Lesson A1–3

Understanding Environmental Impacts of Horticulture

Unit A. Horticultural Science

Problem Area 1. Exploring the Horticulture Industry

Lesson 3. Understanding Environmental Impacts of Horticulture

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-A:** Analyze and evaluate nutritional requirements and environmental conditions to develop and implement a fertilization plan.

Performance Standard: **4.** Determine the environmental factors that influence and optimize plant growth.

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

1. Explain environment and issues related to the environment.
2. Explain how horticulture is beneficial to the environment.
3. Explain how horticulture can damage the environment.
4. Identify how natural resources can be affected by horticultural practices.
5. Identify how chemicals used in horticulture can affect the environment.

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:

Schroeder, Charles B., et al. *Introduction to Horticulture*, Third Edition. Danville, Illinois: Interstate Publishers, Inc., 2000.

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

Biondo, Ronald J. and Jasper S. Lee. *Introduction to Plant and Soil Science and Technology,* Second Edition. Danville, Illinois: Interstate Publishers, Inc., 2003.

Morgan, Elizabeth M., et al. *AgriScience Explorations,* Second Edition. Danville, Illinois: Interstate Publishers, Inc., 2000.

List of Equipment, Tools, Supplies, and Facilities

Writing surface
Overhead projector
Transparencies from attached masters
Copies of student lab sheets

Terms.

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

Abiotic
Biotic
Condensation
Environment
Eutrophication
Evaporation
Habitat
Hydrologic cycle
Infiltration
Intensive land use
Macroenvironment
Microenvironment
Nitrogen cycle
Nonpoint source pollution
Point source pollution
Pollution
Precipitation
Transpiration
Wetlands
Wildlife

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.

Begin the lesson by having the students brainstorm to come up with a definition for the term environment. Once they've come up with a definition, have them write down a description of their environment. Call on several students to share their description with the class.

Summary of Content and Teaching Strategies

Objective 1: Explain environment and issues related to the environment.

Anticipated Problem: What is the environment and what are issues related to the environment?

I. An organism's ***environment*** is made up of those factors that affect its life.

   A. Environments are made up of living, ***biotic***, and ***abiotic***, or nonliving things. Proper horticultural practices can help improve a plant's macroenvironment and microenvironment. A ***macroenvironment*** is the large atmosphere around a plant and the ***microenvironment*** is the area immediately surrounding a plant.

   B. Public demand for a high quality product, growers concerned over how to produce a high quality product at a low cost, and environmental concern have resulted in many emotional environmental issues.

      1. ***Intensive land use*** involves using production practices on large fields to get top yields. These practices can greatly affect the natural resources in an area by altering the natural environment.
      2. The use of integrated pest management is a biological control method used to fight pests. Integrated pest management (IPM) is beneficial for the environment. IPM is a strategy that uses a combination of measures to reduce pest damage with the least disruption to the environment.
      3. Biotechnology and genetic engineering have been used to help produce new plant varieties and improve others. People are concerned with the environmental impact of these genetically altered plants.

Review the activity from the interest approach. To help students better understand this objective have them consider their micro- and macroenvironments. They should also identify the biotic and abiotic elements of their environments. TM: A1–3A highlights issues related to the environment.

Objective 2: Explain how horticulture is beneficial to the environment.

Anticipated Problem: How is horticulture beneficial to the environment?

II. Horticulture is beneficial to the environment in many ways. Its benefits can be both personal and biological.

A. Plants can be used for personal benefit in recreational settings such as golf courses and public parks.

B. Biological benefits of horticulture include the use of plant parts to help prevent erosion, slow water runoff, absorb pollutants, control dust, and provide wildlife habitat.

C. Landscaping can also help improve the value of real estate by increasing the beauty of an area.

At this point show the class pictures of landscaped areas. Have students identify how each is beneficial to the environment. TM: A1–3B highlights examples of horticulture's benefits to the environment.

Objective 3: Explain how horticulture can damage the environment.

Anticipated Problem: How can horticulture damage the environment?

III. Many horticultural practices require the disruption of the earth and the application of chemicals. If not applied as directed, these chemicals are considered pollutants. Pollution is a hazard of horticultural practices.

A. These practices, and others, can cause harm to the environment if not practiced carefully. Improper management and excessive or improper use of chemicals or water supplies are examples of ways horticulture can damage the environment.

