CHAPTER 3

Horticulture and the Environment

OBJECTIVES

This chapter is about the important relationships between horticulture and the environment. It has the following objectives:

1. **Explain environment and the issues associated with maintaining a good environment**
2. **Describe how water resources are related to horticulture**
3. **Explain how fertilizers are environmental concerns**
4. **Explain how pesticides pose a threat to the environment**
5. **Describe the relationships between horticultural practices and wildlife**
6. **Explain the relationship of wetlands to horticulture practices**
7. **Describe the role of best management practices**

TERMS

coastal wetland
environment
eutrophication
habitat
hydrologic cycle
infiltration
inland wetland
intensive land use
macroenvironment
microenvironment
nitrogen cycle
nonpoint source pollution
plant environment
point source pollution
pollution
wetland
wildlife





3-1. Our environment is all of the factors that affect life.

PEOPLE want to have a good quality of life; they want to have the things they need to live and enjoy a healthy environment. Horticulture plays a big role in helping people achieve these "wants" by making the earth a better place to live.

Horticulture contributes in many ways to the environment. Plants add beauty, help prevent pollution, and provide oxygen for people and animals. Plants also help conserve and improve the earth's natural resources. Unfortunately, some horticulture practices can create environmental problems. Using pesticides incorrectly can cause pollution, and not using a ground cover can result in soil erosion.

A strong interdependent relationship exists within the environment. Living things depend on other living things and on nonliving features of the environment. The emphasis in horticulture is on living things—primarily living plants!

KEEPING A GOOD ENVIRONMENT

The ***environment*** is composed of all factors that affect the life of living organisms. It is the surroundings of plants and animals—and people! The environment is made of living and nonliving things. The living things are biotic factors, while the nonliving things are abiotic factors.

Plants exist in close association with each other and their environment. Each part of a natural or artificial environment effects the survival and quality of plants. The ***plant environment*** is the above and below ground surroundings of a plant. It consists of related and interacting forces that determine the adaptation and growth of plant species. The large atmosphere above a plant is known as the ***macroenvironment*** and the area immediately surrounding a plant is the ***microenvironment***.

Horticulture improves the environment, but using the wrong horticultural practices can create problems. The benefits of horticulture are primarily from the plants, and the problems are usually created by the methods people employ when using horticulture. For example, litter results when people improperly dispose of wastes; too much pesticide causes pollution; and land left unprotected erodes. Good horticulturists know the proper practices to use to keep the environment safe.

IMPORTANT ISSUES

Today, people are concerned about the environment. Often, their concerns and the approaches to use are not clear cut. This makes it difficult to deal with the issues.



3-2. No space is wasted in this intensively-farmed California lettuce field.

Studying the issues is important. Practices that maintain high quality plants, preserve the environment, and conserve water resources should be followed. Integrated management strategies help assure the least damage to the environment.

Intensive Land Use

Land is often intensively used. ***Intensive land use*** involves using large fields. Production practices are used to get top yields. These

practices change the natural environment of the land. As a result, wildlife habitats may be destroyed, land may erode, or irrigation may deplete water supplies.

Intensive land use issues are not limited to horticulture. Intensive land use applies to grain, other crops, and forests. The practices of intensive land use change the natural processes of the environment. Further, construction has a huge impact on the environment. Streets, building sites, and other features require much land to develop. This development makes big changes in how the land is used.

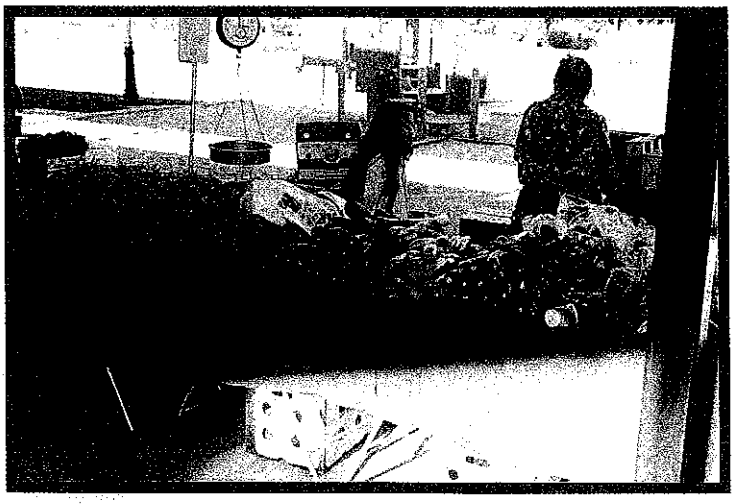
Integrated Pest Management

Integrated pest management (IPM) is using approaches that are environmentally friendly to control pests. It includes biological, mechanical, cultural, genetic, and chemical pest control. IPM reduces the adverse effects of pesticide use on the environment.

The goal of integrated management is to balance effective horticulture systems with good product quality. Costs, benefits, public health, and environmental quality are all considered in IPM. Integrated strategies are also used with water, pests, and nutrient management. These strategies help maintain high quality plants while insuring minimum damage to the environment.

Public Demand

The public demands high quality plant materials. People want attractive homes, businesses, golf courses, sports fields, and parks. People also want fruits and vegetables that are free of insect damage. Meeting these demands requires intense management. Practices must be used that reduce damage to resources and the environment.



