Lesson C7–2

Using Land Capability Classifications

Unit C. Plant and Soil Science

Problem Area 7. Soil Erosion and Land Management

Lesson 2. Using Land Capability Classifications

New Mexico Content Standard:

Pathway Strand: Plant Systems

Standard: **I:** Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and natural environment.

Benchmark: **I-B.** Test appropriate materials or examine data to evaluate and manage soil/media nutrients.

Performance Standard: **6.** Determine land use capability.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Define land capability and ways to improve it.
2. Identify factors that determine land capability.
3. Explain the land capability classification system.

List of Resources. The following resources may be useful in teaching this lesson:

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Biondo, Ronald J. and Jasper S. Lee. *Introduction to Plant & Soil Science and Technology,* 2nd Edition. Danville, Illinois: Interstate Publishers, Inc. 2003 (Chapter 8)

Other Resources. The following resources will be useful to students and teachers:

Brady, Nyle C. *The Nature and Properties of Soils*. Englewood Cliffs, New Jersey: Prentice-Hall, Inc. 1990 (Chapter 15)

Cooper, Elmer L. and L. DeVere Burton. *Agriscience: Fundamentals & Applications.* Albany, New York: Delmar. 2002 (Chapter 9)

Lee, Jasper S. and Diana L. Turner. *Introduction to World AgriScience and Technology*. Danville, Illinois: Interstate Publishers, Inc. 1997 (Textbook and Activity Manual, Chapter 17)

Parker, Rick. *Introduction to Plant Science.* Albany, New York: Delmar. 1998 (Chapter 5)

Plaster, Edward J. *Soil Science & Management.* Albany, New York: Delmar. 1997 (Chapter 17)

Porter, Lynn, et. al. *Environmental Science and Technology.* Danville, Illinois: Interstate Publishers, Inc. 1997 (Chapter 13)

List of Equipment, Tools, Supplies, and Facilities

Writing surface
Overhead projector
Transparencies from attached masters

Terms. The following terms are presented in this lesson (shown in bold italics):

Arable land
Capability factors
Capability unit
Erosion
Internal drainage
Irrigation
Land capability
Land capability subclasses
Land forming

Slope
Soil depth
Soil permeability
Surface drainage
Surface runoff
Surface texture

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Just as animals can be classified as to what they produce, land can be classified as well. We know beef cattle are used to produce beef and dairy cattle are raised for dairy products. Land is classified so producers know the best production practices to use on the land for the highest profitability.

Summary of Content and Teaching Strategies

Objective 1: Define land capability and ways to improve it.

Anticipated Problem: What is land capability and how can it be improved?

I. ***Land capability*** is the suitability of land for agricultural uses. The uses should not cause any damage to the land. ***Arable land*** is land that can be used for row crops. These crops typically require some form of tillage to the soil. To improve arable land, the producer can utilize various cropping practices. Four common practices are:

A. Irrigation—***Irrigation*** is the artificial application of water to soil or a growing medium to assure adequate moisture for plant growth. It is often used on a supplemental basis in areas where seasonal shortages of water may reduce crop yields.

B. Erosion control—Excessive erosion may result in land that is no longer fertile. The long-term productivity of land can be assured by controlling soil erosion.

C. Drainage—Land sometimes needs surface or internal drainage. ***Surface drainage*** is removing water from the surface of the land. Ditches and terraces are most often used for this purpose. ***Internal drainage*** is the removal of water within the soil profile. This may be improved with drain tiles or tubes installed below the normal plowing depth of the soil.

D. Forming—***Land forming*** is the smoothing or reshaping of the land to enhance the use of the land. Small dips are filled and high places are taken down. Typically, land forming involves using laser-guided equipment to assure a good surface. This practice is routinely done in the production of rice.

There are many techniques that can be used to assist students in mastering this material. Students need text material to aid in understanding land capability and how it can be improved. Chapter 8 in Introduction to Plant & Soil Science and Technology is recommended. Use TM: C7–2A to aid in the discussion.

Objective 2: Identify factors that determine land capability.

Anticipated Problem: What factors determine land capability?

II. ***Capability factors*** are the characteristics of land that determine its best crop use. These factors include both surface and subsurface characteristics. Some common factors are:

   A. Surface texture—***Surface texture*** is the proportion of sand, silt, and clay in the soil to plow depth, which is typically 7 inches. Soil can be classified as either sandy, loamy, or clay-like.