B. ***Pollution*** occurs when harmful or degrading materials get into the environment. Pollution can be from point or nonpoint sources.

1. ***Point source pollution*** comes from sources that are easily identified such as large factories. This type of pollution is easier to control than nonpoint source pollution.
2. Nonpoint source pollution is more difficult to control. ***Nonpoint source pollution*** can come from few to many different sources. This type of pollution can occur naturally with rainfall or as a result of human activity such as pesticide poisoning in aquatic animals.

Identify examples of point source and nonpoint source pollution that results from businesses in your community. Review TM: A1–3C to reinforce the definitions of pollution discussed in the objective. To help students further master this objective, reinforce classroom discussion with text readings.

Objective 4: Identify how natural resources can be affected by horticultural practices.

Anticipated Problem: How can natural resources be affected by horticultural practices?

IV. Water resources, wetlands, and wildlife are all natural resources that can be affected by horticultural practices. These affects can be adverse or beneficial.

A. Water resources are essential to the environment, water is essential for all living things. When water is used, nature has its way of restoring it. The hydrologic cycle and infiltration are two ways nature restores water.

1. The ***hydrologic cycle*** is the way water flows through the environment. Water moves through a series of processes including: ***precipitation***, water deposited on the earth in the form of rain or snow; ***evaporation***, the process of changing from a liquid to a vapor while passing through the air; ***transpiration***, movement of water in vapor form; and ***condensation***, change of water from a vapor to a liquid. Major sources of water in the hydrologic cycle are oceans, lakes, rivers, streams, groundwater, and reservoirs.
2. ***Infiltration*** is the movement of water through the soil. Proper land management practices in horticulture can affect both the quantity and quality of water that will eventually become ground water.

B. Wetlands are an important part of the hydrologic cycle. ***Wetlands*** include swamps, bogs, marshes, mores, ponds, or other places where water stands.

1. Wetlands are areas protected by law and plans are being made or are in place to restore or enhance most wetlands. Wetlands are essential to the environment in flood control, wildlife habitat, and shoreline erosion control. It is important to maintain wetlands when using horticultural practices.
2. Wetland ecosystems can also be used to enhance an environment. They can be used for recreation such as fishing and hunting, or provide beauty and comfort for people to enjoy.

C. Wildlife habitats can also be threatened by horticultural practices. ***Wildlife*** can be defined as plants or animals that are not domesticated. With planning, it is possible to create areas for wildlife to live. ***Habitat*** is the place where wildlife lives in nature. Habitats can be natural, such as a forest or wetland, or man-made, such as a golf course or parks.

1. To reduce chemical hazards to wildlife, it is important to understand their habits. Applications should be made when it will cause the least harm to wildlife.
2. It is also important to use the correct pesticide formulations. Granular formulations can be especially dangerous to birds.

To help students better understand the hydrologic cycle show TM: A1–3D during the discussion. Point out each step of the cycle as it is being defined. Refer to Introduction to Horticulture to reinforce this objective.

Objective 5: Identify how chemicals used in horticulture can affect the environment.

Anticipated Problem: How can chemicals used in horticulture affect the environment?

V. Fertilizers and pesticides are the two main horticultural chemicals that affect the environment. When used as directed, neither is harmful to humans, plants, animals, or the environment. Used inappropriately, both could be detrimental to living organisms.

A. The use of fertilizers in agriculture has been around since agriculture began. From placing fish remains in seed beds, to spreading animal manure on fields, fertilization is often a necessary process. While fertilizers are sometimes needed, they should be used with care. Using excessive fertilizers is both financially wasteful and harmful to the environment.

1. ***Eutrophication*** is an overabundance of nutrients in lakes or streams, it is caused by excessive fertilizer running off of nearby fields. Eutrophication can be harmful to aquatic life because it depletes the oxygen supply in the water.
2. Most fertilizers are high in nitrogen. When needed and used by plants, nitrogen is not harmful to the environment. The ***nitrogen cycle*** is the circulation of nitrogen throughout the environment. When excess nitrogen is introduced to the nitrogen cycle and mixed with nitrates found in the soil, the result could be an increase in nitrates found in groundwater. This is a major concern to the health of humans who use groundwater as a source for their drinking water.
3. Phosphorus loss through surface runoff is also an environmental concern. Well-placed turfgrass and ground covers can help reduce phosphorus leaching.