3-3. People want plenty of good fruits and vegetables.

Grower Dilemma

Growers are in a dilemma. They must produce quality products at a low cost while also dealing with public concern about the environment.

Large volumes of horticulture products are needed to meet the demands of people. These quantities would be impossible without the use of certain potentially damaging pesticides and other practices. Are people willing to pay higher prices for products grown without pesticides?

Biotechnology

Using biotechnology is an important issue for some people. Genetic engineering has created new kinds of plants. Although these new plants have useful features, some people feel that they are not natural and pose an environmental danger. For example, tomatoes and squash have been genetically altered to achieve certain qualities. Even though these products are of better quality, people are unsure of their impact on the environment.

Emotion

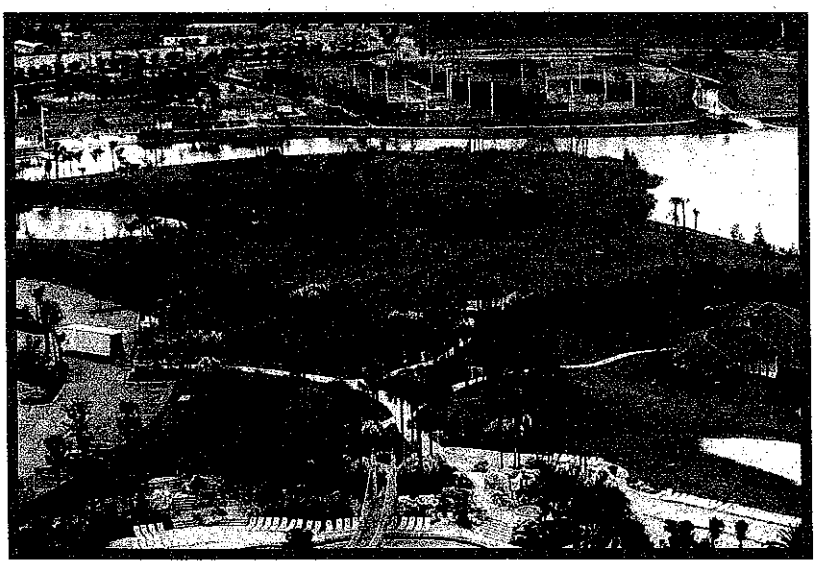
Environmental issues often trigger a lot of emotion. Opinions differ about the use of technology. Soil erosion, contaminated water, and pesticide residues are often emotional issues. Questions about risk and safety are also important.

It is hard for people to make good decisions when emotion is high. Since accurate information helps people make the best decisions, horticulturists need to help provide that information. Helping people understand the issues leads to better choices.

BENEFITS OF HORTICULTURE

Horticulture has many environmental benefits. A few examples are:

- plants have recreational and aesthetic value
- roots, leaves, and stems help control soil erosion



3-4. An attractive golf course is a benefit of horticulture.

- plants absorb atmospheric pollutants
- plants serve as noise and sound buffers
- plants control dust
- plants have a cooling effect on the earth in hot weather
- plants filter fertilizers and pesticides from the environment
- landscaping increases the value of real estate
- plants provide wildlife habitat
- plants increase ground water supply by slowing runoff

Two examples are presented here in more detail.

Maintaining Water Supplies

Turfgrass and groundcover have a big impact on water resources. They hold a large amount of moisture in the upper soil layer. Groundcover reduces runoff and surface soil erosion. Moisture infiltration is increased. Horticultural plants act as filters for pesticides.

Using pesticides properly reduces danger. A good cover of turf "holds" the pesticide and reduces leaching. Only 1 percent of the pesticide used on turfgrass leaches below the zone of the turf. This means that only a very small amount might reach the ground water supply. Other excess pesticide is washed in runoff into streams and lakes, degrading surface water. Always use no more pesticide than recommended.

Maintaining the Atmosphere

Plants help keep the air in good condition. They absorb many contaminants, such as ozone, carbon dioxide, and hydrogen fluoride, without sustaining any damage.

Plants produce oxygen for other forms of life. They filter the air and remove smog components, such as smoke and dust. Plants provide recreational and aesthetic areas in urban landscapes. They also reduce glare and noise.

DANGERS FROM HORTICULTURE PRACTICES

Many kinds of production practices are used in horticulture. Some of these practices have the potential to damage the environment. This damage is caused by the actions of people—not from the horticultural plants themselves. Here are a few examples:



