Moisture-Holding Capacity of Soil

Lesson Plan: NRES B2-8

Anticipated Problems

1. What is moisture-holding capacity?
2. What primary factor determines how much moisture a soil can hold?
3. How do you determine the amount of moisture a soil profile can hold?

Terms

- available soil moisture
- available water-holding capacity
- capillary moisture
- gravitational moisture
- hygroscopic moisture
- infiltration
- leaching
- moisture-holding capacity
- percolation
- permeable
- soil moisture tension
- unavailable soil moisture

Moisture-Holding Capacity

- ***Moisture-holding capacity*** is the ability of the soil within a soil profile to retain water.
  - Water accounts for about 25% of an average soil.
  - It occupies part of the pore space in the soil.
  - When it rains, water enters the soil or flows off the soil's surface.

Infiltration & Percolation

- The process of water soaking into the soil is known as ***infiltration***.
- Once water is in the soil, it moves downward in a process known as ***percolation***.

Permeable

- A quality soil allows both kinds of water movement and is said to be ***permeable***. Water in the soil may be one of three types:
  - Gravitational
  - Capillary
  - Hygroscopic

Three Types of Moisture

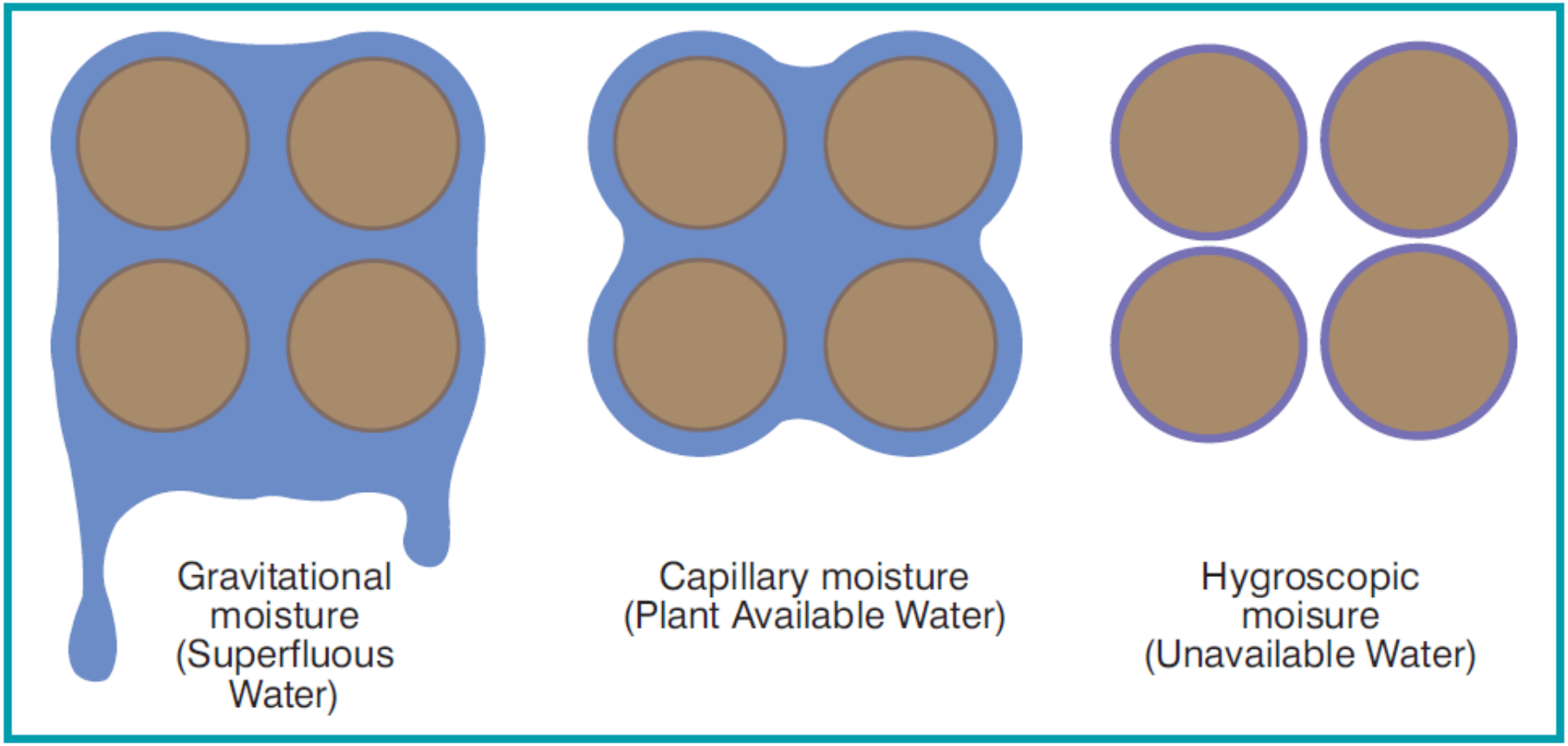
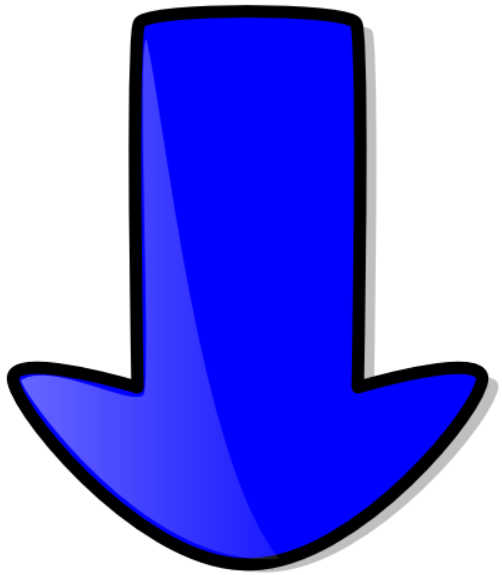


