NET CHANGE IN PROFIT	= *($)*

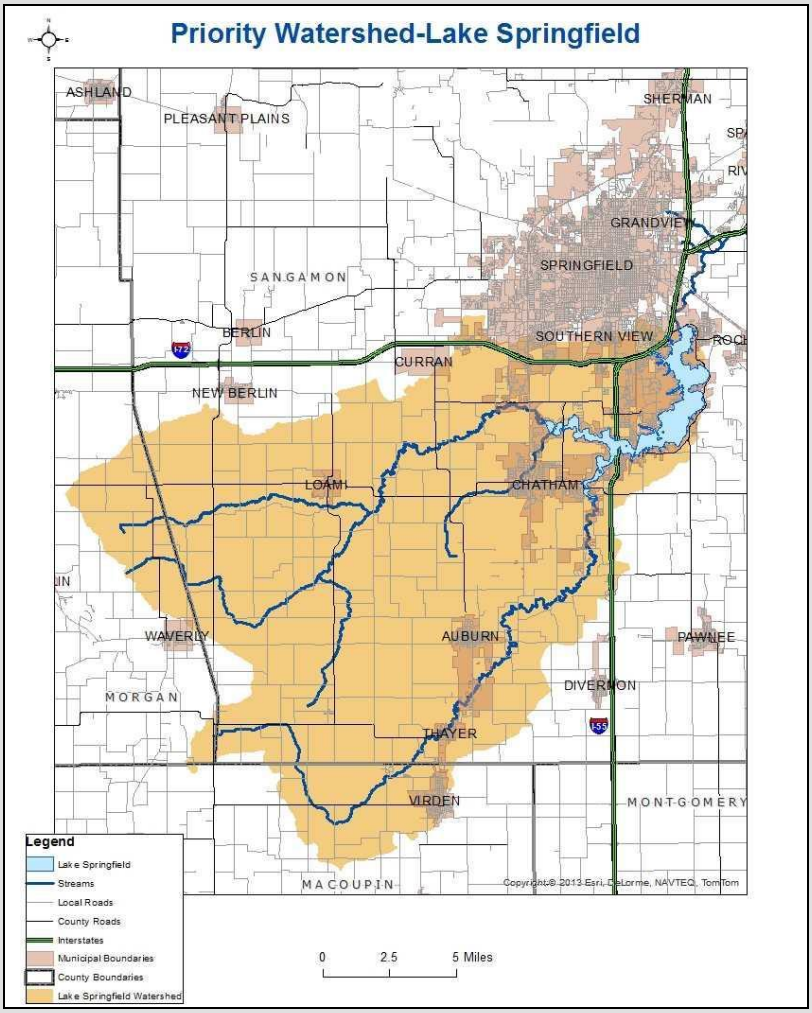
INTANGIBLES (+):

INTANGIBLES (-):

Content

A widely used partial budget format can be found in Figure 1. This budget will help organize the cost and income change data relating to the four partial budgeting questions. In the case of tillage systems, the new or additional costs that may be incurred include the costs of additional equipment or more closely monitoring pest populations (question 1). These costs may take the form of additional inputs, equipment, and managerial time. Current income that may be reduced might take the form of changes in crop rotation or harvest method (question 2). New or additional income may take the same form. For example, before changing tillage systems, we may have had a different timeliness and yield potential, which might mean we are reducing our income due to having lower yield or quality. For question 3, however, we would be increasing our income potential by having more of some other farm product to market. For question 4, current costs

		may be reduced because of changing input and machinery usage. The information in Tables 2, 3, 5, and 6 are a useful starting point for answering some of these questions
	Links/Uploads	http://extension.psu.edu/plants/crops/soil-management/conservation-tillage/economics-of-conservation-tillage
	Attributions	Images and content courtesy of Penn State Extension – Pennsylvania State University.
Unit 3 **Lesson 1: Practice**	**Title**	Discussion Board Activity I
	Image	
	Sub-Title	Economics of Conservation Practices
	Directions	Directions - This discussion question is meant to stimulate your ideas of surface conservation and their opportunities in an agricultural nutrient loss reduction practice. Thus, please answer this question with regards to the following agricultural surface activities concept (every soil has some form of surface management requirement… Some more than others). Throughout the unit/week, please log into the discussion board, review the answers of your classmates and respond to at least one of the discussion answers with further comments or questions. If you do not respond to one of your peer's comments, you will lose 5 points.
	Discussion Topic	Choose one question and answer on the link provided: • Question: How should economics be considered when reducing soil erosion is our goal? • Question: What is the implication of different tillage systems to long-term soil health?
	Links/Uploads	(left specifically for Discussion Board Link/upload)