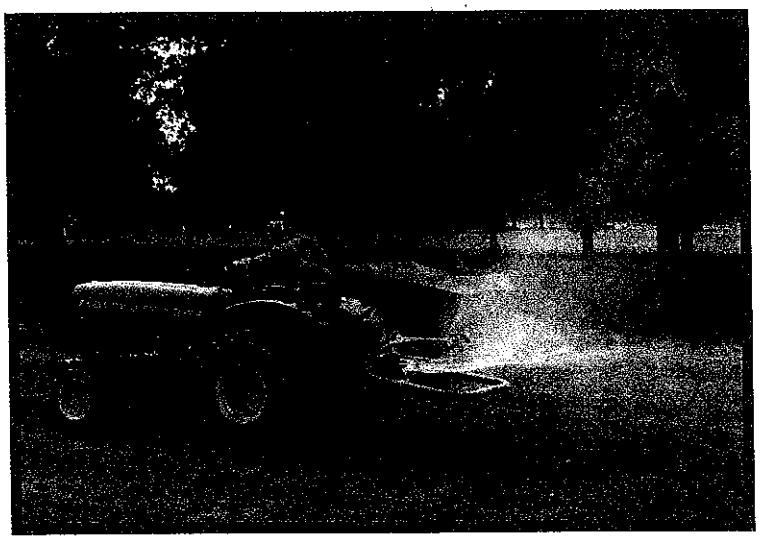
3-5. This land is eroding because of poor practices.

- excessive and improper use of pesticide creates pollution
- improper soil management leads to erosion
- horticulture crops can deplete ground water supplies, particularly if irrigation water is pumped from aquifers
- horticultural wastes may be improperly disposed of and create pollution, such as those from a vegetable processing plant

POLLUTION AND ENVIRONMENTAL DAMAGE

Pollution occurs when harmful or degrading materials get into the environment. People are aware of the possible environmental harm that some pesticides can cause, but they are often not as aware of other ways the environment is degraded or made less desirable.

Pollution comes from two sources: point and nonpoint. ***Point source pollution*** comes from sources that can be readily identified. For example, waste water from a steel mill is point pollution. Both sources are important, but nonpoint source pollution is the most difficult to control.



3-6. If not properly used, fertilizer could damage the water supply through runoff and leaching.

Nonpoint Source Pollution

Nonpoint source pollution comes from many sources that cannot be specifically identified. Nonpoint sources are diffused in origin, time, and points of discharge. They may relate to climatic conditions, such as rainfall. They can occur naturally or as the result of human activity.

Nonpoint sources in horticulture include:

- leaching and runoff containing nutrients and pesticides may damage the water supply
- soil erosion and runoff losses of sediment and nutrients during construction and adverse weather conditions damage land and water
- beneficial nontarget soil organisms may be killed by pesticides
- wildlife and aquatic organisms may be affected by pesticides
- use of pesticides results in insects and diseases developing resistance to the pesticides
- excessive use of water for irrigation reduces ground water supplies
- some horticulture practices may disturb wetlands and wildlife habitats

Most environmental concerns in horticulture are from nonpoint sources rather than point sources. The concept of nonpoint source pollution can be used to develop an environmentally-friendly horticulture.

Potential Damage

Some horticulture practices can damage the environment. Construction and maintenance work can lead to contamination of surface and runoff water by sediment and nutrients. Because of this potential damage, erosion control is often used at construction sites.

Pest populations can develop resistance to chemicals. Using pesticides can have negative impacts on nontarget organisms, including plants and animals. Excessive use of water can create shortages. In some cases, wetlands have been developed into other uses. The benefits of the wetland area on the water cycle are lost.

People can follow steps that reduce the potential for damage. The procedures in this book are sensitive to maintaining a good environment.

WATER RESOURCES AND HORTICULTURE

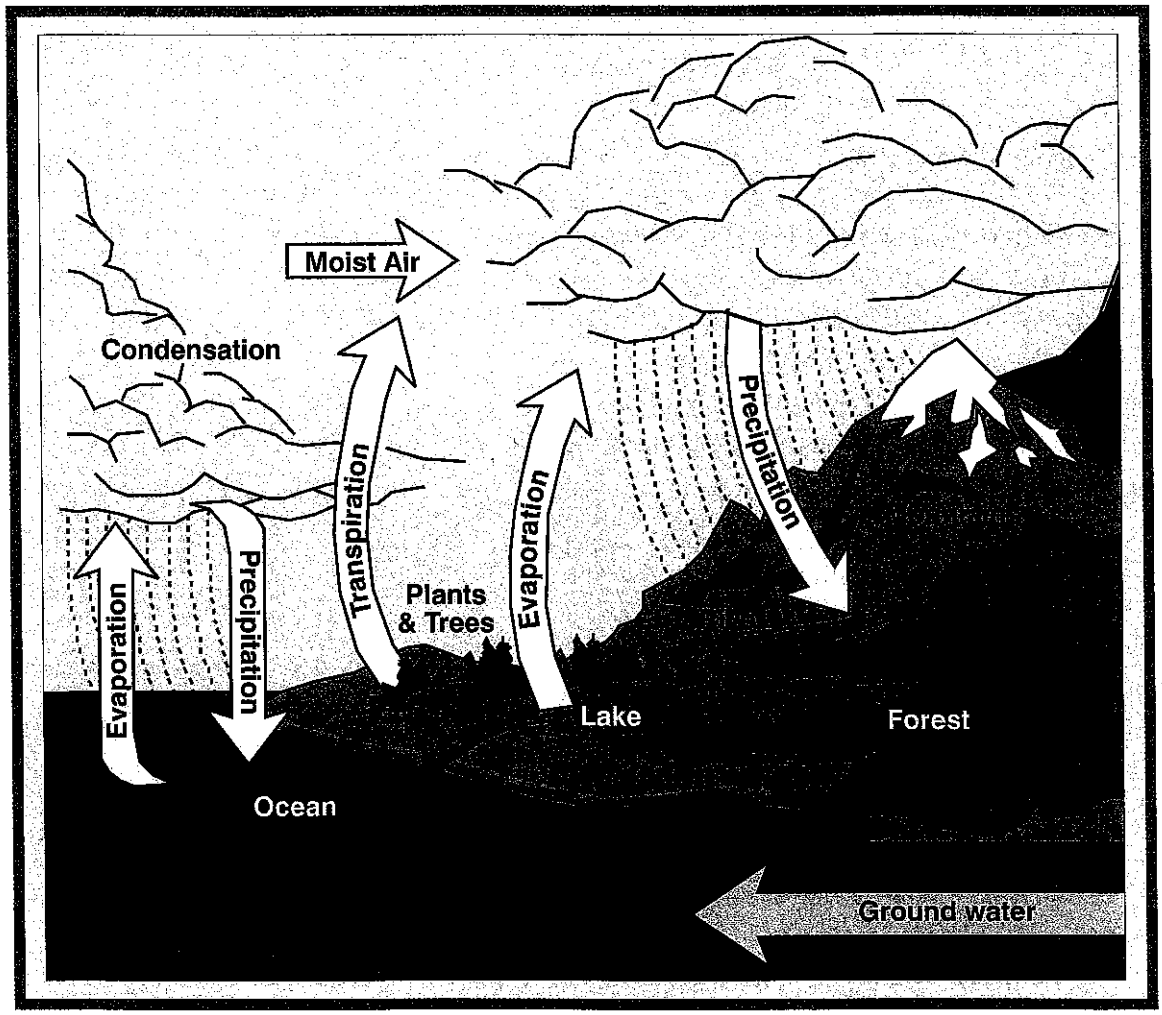
Water is essential for life. It controls the structure and function of ecosystems. The earth has a limited supply of usable water. The amount of water on the earth does not change, only the location and suitability of that water changes. Nature has important ways of restoring water to good condition so it can be reused.

