

CHAPTER

4

The Horticulture Industry

Chapter Outcomes

After studying this chapter, you will be able to:

- Describe the plant sciences: botany, agronomy, horticulture, and forestry.
- Compare and contrast edible and ornamental horticulture.
- Understand organic and sustainable production of crops.
- Discover sources for locally grown food.
- Describe the green industry.
- Discuss the outlook for horticulture careers and list horticultural organizations.

Words to Know

agronomist	green industry	perennial
agronomy	hardscape	plant science
balled-and-burlapped (B&B)	high-density orchard	pomologist
bare root (BR)	horticulture	pomology
botanist	horticulturist	postharvest
botany	integrated pest	pot-in-pot (PNP)
bramble	management (IPM)	propagate
community supported	interior	senescence
agriculture (CSA)	interiorscape	silviculture
enologist	interiorscaper	sod
ethylene	interior	sustainable agriculture
evapotranspiration	scaping	tree plot
floriculture	locavore	turfgrass
forest stand	nursery	vegetative
forester	nursery and landscape	viniculture
forestry	industry	viticulture
geocarpy	olericulture	viticulturist
	organic food	
	ornamental horticulture	

Before You Read

Look at the *Words to Know* list above. Write definitions for the words you know. Put the words you cannot define into a separate list. Skim through the chapter and write down the topics that you think you might know well, and those that you do not know much about. Once you are finished, pair up with another student and share your lists.

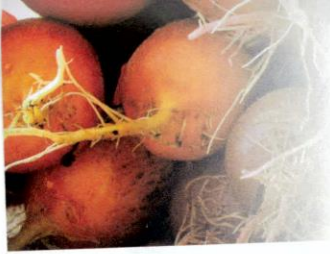


While studying this chapter, look for the activity icon  to:

- **Practice** vocabulary terms with Words to Know activities.
- **Expand** learning with identification activities.
- **Reinforce** what you learn by completing Know and Understand questions.

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everything from flowers to potatoes to apples. Horticulturists grow plants for food and some for landscaping or other aesthetic purposes. Horticulturists nurture plants in homes, businesses, gardens, parks, highways, and even laboratories. Wherever you see a plant that is purposefully grown, you can almost bet it has been touched by a horticulturist's green thumb at some point in its development. This chapter will help you understand what horticulture is, who horticulturists are, and what types of horticulture careers are available.



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Figure 4-1. The fresh fruits and vegetables we eat everyday are the “fruits of labor” of people working in the horticulture industry. A horticulturist is responsible for the health of plants and trees as well as the processing and shipping of fruits and vegetables he grows. **Take a moment and think about the foods you ate for breakfast or lunch today. How many people were involved in their production?**

What Is Plant Science?

Horticulturists usually have a background that includes knowledge in various areas of plant science. *Plant science* is the study of plant growth, reproduction, and adaptation as well as the use of plants for food, fiber, and ornamental purposes. Areas of plant science include the following:

- **Botany** is the scientific study of plants, including their structure, genetics, ecology, classification, and economic importance.
- **Agronomy** is the science and technology of cultivating crops for food, fiber, and fuel.
- **Forestry** is the science or practice of planting, managing, restoring, and caring for forests.
- Horticulture is the science, art, technology, and business of plant cultivation (including fruits, vegetables, flowers, turfgrass, and ornamentals).

Each of the applied plant sciences involves specific education and experiences.

Botany

Botany, or plant biology, is a branch of biology and is known as the foundation of plant science. A **botanist** studies plant sciences and is sometimes called a plant scientist. The science of botany can be traced back to the ancient Greeks and Romans, but it was not until the sixteenth century that it truly began to flourish. This was mainly due to the work of physicians and herbalists who were studying plants to identify those useful in medicine. Training in botany was even part of the medical curriculum.

Throughout history, botanical gardens have been maintained around the world, and they continue to be so today. These gardens are intended for the study of plants and educate visitors about the vast world of plants, their usefulness, and their beauty. Cities such as New York, Atlanta, and St. Louis boast about their premiere botanical gardens that are visited by millions annually.

Agronomy

As stated earlier, agronomy is the science and technology of cultivating crops for food, fiber, and fuel. In agronomy, crops are grown in rows, harvested, and processed. There are many areas of study in agronomy. An *agronomist*, a person who studies or practices cultivating crops for food, fiber, and fuel, may specialize in areas such as:

- Biotechnology.
- Soil science.
- Weed science.
- Plant breeding.

Crop plants that typically cannot be eaten or used in their raw form (soybeans, cotton, tobacco, field corn, rice, and wheat) are included in agronomy.