	Attributions	Image courtesy of Sustainable Facilities Tool - General Services Administration. Discussion topic provided by Richard Lyons.
Unit 3 **Lesson 1: Perform**	**Title**	Lab Activity
	Image	
	Sub-Title	Lab Assignment #3 – *Measuring Crop Residue Amounts On a Field Scale;*
	Content	**See Lab #2 handout to begin exploring the following:** **Lab Objectives:** **Introduction:** **Tools and Materials:** **Safety Precautions:** **Procedures:** **Maintenance of Workstation/Tools:** **Summary Statement:** **Questions:** **This lab assignment is a guided, clinical field lab activity. Aiding our focus and understanding of today's agricultural conservation cropping management criteria. Lake Springfield Watershed is an excellent learning lab. The**

		guided tour consists of two portions: First, revisiting the project's very beginning with the Statement of Needs and subsequent response by its Architectural/ Engineering design team. The second portion will be a guided field/systems tour inside and out.
	Links/Uploads	AWM101lab#3.docx AWM101Lab#3KEY.docx Additional Information: https://en.wikipedia.org/wiki/Crop_residue
	Attributions	Image courtesy of Illinois Environmental Protection Agency Laboratory Content by Richard Lyons
Unit 3 **Lesson 2: Overview**	**Title**	Introduction to Soil Profile Microorganisms and Root Development Under Conventional, Zero-till, and Strip-till Systems
	Image	
	Content	**An Introduction to Soil Profile Organisms and Root Development Under Zero-till, Strip-till, Mulch-till, and Conventional Tillage** will help the watershed manager work with the producer in the watershed understand the types and numbers of microorganisms present in the root zone. Evaluation of these organisms provides insight into the health of the soil.
	Attributions	Image courtesy of Natural Resources Conservation Service Laboratory Content by Richard Lyons

Unit 3
Lesson 2: Objectives and To-Do List

This is a weekly task list for the student.

Should include items like: *Read Chapter 15, Submit your Project, Respond to Discussion Board, Review Key Terms, etc.*

Please include a short sentence and **point value** where appropriate.

Please include the Course To-Do List Docs or PDFs

Title	Lesson 2 To-Do List
Objectives	By the end of this lesson, the student should be able to: • List the different soil organisms present in the A & B Horizons • Explain the effect of tillage on soil organisms • Explain the relationships between the different types of soil organisms
Prepare	View: Soil Profile Microbes Under Differing Tillage Methods • Soil Health Theater – NRCS http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/health/?cid=stelprdb1245890
Prepare	Read: • From the Surface Down… An Introduction to Soil Surveys for Agronomic Use https://extension.illinois.edu/soil/Surface/surdown.pdf
Practice	• Discussion Group II (10-pts.) – General Discussion Questions: 1)
Perform	• Quiz #2 (20-pts.)
Links/Uploads	Soil Health Theater – NRCS http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/health/?cid=stelprdb1245890 From the Surface Down… An Introduction to Soil Surveys for Agronomic Use https://extension.illinois.edu/soil/Surface/surdown.pdf

Unit 3
Lesson 2: Prepare

Title

Reading and Audio-Visual Assignments

Image

Sub-Title

Soil Profile Microbes Under Differing Tillage Methods

Content

The creatures living in the soil are critical to soil health. They affect soil structure and therefore soil erosion and water availability. They can protect crops from pests and diseases. They are central to decomposition and nutrient cycling and therefore affect plant growth and amounts of pollutants in the environment. Finally, the soil is home to a large proportion of the world's genetic diversity.