THE HYDROLOGIC CYCLE

The ***hydrologic cycle*** is the cycle of water in the environment. Water moves in a series of processes. Precipitation either goes into the soil or runs off. Plants help hold the water from run off so that it can soak into the soil. As water moves through the soil, impurities are removed from it, and ground water is restored.

The major sources of water are groundwater, streams, rivers, lakes, and reservoirs. These provide water for drinking, irrigation, industrial use, recreation and natural beauty, and transportation.

How water is used is a concern. Industrial development has been shaped by the location of water. Water for irrigation is often needed for horticulture production. Both industry and agriculture expand where the water supply is adequate.



3-7. The hydrologic cycle.

INFILTRATION

Infiltration is the movement of water into the soil. Horticultural practices influence infiltration. Thatch in turfgrass holds water. Black and hydrophobic layers under the turfgrass cause water to run off. Using synthetic materials, such as black plastic in landscape beds, decreases the rate of infiltration. The quantity and quality of water that becomes ground water depends on how the land is managed.

FERTILIZERS AND THE ENVIRONMENT

Fertilizers are often used with horticulture crops. They provide additional nutrients to help plants grow. Some of the fertilizer may be unused. The unused fertilizer may enter water supplies. Water with high nutrient levels changes the natural ecology of streams and lakes.

Fertilizer should be used only as needed. The rate of application should be appropriate. Excessive fertilizer is wasted and can damage water.

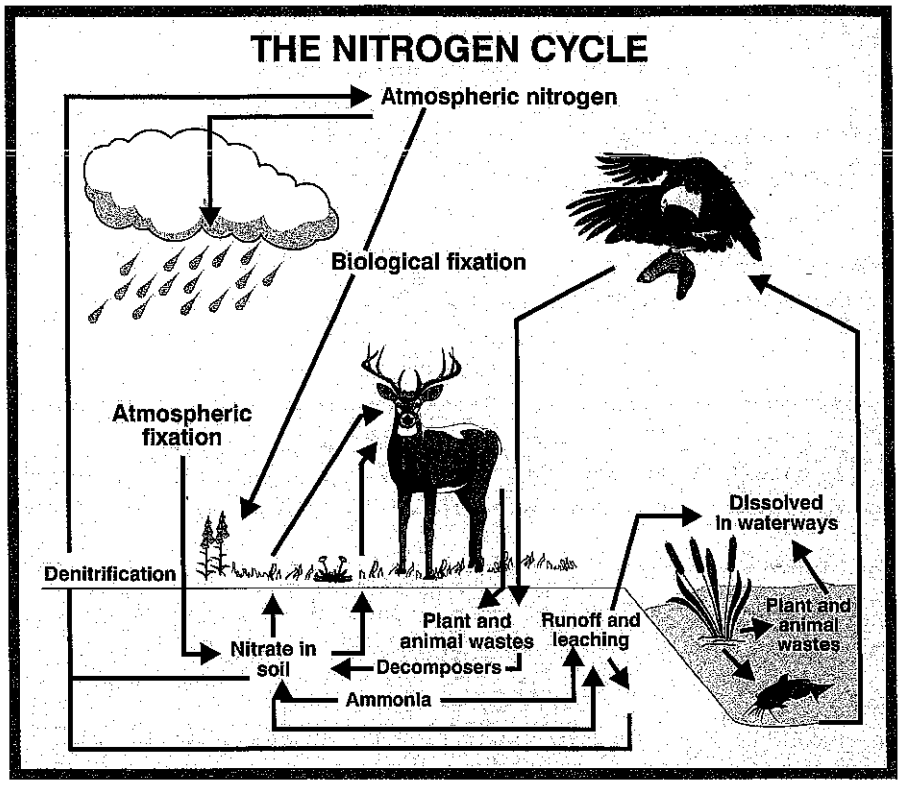
Plants require different amounts of nutrients, with their needs based on the level of management and how they are being grown. Turfgrass on golf greens requires more nutrients than utility turfgrasses on roadsides. An ornamental plant in a high intensity culture requires more nutrients than the same plant in a natural setting.