Forestry

Forestry, the science or practice of planting, managing, restoring, and caring for forests, is also called *silviculture*. *Foresters* are the dedicated people who plant, manage, and care for forests. Foresters craft and conserve forests to sustain the ecosystems while allowing the nondestructive harvest of lumber and tree products. A *forest stand* consists of trees occupying a specific area that are uniform in species, size, age, arrangement, and condition. Foresters manage forest stands using silvicultural practices to meet the objective of a *tree plot* (a carefully measured area of trees). Whether the forest is grown for beauty or to be selectively cut for specific trees and tree products, forests and their products provide limitless resources.

Edible and Ornamental Horticulture

As with most fields of study, horticulture includes various specialized sciences and practices, and horticulturists can seek both formal and informal career training. Horticulturists can further their studies and focus in specialty areas through community college, university, fieldwork, and global study-abroad programs, **Figure 4-2.**

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Corner Question

What is a typical forest product that people use when they have a headache or suffer from acne?



Did You Know?

Without the work of agronomists, you may have never had a favorite pair of jeans, peanut butter and jelly sandwiches, or rice in your Chinese take-out food. The next time you enjoy a bowl of cereal or munch on potato chips, remember to thank an agronomist.



xuanhuongho/Shutterstock.com

Figure 4-2. Flowers are cultivated around the world for use in medicine, food, and floriculture. **If you were a horticulturist based in the United States, how could you benefit from traveling and studying horticulture in places such as this garden in Vietnam?**

Corner Question

People have always linked the affinity for growing plants to having a “green thumb.” Where did this term originate?

Horticulturists often specialize in either edible or ornamental horticulture. Edible horticulture includes olericulture, pomology, and viticulture, while ornamental horticulture includes floriculture, nursery and landscape production, interiorscaping, and turfgrass management. These areas of horticulture are explained in the following sections.

Olericulture

Olericulture is the science, cultivation, processing, storage, and marketing of herbs and vegetables. People who grow herbs and vegetables are olericulturists.



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Figure 4-3. Thai basil is a delightful addition to many dishes. It is grown by olericulturists. How many types of basil can you find at local nurseries or farmers markets?

Herbs

Herbs are the *vegetative* parts of the plant (roots, stems, and leaves) harvested for flavorings, foods, perfumes, or medicines. Botanists and horticulturists may also refer to an herb as an herbaceous plant. In the culinary world, herbs are referred to as spices. Although chefs often use the seeds of these plants and consider them herbs, a true herb is only the root, stem, or leaf of a plant.

Herbs have been cultivated for both medicinal and culinary purposes since the dawn of gardening. They were typically grown outdoors and dried for later use. Today, many people grow herbs in planters and on windowsills as well as in outdoor gardens for easy access to fresh herbs for their tea or coffee and for cooking. Lavender, parsley, chives, chicory, cilantro, lemongrass, oregano, and basil are some of the most popular herbs cultivated, **Figure 4-3**.

Vegetables

Consider the age-old debate of the tomato: is it a vegetable or a fruit? The answer, it seems, varies by profession. Chefs traditionally consider fruits and vegetables by the course of the meal in which they are eaten. Fruits are typically sweet and eaten as desserts. Vegetables are typically eaten as appetizers, main courses, and side dishes. Thus, for chefs, the tomato may be considered a vegetable. Horticulturists who grow tomatoes for food may also consider them to be a vegetable. However, botanists consider the tomato to be a fruit because it develops from the fertilized ovary of a flower. Botanists also consider squash, pumpkins, cucumbers, peppers, eggplants, and pea pods as fruits whereas most people call them vegetables. As a tomato grower, you may prefer the Supreme Court’s 1893 ruling in favor of vegetable. It all depends on your perspective.

In horticulture, a vegetable can be the roots, stems, leaves, flowers, or fruit of a plant. Therefore, all fruits are vegetables, but not all vegetables are fruits (to further the fruit/vegetable debate). The roots of sweet potatoes, carrots, radishes, and parsnips are harvested for eating raw or for cooking. When you eat celery or asparagus, you are eating the stems of those plants. The leaves of plants such as spinach, lettuce, cabbage, and kale are eaten. With some plants, such as onions, leeks, and shallots, both the stem and

leaves are eaten. The flowers of plants can also be eaten as a vegetable, as is the case with broccoli and cauliflower. Fruits include beans, peas, tomatoes, cucumbers, squash, peppers, and sweet corn.

Vegetable Growers

Vegetable growers should enjoy working outdoors in a variety of conditions. They must be prepared to lead teams of people and have good communication skills. Vegetable growers have the opportunity to provide people with nutritious plants for better health. Growers must make daily choices for plant management. They face many challenges that require critical thinking and problem solving, **Figure 4-4**.