Explore the Science of Soil Health

Following the popular "Soil Health Lessons in a Minute" video demonstrations, NRCS and film maker Robin "Buz" Kloot, PhD, have once again teamed up to develop a series of short videos—this time focusing on the science of soil health. Buz, who is a Research Associate Professor at the Arnold School of Public Health, University of South Carolina, made a cross-country trek in the fall of 2013 to interview some of the nation's leading researchers and experts—in order to more fully understand the science of soil health.

Videos

The Science of Soil Health: Season 1
Episode 1: Series Trailer
Episode 2: Getting a handle on mineralizable N in soils
Episode 3: Changing the way we think about microbes
Episode 4: What happens when you till?
Episode 5: Cover crops and moisture
Episode 6: Simulating rainfall on pastures
Episode 7: Understanding the value of legumes and nitrogen-fixing microbes
Episode 8: Using cover crops to soak up nutrients for the next crop
Episode 9: Night crawlers and soil water flow
Episode 10: Fighting plant disease with microbes
Episode 11: Without carrot or stick

The Science of Soil Health: Season 2
Episode 1: Soil feeds plants and vice versa
Episode 2: Compaction
Episode 3: Precision cover cropping

Episode 4: The Weil Brassica Research Team
Episode 5: Dynamic Cropping Systems
Episode 6: The Science of Soil Health: Systems in Agroecology
Episode 7: Natural Systems and Weeds
Episode 8: The Science of Soil Health: Using Insects to Manage Pests
Episode 9: The Science of Soil Health: Mimicking Nature in the Lab

The Science of Soil Health: Season 3
Episode 1:Cycle, re-cycle, repeat: Carbon's journey through the soil powers life as we know it
Episode 2:Breathtaking symbiosis…
Through respiration, soil microbes provide key benefit to plants, scientist says
Episode 3: The Science of Soil Health: Going Deeper
Episode 4: The Science of Soil Health: Going Deeper, Part 2
Episode 5: The Science of Soil Health: Finale, Part 1
Episode 6: *Bringing the science of soil health home*: Chapter 1 – Introduction

Content

Inherent and Dynamic Properties of Soil…

Soil has either inherent and dynamic properties, or qualities. Inherent soil quality is a soil's natural ability to function. For example, sandy soil drains faster than clayey soil. Deep soil has more room for roots than soils with bedrock near the surface. These characteristics do not change easily.

Dynamic soil quality is how soil changes depending on how it is managed. Management choices affect the amount of soil organic matter, soil structure, soil depth, and water and nutrient holding capacity. One goal of soil health research is to learn how to manage soil in a way that improves soil function. Soils respond differently to management depending on the inherent properties of the soil and the surrounding landscape.

Understanding soil health means assessing and managing soil so that it functions optimally now and is not degraded for future use. By monitoring changes in soil health, a land manager can determine if a set of practices is sustainable. See **Soil Health Assessment** and **Soil Health**

Management principles for soil health for more information.

Links/Uploads

The Science of Soil Health: Season 1
Episode 1: Series Trailer
Episode 2: Getting a handle on mineralizable N in soils
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Episode 4: The Science of Soil Health: Going Deeper, Part 2
Episode 5: The Science of Soil Health: Finale, Part 1