Eutrophication happens when lakes or streams have too many nutrients. It is caused by excess fertilizer nutrients washing into lakes and streams. This can create problems, such as excessive algae growth, oxygen depletion, and reduced water clarity, for aquatic life. Oxygen depletion can quickly cause the death of fish and other organisms in the water. Using fertilizer properly will help prevent eutrophication.

NITROGEN CYCLE

An important plant nutrient is nitrogen. Fertilizers often contain high amounts of nitrogen. Excess fertilizer that is not used by plants can potentially damage the environment.

The ***nitrogen cycle*** is the circulation of nitrogen in nature. Decaying organic matter is converted to ammonium compounds in the soil. These compounds are converted to nitrates through nitrification as a result of bacteria action. The presence of nitrates in drinking water is a major concern.



3-8. The nitrogen cycle.

PHOSPHORUS LOSSES

Phosphorus is lost by surface runoff. Turfgrasses and groundcovers help stop leaching. Soil texture, amount of percolation, fertilizer rate and timing, irrigation, and rainfall affect leaching.

PESTICIDES AND THE ENVIRONMENT

Pesticides are chemical materials used to kill pests. They are widely used in agriculture, forestry, and horticulture. Pesticides help control weeds, insects, diseases, and other organisms that damage plants. Regardless of the benefits, using pesticides is controversial.

Some pesticides leave residues or small traces of the material behind. These residues have been associated with many environmental problems. Here are a few examples:

- a decline in certain bird populations
- the presence of residues in aquatic ecosystems

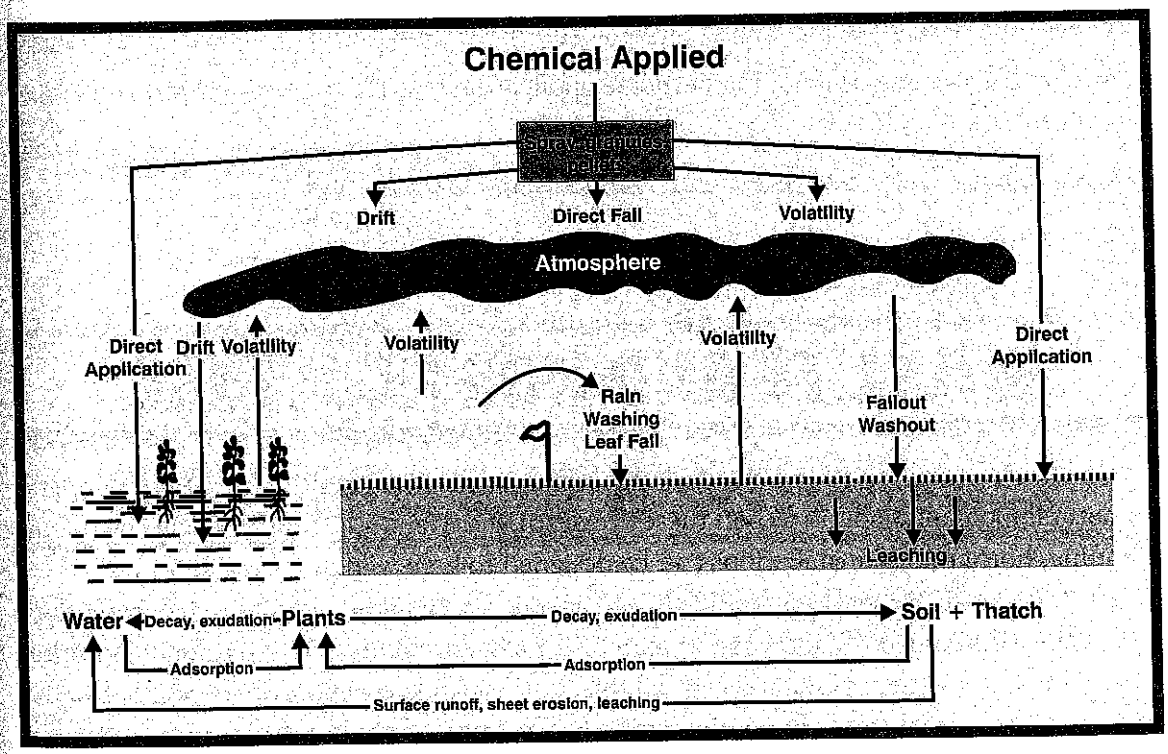
- the possible effects of carcinogens on human health
- residues in the soil
- contamination of water sources
- destruction of nontarget organisms
- advancement of nonpests to pest status
- the emergence of resistant pest populations

HEALTHY PLANTS TOLERATE LOW PEST POPULATIONS

Keeping plants healthy reduces the need for pesticides. Healthy plants can tolerate low-level pest populations and can recover more quickly from pest attacks. With severe pest attacks, however, pesticides may be the only alternative.