FIGURE 2. Three types of moisture found in soils.

Gravitational Moisture

- ***Gravitational moisture*** is the water that moves downward through the soil as a result of gravity.
  - It may help replenish groundwater supplies.
  - It is also available to plants.

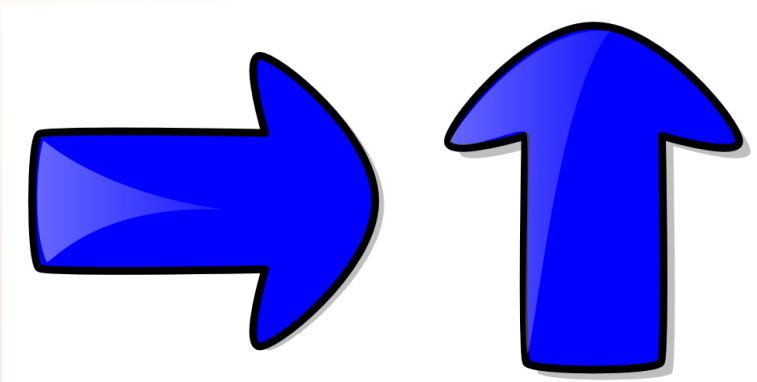


Leaching

- Gravitational water flows quickly through soil that has large pores and slowly through soil that has small pores.
  - As water moves through the soil, it carries dissolved minerals, chemicals, and salts.
  - This loss of water-soluble nutrients, chemicals, and salts from the soil is referred to as ***leaching***.

Capillary Moisture

- ***Capillary moisture*** is the water held within the pore spaces between soil particles against the forces of gravity.
  - It is available to plants.
  - It may move upward or sideways by capillary action.
  - Clay soils hold more capillary water than sandy soils because they have more pore spaces.



Hygroscopic Moisture

- ***Hygroscopic moisture*** is the water that tightly clings to the soil particles.
  - It forms a thin film around individual soil particles.
  - This moisture is usually unavailable to plants.
  - Water may be available or unavailable for plant use.

Available Moisture

- ***Available soil moisture*** is the water in the soil that can be used by plants.
  - When moisture levels are high, plants can easily extract moisture from the soil.
  - As the water is used, soil moisture tension increases. ***Soil moisture tension*** is the force by which soil particles hold on to moisture.

Hygroscopic Moisture

- Hygroscopic moisture has high soil moisture tension. Although the water is present in the soil, it is considered ***unavailable soil moisture*** for plant use.