A. Pesticides are chemicals used to kill plant and animal pests. When used correctly, pesticides will cause little or no harm. Risk in using pesticides is associated with residues. Pesticide residue has been proven to cause problems such as water contamination, emergence of resistant pest populations, and decline in certain bird populations.

1. To reduce the need for pesticides it is important to keep plants healthy. Healthy plants don't need pesticides, they are able to tolerate low levels of pest population.
2. Pesticides enter the environment in many ways. Some are vaporized, others leach through the soil, and others travel in surface runoff. It is important to use pesticides as specifically directed because they decompose slowly in the environment.

Display TM: A1–3E to reinforce the nitrogen cycle. Lead a discussion on how agricultural chemicals can influence the environment. Discuss some of the practices that have been developed to decrease the impact of agricultural chemicals on the environment.

Review/Summary. Summarize the lesson by reviewing the student learning objectives. The anticipated problems can be used as student review questions. Chapter reviews from the books listed on the resource lists may also be useful.

Application. The following student activities can be used to apply the student learning objectives:

LS: A1–3A—Point and Nonpoint Source Pollution

LS: A1–3B—Understanding Horticulture Issues

Evaluation. Evaluation should be based on student comprehension of the learning objectives. This can be determined using the attached sample written test.

Answers to Sample Test:

Part One: Matching

1. a 2. d 3. e 4. f 5. c 6. b

Part Two: Completion

1. hydrologic
2. wetlands
3. infiltration
4. nitrogen
5. eutrophication

Part Three: Short Answer

The source of nonpoint source pollution is difficult to detect; it can come from few to many sources. Point source pollution comes from sources that are easily identified.

Horticulture is beneficial to the environment for many reasons: plant parts help control erosion, slow water runoff, absorb pollutants, control dust, and provide wildlife habitat.

Answers to LS: A1–3A:

Part One:

A. np
B. np
C. p

Sample Test Name_____

Test

Lesson A1–3: Understanding Environmental Impacts of Horticulture

Part One: Matching

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

a. environment
b. habitat
c. macroenvironment
d. biotic
e. abiotic
f. microenvironment

_____ 1. factors that affect an organism's life
_____ 2. living things
_____ 3. nonliving things
_____ 4. the area immediately surrounding a plant
_____ 5. the large atmosphere around a plant
_____ 6. place where wildlife lives, finds food, and finds protection

Part Two: Completion

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

1. The _____ cycle is the way water flows through the environment.
2. ._____ are areas where water stands, examples include bogs, swamps, and marshes.
3. _____ is the movement of water through the soil.
4. The _____ cycle is the circulation of nitrogen though the environment.
5. _____ is an overabundance of nutrients in lakes or streams.

Part Three: Short Answer

Instructions. Provide information to answer the following questions.

1. Explain the difference between point source pollution and nonpoint source pollution.

2. How is horticulture beneficial to the environment?

TM: A1–3A

ENVIRONMENTAL ISSUES

- Intensive land use
- Integrated pest management
- Biotechnology
- Genetic engineering
- Public demand for a quality product at a lower cost

TM: A1–3B

PERSONAL BENEFITS OF HORTICULTURE

- Provides recreational and aesthetic value
- Increases the value of real estate

BIOLOGICAL BENEFITS OF HORTICULTURE

- Plant roots help prevent soil erosion
- Plants help slow water runoff
- Plants help control dust and absorb pollutants
- Plants provide wildlife habitat