HOW PESTICIDES GET INTO THE ENVIRONMENT

Pesticides get into the environment in several ways. After being applied, some pesticides change into vapor and enter the atmosphere. Other pesticides are held in union by the soil



3-9. Fate of chemicals applied to turfgrass.

colloids and thatch. Water can carry pesticides in runoff or when it percolates into the soil. Properly disposing of used pesticide containers prevents materials in the containers from polluting the environment. Decomposition of pesticides often occurs slowly in the environment.

Turfgrasses and groundcovers serve as biotic environmental filters for pesticides. These plant materials hold the pesticide and allow it to degrade. This keeps it from immediately entering the soil or water.

GUIDELINES FOR USING PESTICIDES

General guidelines for using pesticides should be followed. The guidelines are "environmentally friendly management strategies."

Here are several guidelines for using pesticides:

- use only chemicals specifically labeled for application
- properly maintain and operate equipment
- calibrate equipment to insure even applications of intended volumes
- properly dispose of unused chemicals and containers
- use antibacksiphoning devices in chemigation equipment
- plan the rate and time of the pesticide application relative to precipitation and irrigation
- maintain a buffer zone between target areas and surface water
- carefully clean application equipment after use

WILDLIFE AND HORTICULTURE

Wildlife is plant and animal organisms that have not been domesticated. They depend on natural food and habitat. When these are destroyed, the wildlife may not survive. With planning, horticultural installations can be designed to help wildlife.

Habitat is the place where wildlife live in nature. The habitat provides food, protection, and other wildlife needs. Golf courses, parks, grounds, production land buffers, and other areas can offer a variety of habitats for wildlife. Ducks can live in ponds. Songbirds can use trees in horticultural areas. Hummingbirds can be attracted to the flowers in a landscape. Areas that have had horticultural improvements support a wide range of wildlife.

CHEMICAL HAZARDS



3-10. This protected wetland area provides a safe habitat for wildlife.

Wildlife may be exposed to pesticides, fertilizers, and other chemicals. This exposure can come from residues on treated plants and in standing water or wetland areas. In some cases, the wildlife eat chemically-targeted species, such as when a bird eats a poisoned insect. Wildlife also inhale and absorb pesticides. Formulations may have a degree of danger to wildlife. Granular formulations may be picked up and swallowed. Pesticides that are in or on materials wildlife normally eat are especially dangerous. For example, if grain is treated with a pesticide for ants, birds may eat the grain products!

Pesticide applications should be carefully planned. Exposure can be reduced by knowing the activity of various wildlife. Areas that have early morning wildlife activity should be treated later in the day. Areas having nocturnal activity should be treated early in the day. Horticultural areas can be good sources of food, cover, water, space, and nesting habitat for wildlife.