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Figure 4-4. Vegetable growers must make decisions and solve problems related to gardening. **How would you cultivate a garden? What would be your biggest challenge?**

Corner Question

Where did pumpkin pie originate?



Pomology

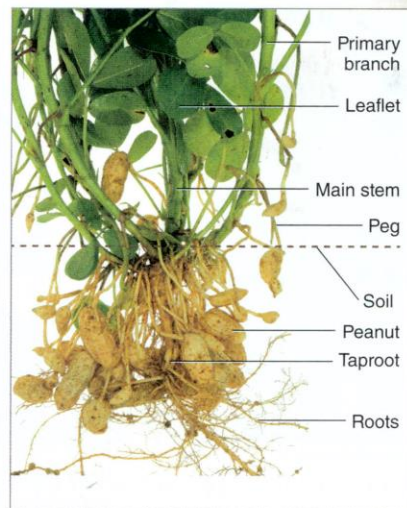
Pomology is the cultivation, processing, storing, and marketing of fruits and nuts. People who work this area are known as *pomologists*. The study, management, and harvest of fruit and nut trees helps feed and medicate people around the world. Fruit from trees such as those in the citrus family (grapefruit, tangerine, and oranges) provide the vitamin C used to help ward off sickness and disease such as the common cold.

STEM Connection

Peanuts

How does a fruit grow underground?

Peanuts provide countless products that are used daily by Americans. Peanuts are not true nuts. The peanut is a member of the legume or bean family. *Arachis hypogaea* is the botanical name of the peanut and means "under the earth." This agronomic crop is originally from South America, but it has found a home in the soft soils of the southeastern United States. Peanuts exhibit something called **geocarpny** (a rare means of plant reproduction). After pollination, the flower stalk elongates and pushes into the ground. Where each plant stem touches the soil, a nodule (or peanut) forms. The mature fruit, now called a legume, is nestled in the soil waiting for harvest. **How many peanuts would it take to make one jar of peanut butter?**



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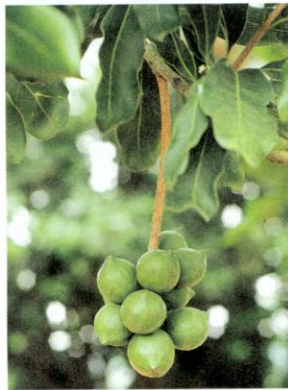
Thinking Green

Espalier Fruit Fencing

A pomologist can create a living fence through the intensive pruning and training techniques known as espalier. This vertical and interlinked growth of fruit trees can provide borders or privacy screens and edible fruit.



Irina Fischer/Shutterstock.com



A joloel/Shutterstock.com



B Franck Boston/Shutterstock.com

Figure 4-5. Macadamia nuts (A) are native to Australia but are grown for commercial purposes mainly in Hawaii. Almonds (B) are native to the Middle East and South Asia. **Where else do these trees grow around the world? Are the nuts expensive? Where do other nut trees grow?**

Almond, pecan, pistachio, and macadamia nut trees produce fruits that provide essential fats and proteins. Pomology also includes the cultivation of fruits that grow on prickly, rambling vines or shrubs called **brambles** (boysenberries, loganberries, raspberries, and blackberries), and smaller, fruit-bearing plants such as blueberries and strawberries. Regardless of whether fruit grows on the ground or up high in a tree, all fruits offer benefits for horticulturists and consumers alike.

Growing Practices

The tree fruit and nut industry is feeding a growing population and meeting this goal through scientific research and application. For instance, apple trees and orchards are managed quite differently today than they were 20 years ago. A **high-density orchard** is a fruit tree orchard with between 150 and 180 trees per acre that bears fruit within 2 to 3 years of planting. Many traditional orchards have been converted to high-density orchards, growing almost four times the number of trees in traditional orchards. Trees may also yield increased harvests with earlier and better quality fruit. In order to feed 9 billion people in 2050, practices similar to high-density orchards must be applied to other crops in pomology and further scientific study must be pursued.

Fruit and Nut Growers

Fruit and nut growers, or pomologists, must be physically fit because the work requires a great deal of physical labor. Head growers manage crops and lead other workers. Pomologists must keep up to date with current research and be excellent recordkeepers. They must decide how best to cultivate their fruits, **Figure 4-5**. Fruits require intense pesticide spray programs or other means of pest management.

Viticulture

Viticulture, sometimes called **viniculture**, is the cultivation of grapes to be eaten fresh and to be used for making juices, raisins, jams, jellies, and wines. Grapes are cultivated by **viticulturists**, then marketed, processed, and stored. Viticulturists must pay close attention to pruning and training grape vines, properly fertilizing soils, and managing pest populations. **Enologists** are people who use grapes to make wine using chemistry and food science knowledge.