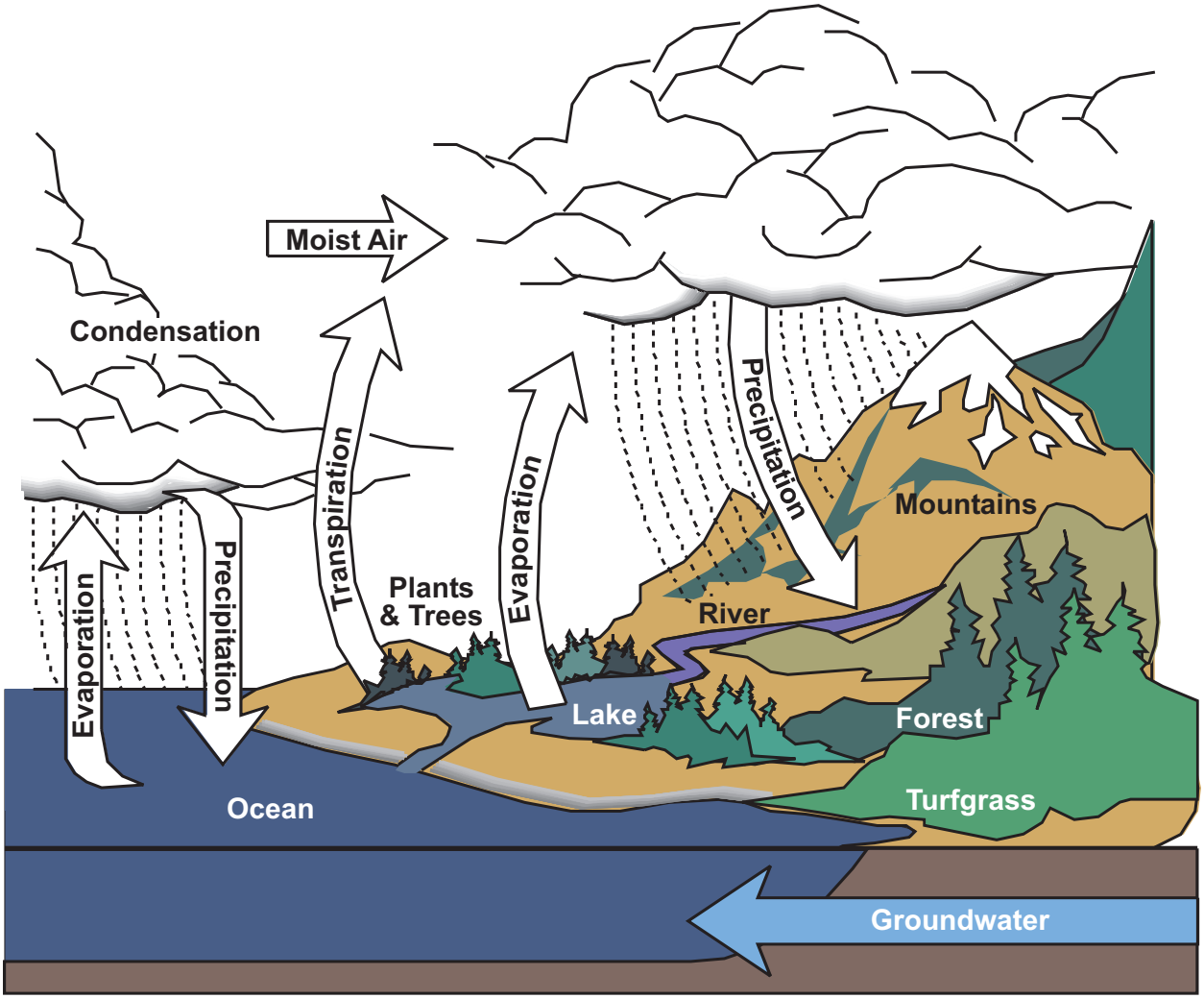
TM: A1–3C

ENVIRONMENTAL DANGERS OF HORTICULTURE

- **Pollution—harm caused to the environment by improperly applied chemicals**
- **Point source pollution—pollution from easily identifiable sources**
- **Nonpoint source pollution—pollution from few to many sources, it is not easily identifiable**