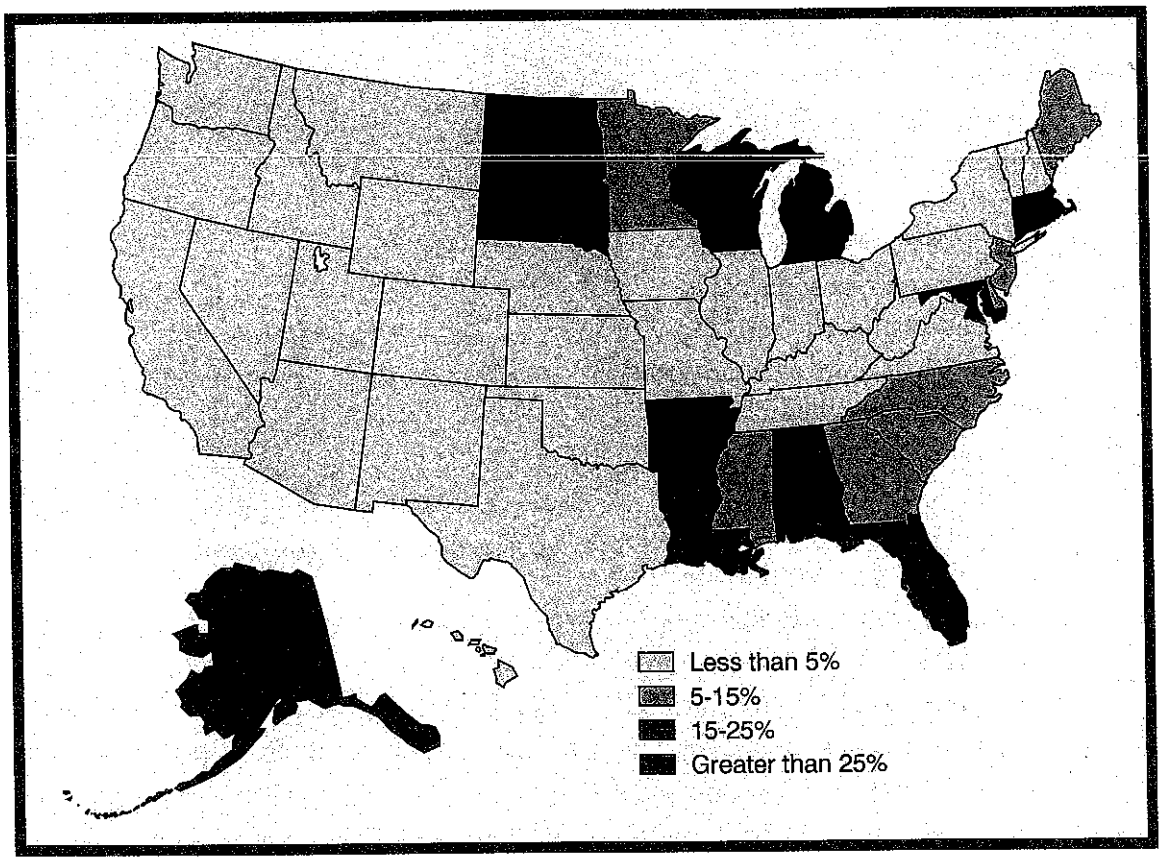
PROJECT INSTALLATION

Projects in or near a wildlife refuge or habitat may run the wildlife away. Allow space for wildlife. Unchanged areas along creeks or in woods provide a safe habitat. Work on one part of a site at a time. This will allow wildlife to move about but remain in the area.

WETLANDS AND HORTICULTURE

Wetlands are swamps, bogs, marshes, mires, ponds, and other places where water often stands. Wetlands are important in the water cycle. Underground water supplies are restored by the actions of wetlands.

Wetlands form between dry uplands and streams or lakes. Wetlands are often difficult to identify because they range from aquatic to terrestrial systems.



3-11. Percentage of land area in states classified as wetland.

Wetlands were once considered to have little value; thus, many wetlands were destroyed for agricultural production and in urban development. However, with a good understanding of ecological processes and environmental values, wetlands are now viewed as a natural resource. Wetlands provide habitat for wildlife, aesthetic and recreational areas, flood control, improvements in water quality, and shoreline erosion control.

Wetlands are divided into two major groups, coastal and inland wetland ecosystems. ***Coastal wetlands*** include tidal salt marshes, tidal freshwater marshes, and mangrove wetlands. ***Inland wetlands*** include freshwater marshes, northern peatlands, southern deepwater swamps, and riparian (stream) wetlands.

WETLAND PROTECTION

Wetlands are now protected by law, and programs to restore previously destroyed wetlands have been established. In some cases, wetland restoration is improving existing

wetlands that have been degraded. Wetlands may be reestablished in areas where they were once located.

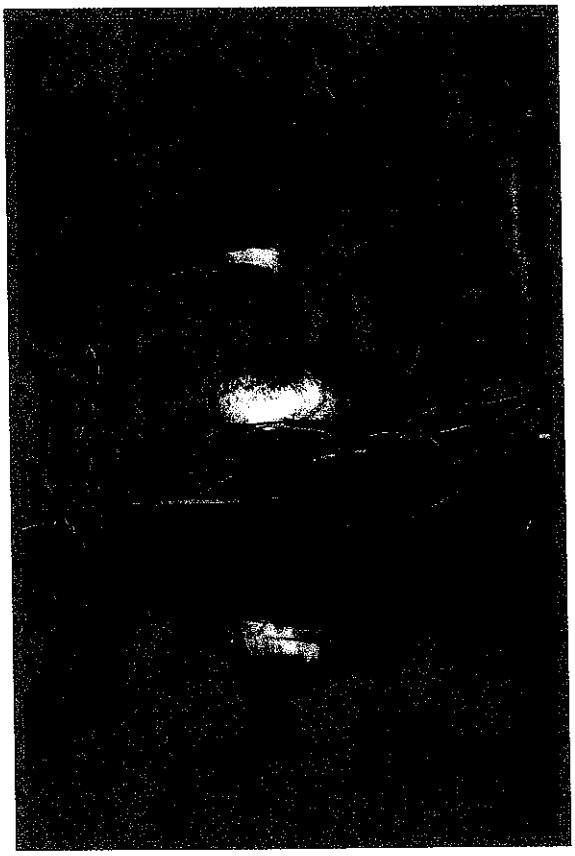
Wetland creation is forming a wetland in an area where wetlands do not naturally occur or have not recently occurred. Wetland enhancement is changing one or more ways the wetland is used.

WETLAND ECOSYSTEMS

Wetlands are diverse and productive ecosystems. They are the habitat for zooplankton, worms, insects, crustaceans, reptiles, amphibians, fish, birds, mammals, and plants.

Wetlands are homes for water wildlife. Waterfowl, such as ducks and geese, are often found in wetlands. Fish and shellfish live in wetland areas. Muskrats, otters, and beavers make wetlands their home. Wetlands located along coastlines, riverbanks, and lakeshores help control erosion. Wetland vegetation protects the shorelines from erosion by waves, tides, storms, and wind. Inland wetlands serve as buffer zones by slowing water flow in rivers.