   B. Internal drainage—Internal drainage is known as permeability. ***Soil permeability*** is the movement of air and water through the soil. It is determined by the texture and structure of the soil. It can be classified as very slow, slow, moderate, and rapid.

   C. Soil depth—***Soil depth*** is the thickness of the soil layers that are important in crop production. Soil depth classifications are very shallow, shallow, moderately deep, or deep.

   D. Erosion—***Erosion*** is the loss of topsoil by water, wind or other forces. Much of the fertility of land is in the topsoil. Four categories of erosion are used: very severe erosion, severe erosion, moderate erosion, and none to slight erosion.

   E. Slope—***Slope*** is the rise and fall in the elevation of land. It is commonly measured in percent or the number of feet of rise and fall in 100 feet. Six classes of land slope are commonly used: very steep, steep, strongly sloping, moderately sloping, gently sloping, and nearly level. The slope of the land plays a major role in the level of erosion on the soil.

   F. Surface runoff—***Surface runoff*** is the water from rain, snow, or other precipitation that does not soak into the ground. The amount of runoff depends on the soil texture and slope of the land. The categories of surface runoff are: very slow, slow, moderate, and rapid.

There are many techniques that can be used to assist students in mastering this material. Students need text material to aid in understanding the factors that determine land capability. Chapter 8 in Introduction to Plant & Soil Science and Technology is recommended. Use TM:C7–2B thru TM:C7–2E to aid in the discussion on this topic.

Objective 3: Explain the land capability classification system.

Anticipated Problem: What is the system used to classify land capability?

III. The system of land capability classification involves land classes, subclasses, and capability units.

   A. Land capability classes are based on the capability factors of the land. The Roman numerals I thru VIII are used. The land capability classes are:

1. Class I: Very good land—Class I land has no limitations. It is nearly level and has deep soil, good internal drainage, and good surface drainage. This land can be cropped every year without special practices to control erosion.
2. Class II: Good land—This land has deep soil with a few limitations. The soil requires moderate attention to conservation practices. Contour plowing and other easy to use practices are often used.
3. Class III: Moderately good land—This land has more limitations than Class II. Crops must be more carefully selected. This land is often found on gently sloping hills. Increased attention must be given to conservation practices, such as terraces and strip cropping. This land can be productive with proper management by the producer.
4. Class IV: Fairly good land—This class of land is the lowest that should be cultivated. It has very severe limitations that restrict the choices of crops and require special conservation management practices. This land is on hills and has more slope than land found in Class III. The land is frequently subject to erosion, especially gullies.
5. Class V: Unsuited for cultivation—Class V land can be used for pasture crops, cattle grazing, hay crops, and tree farming. The land is often used for wildlife and recreation areas. The soil typically has good tilth and fertility, but is restricted in use by rock outcrops or frequent overflow from nearby waterways. The land is often gently sloping or nearly level.
6. Class VI: Not suited for row crops—This land class has too much slope for growing row crops. The soil may have fair productivity if it has not been damaged by erosion. Gullies often quickly form if not carefully managed.
7. Class VII: Highly unsuited for cultivation—Class VII land has severe limitations. This class should not be cultivated. Best uses are permanent pasture, forestry, and wildlife. Slope is often well over 12 percent. The soil is very shallow. Large rock surfaces may be present. This land is often found in dry areas.
8. Class VIII: Unsuited for plant production—This land cannot be used for row crops or other crops where the land is tilled. It is often lowland covered with water most or all of the time. The soil may be wet and high in sand or clay. This class of land is often used for waterfowl habitat.

B. All classes except Class I have one or more limitations. ***Land capability subclasses*** indicate factors that limit soil use by means of a single letter code added to the class number. The letter codes are:
   1. e—Runoff and erosion. Land with slope greater than 2 percent are those that need some form of water control.
   2. w—Wetness. These soils may be poorly drained or occasionally flooded. Some such soils may be drained; others are classed as wetlands and are best left as is.
   3. s—Root zone or tillage problems. These soils are shallow, stony, droughty, infertile, or saline. Wind and water erosion may be problems.
   4. c—Climatic hazard. Areas of rainfall or temperature extremes make farming difficult.

C. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, and require similar management. A ***capability unit*** is a soil group within a subclass. They have similar productivity capabilities and other responses to management practices. Capability units are generally designated by adding Arabic numbers 0 to 9 to the subclass symbol. Thus, in one symbol, the Roman numeral designates the capability class or degree of limitation; the small letter indicates the subclass or kind of limitation; and the Arabic numeral specifically identifies the capability unit with each subclass.

There are many techniques that can be used to assist students in mastering this material. Students need text material to aid in understanding the system used to classify land capability. Chapter 8 in Introduction to Plant & Soil Science and Technology is recommended.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Questions at end of chapters in the textbook may also be used in the review/summary.

Application. Complete pages 57–62 in the Activity Manual for *Introduction to Plant & Soil Science and Technology.*

Evaluation. Focus the evaluation of student achievement on mastery of the objectives stated in the lesson. Measure student performance on classroom participation, laboratory assignments, and written tests or quizzes.

Answers to Sample Test:

Part One: Matching

1 = g, 2 = e, 3 = b, 4 = c, 5 = d, 6 = f, 7 = h, 8 = a

Part Two: Completion

1. capability class; subclass; capability unit
2. I
3. texture

Part Three: Short Answer

e—Runoff and erosion

w—Wetness

s—Root zone or tillage problems

c—Climatic hazard

Sample Test Name _____

Test

Lesson C7–2: Using Land Capability Classifications

Part One: Matching

Instructions. Match the term with the correct response. Write the letter of the term by the definition.

a. Arable land	b. Internal drainage	c. Slope
d. Capability factors	e. Soil permeability	f. Surface texture
g. Capability unit	h. Land capability	

_____ 1. A soil group within a subclass.

_____ 2. The movement of air and water through the soil.

_____ 3. The removal of water within the soil profile.

_____ 4. The rise and fall in the elevation of land.

_____ 5. The characteristics of land that determine its best crop use.

_____ 6. The proportion of sand, silt, and clay in the soil to plow depth.

_____ 7. The suitability of land for agricultural uses.

_____ 8. Land that can be used for row crops.

Part Two: Completion

Instructions. Provide the word or words to complete the following statements.

1. In the land capability classification system, the Roman numeral designates the _____ _____ or degree of limitation; the small letter indicates the _____ or kind of limitation; and the Arabic numeral specifically identifies the _____ _____ with each subclass.
2. Class _____ land has no limitations.
3. The amount of runoff depends on the soil _____ and slope of the land.

Part Three: Short Answer

Instructions. Provide information to answer the following question.

List the subclasses used in the land capability classification system and give their definitions.