TM: A1–3D

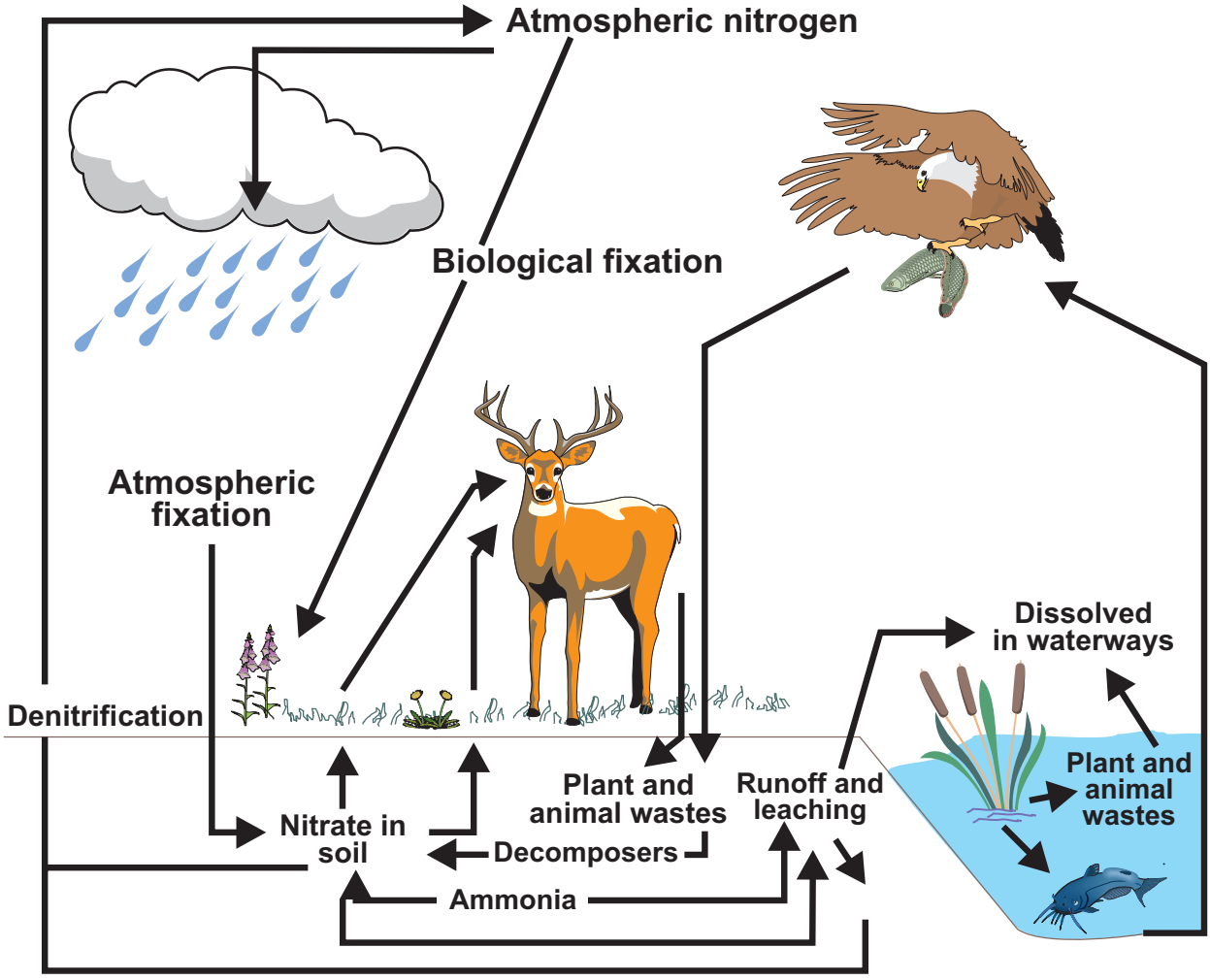
THE HYDROLOGIC CYCLE



(Courtesy, Interstate Publishers, Inc.)

TM: A1–3E

THE NITROGEN CYCLE



(Courtesy, Interstate Publishers, Inc.)

Lab Sheet

Point Source and Nonpoint Source Pollution

Part One: Identify Pollution Sources

Instructions: Read the following passages. Determine whether they're examples of point or nonpoint source pollution. Label p *for point source pollution and* np *for nonpoint source pollution.*

_____ A. A local landscape construction company has been developing a tract of land along a stream bank. As large equipment traveled back and forth, soil eroded into the stream. Aquatic life downstream were injured as a result.

_____ B. A farmer applied pesticides to his wheat crop to eliminate an insect problem. A flock of birds passed and some stopped to eat the wheat. These birds later died.

_____ C. A local lawn maintenance company was found to have been dumping excess company waste water into a local river. Aquatic life was reduced greatly as a result.

Part Two

Instructions: Identify a point and nonpoint source pollution. Write them below.

Point Source Pollution

Nonpoint Source Pollution

LS: A1–3B Name_____

Lab Sheet

Understanding Horticulture Issues

Instructions: In order to better understand the environmental issues related to horticulture, you must first study them. Choose an issue related to horticulture's effect on the environment. Using a variety of resources, write a one to two page paper relating to the issue you chose. Use the space below to site your resources.