Attributions

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Unit 3
Lesson 2: Prepare

Title

Reading Assignment

Image

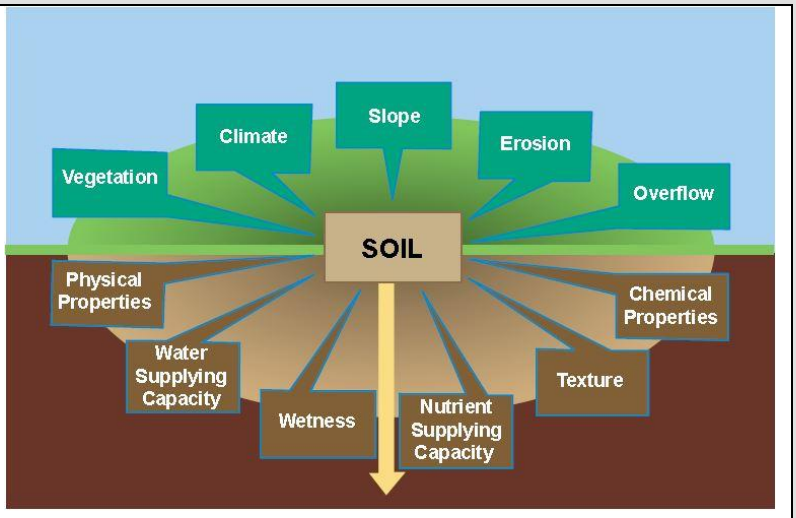

Figure 1. – Facts about soil.

Sub-Title

Soil Profile Root Development Under Differing Tillage Methods

Content

Much of our life's activities and pursuits are related and influenced by the behavior of the soil around our houses, roads, septic and sewage disposal systems, airports, parks, recreation sites, farms, forests, schools, and shopping centers. What is put on the land should be guided by the soil that is beneath it.

Like snowflakes, no two soils are exactly the same. Surface as well as below the surface soil features change across landscapes (fig. 1). A grouping of soils having similar properties and similar behavior is called a series. A series generally is named for a town or local landmark. For example, the Mexico series is named for a town in north central Missouri. More than 20,000 soil series have been named and described in the United States, and more are being defined each year. In mapping, a soil series is further divided into a phase of a series by properties that are important to soil use, such as surface texture and slope. These phases of soil series, once identified, all have a characteristic behavior. The behavior for that kind of soil and individual phase is applicable no matter where the soil is observed.

One of the main references available to help land users determine the potentials and limitations of soils is a soil survey. Copies of a soil survey for a specific county are available from the Natural Resources Conservation Service office responsible for that county. Reference copies are also available in the county or depository libraries. A soil survey is prepared by soil scientists who determine the properties of soil and predict soil behavior for a host of

		uses. These predictions, often called soil interpretations, are developed to help users of soils. A soil survey generally contains soils data for one county, parish, or other geographic area, such as a major land resource area. During a soil survey, soil scientists walk over the landscapes, bore holes with soil augers, and examine cross sections of soil profiles. They determine the texture, color, structure, and reaction of the soil and the relationship and thickness of the different soil horizons. Some soils are sampled and tested at soil survey laboratories for certain soil property determinations, such as cation-exchange capacity and bulk density.
	Links/Uploads	https://extension.illinois.edu/soil/Surface/surdown.pdf
	Attributions	Image and content courtesy of University of Illinois Extension – UIUC.
Unit 3 **Lesson 2: Practice**	**Title**	Discussion Board II Activity
	Image	
	Sub-Title	Discussion Board – What Effects Soil Organisms and Rooting?
	Directions	Directions - This discussion question is meant to stimulate your ideas of nutrient terms and their definitions in an agricultural nutrient efficiency practice. Thus, please answer this question with regards to the following agricultural conservation practice systems efficiency concept (every soil has some form of efficient nutrient conservation practice systems' management requirement… Some more than others).

		Throughout the unit/week, please log into the discussion board, review the answers of your classmates and respond to at least one of the discussion answers with further comments or questions. If you do not respond to one of your peer's comments, you will lose 5 points.
	Content	Question: What types of farm equipment are needed for the different cropping systems…? Discuss how your choice matches your conservation cropping system?
	Links/Uploads	(left specifically for Discussion Board Link/upload)
	Attributions	Image courtesy of Sustainable Facilities Tool - General Services Administration. Discussion topic provided by Richard Lyons
Unit 3 **Lesson 2: Perform**	**Title**	Assignment
	Image	
	Sub-Title	Scheduled Quiz #2 (20-pts.)
	Content	Complete Quiz #2 Worth 20-Pts
	Links/Uploads	AWM101quiz#2.docx AWM101quiz#2KEY.docx
	Attributions	Image courtesy of Lincoln Land Community College – Springfield, IL Content by Richard Lyons