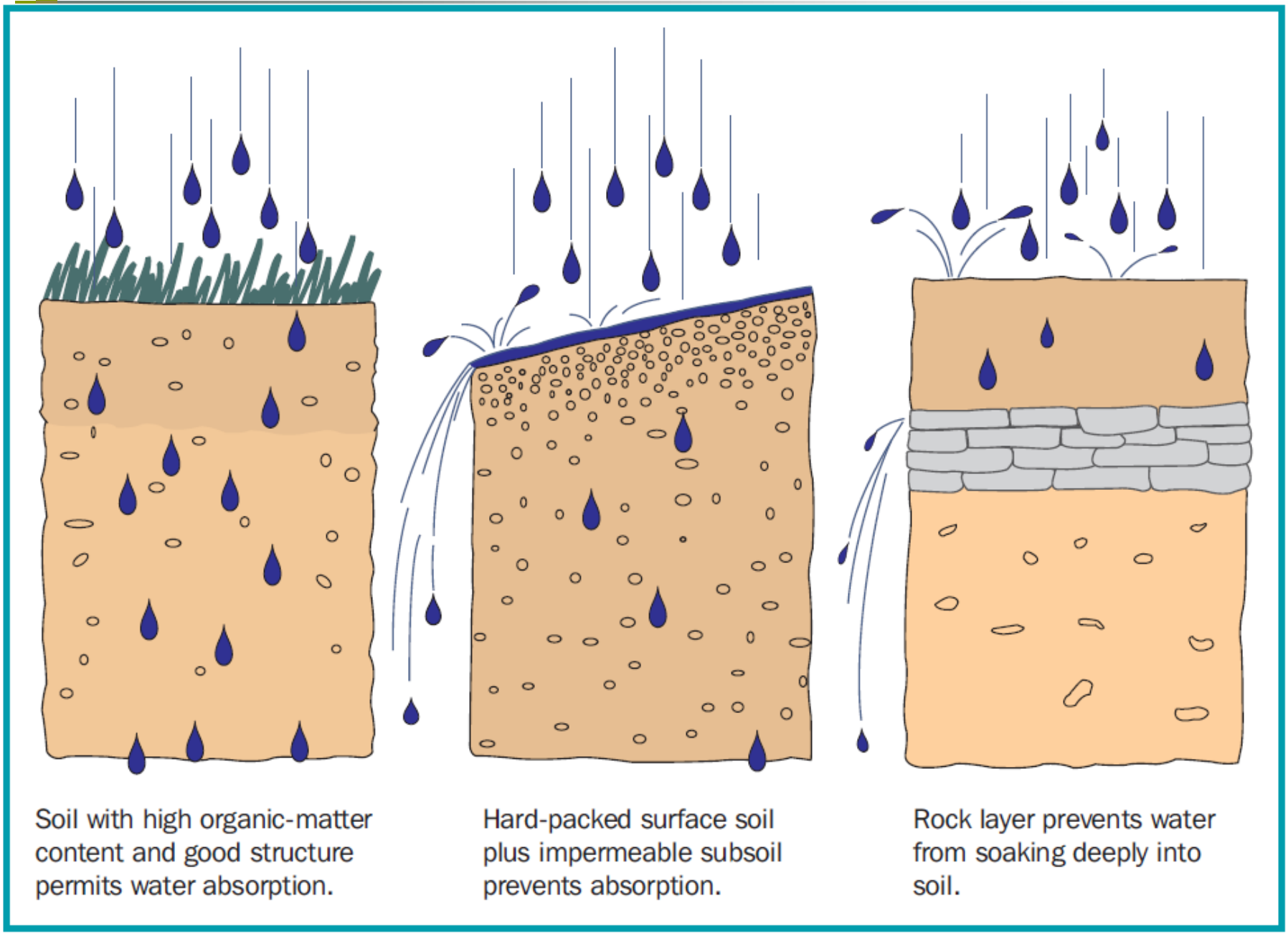


FIGURE 1. Permeable soil allows water to infiltrate and percolate.

How Much Moisture?

- Moisture-holding capacity is determined primarily by the soil's texture.
  - As a rule, the finer the texture of the soil, the more moisture it will hold.
  - A soil with a high percentage of sand holds less water than one with a low percentage of sand.

How Much Moisture?

- Water percolates rapidly through the large pore spaces created by sand.
  - Plants growing in sandy soils experience water stress more quickly than those growing in loam and clay soils.