TM: C7–2A

WAYS TO IMPROVE ARABLE LAND

Irrigation

Erosion Control

Drainage

Land Forming

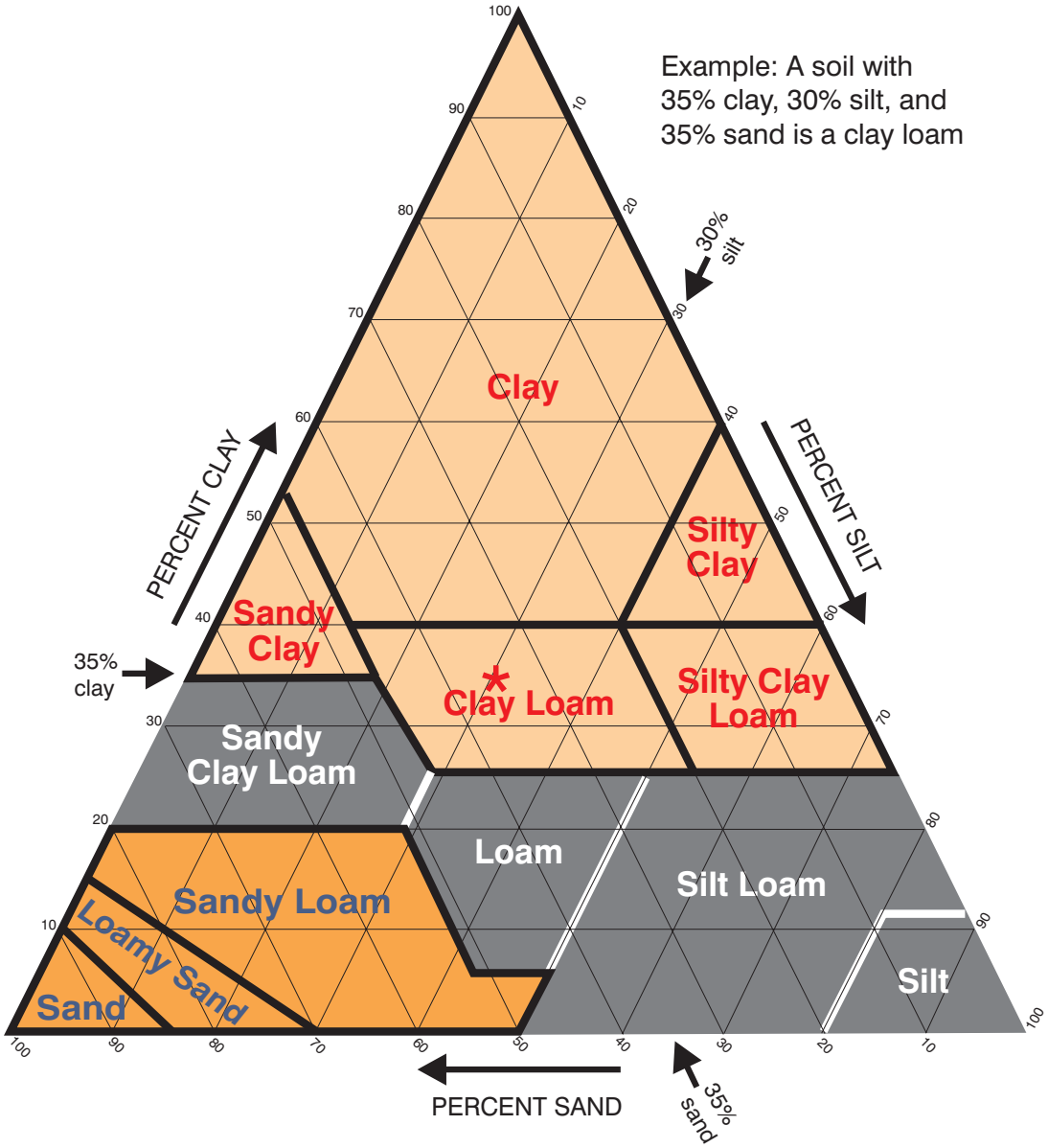
TM: C7–2B

CLASS CHARACTERISTICS OF VARIOUS SOILS

Characteristics	Sand	Silt	Clay
Looseness	Good	Fair	Poor
Air Space	Good	Fair to Good	Poor
Drainage	Good	Fair to Good	Poor
Tendency to Form Clods	Poor	Fair	Good
Ease of Working	Good	Fair to Good	Poor
Moisture Holding Ability	Poor	Fair to Good	Good
Fertility	Poor	Fair to Good	Fair to Good