Rural and urban wetlands are used for recreation. People enjoy fishing, hunting, canoeing, and bird watching. Wetlands also provide excellent aesthetics for urban retreats. People enjoy the wonders of nature.



3-12. Waterfowl use wetlands for habitat.

MAINTAINING WETLANDS

Here are several suggestions for maintaining wetlands when using horticulture practices:

- mow turfgrass with smaller equipment
- limit fertilizer use
- use slow release fertilizers to avoid nutrient buildup
- direct irrigation and drainage systems away from wetlands
- limit pesticide use to minimize effects on nontarget species

- implement an integrated systems approach to management
- establish buffer zones along the perimeter between wetlands and development areas
- store pesticides where leakage would not get into wetlands
- design paths, streets, and parking lots so that storm runoff does not directly enter the wetlands area.

BEST MANAGEMENT PRACTICES (BMPs)

Properly managing water, nutrients, and pests is a must in having high quality plant materials. Reductions in the use of pesticides, fertilizers, and irrigation water are not always economic issues.

The public sometimes feels that pesticides and fertilizers have a negative effect on the environment. People may oppose their use. Although it is often easy to identify the issues, it is much more difficult to find good solutions.

SYSTEMS APPROACH

A systems approach involves a number of decisions. The proper species and cultivar must be selected. Soil management practices must be used. Nutrient levels, irrigation, and drainage must be managed. Integrated pest management is a part of the systems approach.

Conservation of soil, water, and other natural resources is a primary concern. Best management practices are based on economic thresholds, chemical management, and biological controls. The emphasis is on environmentally friendly approaches.

Integrated systems have many areas. People need much information. Site-specific strategies are used with horticulture programs. Realistic uses are made of cultural practices, water, and nutrients. Thresholds are set for chemical use. Careful monitoring is used.

UNDERSTANDING NATURAL PROCESSES

Plants and animals have certain needs. Each species has requirements for food, water, shelter, and space. Horticultural activities should be planned so that food, water, and shelter are provided close by so that animals can meet their needs without going very far.

The "edge effect" is when one vegetation type meets another type. The border between a marsh and meadow is an edge. The border between a woods and a nursery is also an edge. The area between a golf hole and a body of water provides an edge effect. The "edge" supports more diversity in wildlife than the pure area.

Best management practices involves three things: a habitat inventory, an animal or resident inventory, and an interspersion analysis. The focus is on optimizing yields or aesthetics while minimizing environmental impacts and promoting environmental stewardship. Such an analysis locates the present habitat and identifies needs for a desired species. This also helps in identifying what is needed to discourage unwanted wildlife. An example of unwanted wildlife is geese leaving their habitat near a golf course and walking on the golf course. The manure they leave reduces the quality and appearance of the golf green, as well as being undesirable to people. A more detailed presentation of best management practices is included in Chapter 8.

REVIEWING

MAIN IDEAS

Horticulture can help maintain a good environment. Issues are sometimes associated with land use for horticulture. Many of these issues are not horticulture specific. Intensive management of land for crops, forests, and urbanization impact the environment. The use of integrated management systems reduces environmental impact. Pest control measures include biological, mechanical, cultural, and chemical.

The public wants high quality plant materials. This includes golf courses, sports fields, parks, and residential sites. As a result of this demand, a production intensity must be used to assure that people get what they want.

Horticulture systems offer considerable environmental benefits. Benefits include erosion control, chemical filters, dust control, wind control, cooling effects, noise reduction, desirable wildlife habitat, and appreciation of real estate value.

The management of water, nutrients, and pests is important in having high quality plant materials. Reducing the use of pesticides, fertilizers, and irrigation water are not always economic issues. Using natural conditions can help control pests. Natural repellents in plants, insect-eating birds, toads, frogs, and other wildlife can help control pests.

QUESTIONS

Answer the following questions using complete sentences and correct spelling.

1. What is the environment and why is it important to people?
2. Why are growers in a dilemma? Explain.
3. What are the benefits of horticulture to the environment?
4. What are the major dangers to the environment from horticultural practices?
5. What is pollution? What is nonpoint source pollution?
6. How does horticulture impact the water cycle and infiltration?
7. What is eutrophication? Why is it important?
8. What are pesticides? Why are they used? What can be done to reduce reliance on pesticides?
9. What are wetlands? How does horticulture relate to wetlands?
10. What is integrated pest management? What is best management practices?

EXPLORING

1. With the assistance of your teacher or county extension agent as resource people, select a turfgrass or horticultural area in your community for study. Identify the management issues that currently impact the environmental quality on that site and the surrounding areas. Place these issues in order of priority based on local community laws and standards. Decide what issues might surface in the next five to ten years. How similar are these lists and how do they differ? Why?

2. Select a wetlands area in your community and conduct an in-depth study of a representative sample of the site. Conduct an integrated resource management study. What impact does the surrounding land use have on the environmental quality of the wetlands? Is there a buffer zone surrounding the wetlands, and did you observe the "edge effect?" Explain your findings. Use your teacher and the local county extension agent as resource people.