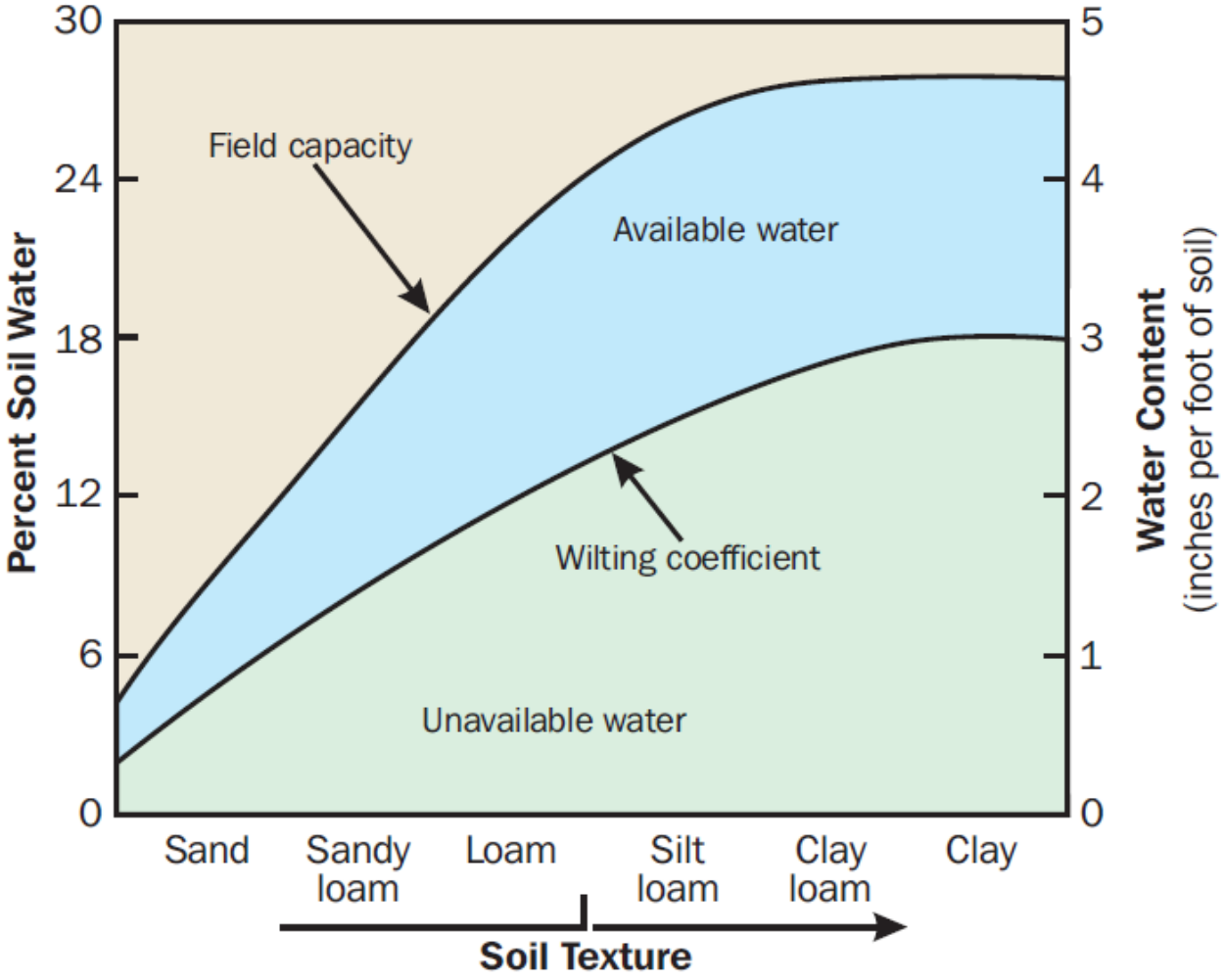
How Much Moisture?

- Soils with a high percentage of clay hold water and keep it from percolating out of the root zone.
  - Some of the water is held too tightly for plant use.
  - This means less water is available to plants than if silt were present.
  - A good silt loam holds the most moisture available for plants.

Available Water-Holding Capacity

- The amount of moisture a soil can hold for plants is referred to as ***available water-holding capacity***.

THE AMOUNTS OF AVAILABLE AND UNAVAILABLE WATER INCREASE AS THE CLAY CONTENT OF SOIL INCREASES



Available Water-Holding Capacity

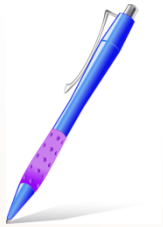
- Available water-holding capacity depends on:
  1. How deep the soil profile is.
  2. The type of soil texture found throughout the soil profile.

Moisture Per Inch of Soil

- On average, each of the following textures will hold the designated amount of moisture per inch of soil:
  - Fine textured—0.20 inches of water
  - Moderately fine textured—0.25 inches of water
  - Medium textured—0.30 inches of water
  - Moderately coarse textured—0.20 inches of water
  - Coarse textured—0.10 inches of water

Calculate Water-Holding Capacity

- To determine the available water-holding capacity for a given area:
  1. Multiply the depth of each horizon, to a maximum depth of 60 inches, by the amount of water the texture within that horizon can hold
  2. Add the totals of all the horizons to calculate total water-holding capacity.



Review

- What is term for the process of water soaking into the soil?
- What are the three types of moisture in soil?
- What is the primary factor that determines moisture-holding capacity of soil?