TM: C7–2C

THE SOIL TEXTURAL TRIANGLE



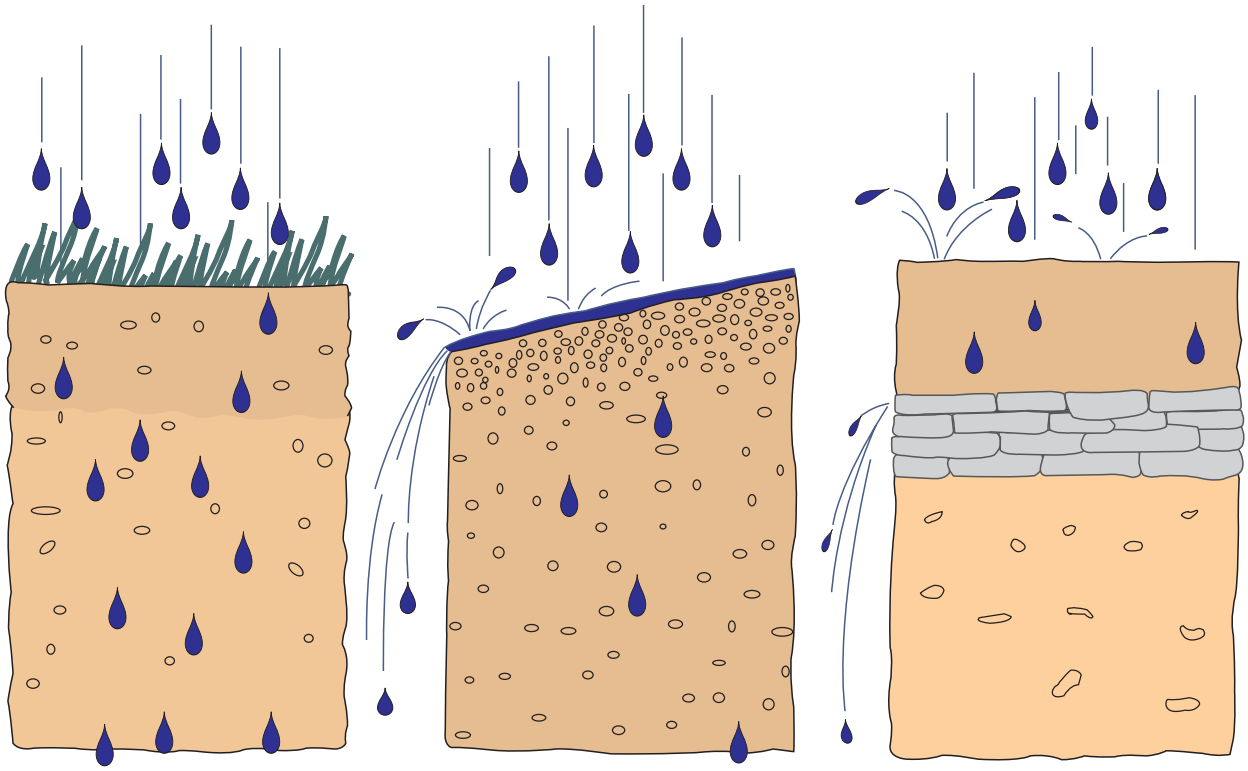
TM: C7–2D

SOIL TEXTURAL CLASSES

Sand	Dry—Loose and single grained; feels gritty. Moist—Will form very easily—crumbled ball. Sand: 85–100%, Silt: 0–15%, Clay 0–10%
Loamy Sand	Dry—Silt and clay may mask sand; feels loose, gritty. Moist—Feels gritty; forms easily—crumbled ball; stains fingers slightly. Sand: 70–90%, Silt: 0–30%, Clay: 0–15%
Sandy Loam	Dry—Clods easily broken; sand can be seen and felt. Moist—Moderately gritty; forms ball that can stand careful handling; definitely stains fingers. Sand: 43–85%, Silt: 0–50%, Clay: 0–20%
Loam	Dry—Clods moderately difficult to break; somewhat gritty. Moist—Neither very gritty nor very smooth; forms a ball; stains fingers. Sand: 23–52%, Silt: 28–50%, Clay: 7–27%
Silt Loam	Dry—Clods difficult to break; when pulverized feels smooth, soft and floury, shows fingerprints. Moist—Has smooth or slick buttery feel; stains fingers. Sand: 0–50%, Silt: 50–88%, Clay: 0–27%
Clay Loam	Dry—Clods very difficult to break with fingers. Moist—Has slight gritty feel; stains fingers; ribbons fairly well. Sand: 20–45%, Silt: 40–73%, Clay: 27–40%
Silty Clay Loam	Same as above, but very smooth. Sand: 0–20%, Silt: 40–73%, Clay: 27–40%
Sandy Clay Loam	Same as for Clay Loam. Sand: 45–80%, Silt: 0–28%, Clay: 20–35%
Clay	Dry—Clods cannot be broken with fingers without extreme pressure. Moist—Quite plastic and usually sticky when wet; stains fingers. (A silty clay feels smooth, a sandy clay feels gritty.) Sand: 0–45%, Silt: 0–40%, Clay: 40–100%

TM: C7–2E

PERMEABLE SOIL ALLOWS WATER TO INFILTRATE AND PERCOLATE



Soil with high organic matter content and good structure permits water absorption.

Hard-packed surface soil plus impermeable subsoil prevents absorption.

Rock layer prevents water from soaking deeply into soil.

TM: C7–2F

LAND CAPABILITIES