Grape Cultivation

Today, grapes grow all over the world and in nearly every state of the United States. In 2012, more than 7 million tons of grapes were harvested in the United States; nearly 90% were from California alone. Grape cultivation is also strong in Michigan, New York, Virginia, Pennsylvania, and Arkansas. Since people have realized the many health benefits associated with grapes and grape products, the demand for this crop has skyrocketed. Grape cultivation has greater yield and value than many other horticultural crops. The future of grape production promises strong economic returns.

Viticulturists

Grape vines are a complex crop that requires a great deal of study and attention. A viticulturist usually has a college degree or some formal training of grape cultivation. Viticulturists must work outdoors and lead or work with a team of growers, **Figure 4-6**. The work can be strenuous, and critical thinking and problem-solving skills are very important. Viticulturists are rewarded for their efforts with delicious fruit and the opportunity to work in beautiful outdoor settings.

Floriculture

Floriculture is the study, cultivation, and marketing of flowers and ornamental plants. It may also be referred to as *ornamental horticulture* because it includes the creative and decorative aspects of horticulture. Careers that fall under floriculture include buyers, growers, floral designers, florists, interiorscape designers, product developers, wholesalers, brokers, and greenhouse owners and employees, **Figure 4-7**.

Because of the wide range of the floriculture field, people who work in floriculture may or may not be involved with each aspect of the industry. For example, florists who specialize in weddings most likely do not grow the flowers and plants they use in their designs. They probably order from local wholesalers who, in turn, order from local, national, or international growers and brokers. It may seem that a floral designer does not need to know details about growing flowers or ornamental plants. However, many designers do have extensive knowledge about plant morphology, breeding, harvesting, and handling practices. This knowledge helps them make wise choices in designing and purchasing materials for their work.

Did You Know?

Grape seeds are a by-product of grape processing and quite useful. The grape seed oil (extracted by crushing the seeds) is used to create products for cosmetics, medicines, and healthy cooking.



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Figure 4-6. A viticulturist picks ripe grapes ready for juice making.



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Figure 4-7. This beautiful wedding bouquet was created by a florist. How much time passes between the harvest of cut flowers and the day of an event?

Plants cultivated for floriculture include bedding plants, houseplants, potted or container plants, and cut flowers and foliage. Many of the plants and flowers are grown to fill seasonal and holiday demands. For example, florists have three mainstay holidays: Valentine's Day, Mother's Day, and Christmas. The primary flowers and plants used for these holidays are:

- Red roses for Valentine's Day.
- Corsages, standard arrangements, dish gardens, container arrangements, and flowering plants for Mother's Day.
- Poinsettias and evergreens for Christmas.

Other popular holiday plants include lilies for Easter and chrysanthemums for both spring and fall decorating. These plants are often sold in pots for the garden or in mixed containers for use on a porch or patio.

Nursery and Landscape Industry

The *nursery and landscape industry* cultivates and arranges outdoor plant materials to create spaces that are inviting, beautiful, and useful to people and the ecosystem. There are countless subdivisions and occupational opportunities within this facet of horticulture. The nursery and landscape industry is often referred to as the *green industry*.

Hands-On Horticulture

Postharvest: Physiology and Technology

Horticulturists are always racing to get harvested products to the consumer because from the moment a crop is harvested, it begins to decompose. People who work and study this area of horticulture are in the field of postharvest. **Postharvest** is the cooling, cleaning, sorting, storing, packing, and shipping of produce, flowers, and other plant materials. Because postharvest principles apply to everything from cut flowers in floriculture to apples in pomology, scientists and technologists studying and developing postharvest techniques may work in any of these areas.

The goals of postharvest include preventing spoilage and prolonging shelf life. The methods used to reach these goals vary by product. For example, all harvested crops have optimum storage conditions that include temperature and humidity ranges. Storing crops at less than optimum temperature or humidity ranges will often hasten ripening or degradation.

Some harvested crops cannot be stored together because one may hasten the ripening or **senescence** (biological aging) of the other. This is usually the result of a natural chemical called **ethylene**. Ethylene is a hormone produced and



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emitted in varying quantities by different fruits and vegetables. Ethylene is also emitted by decaying plant materials. Some fruits, vegetables, and flowers are more sensitive to ethylene than others, and care should be taken to know which crops should not be stored together. **Do you know which fruits and vegetables should not be stored together?**

Postharvest goals are also achieved through proper sanitation techniques. These techniques are used to suppress pathogenic exposure and growth and prevent damage that may lead to physical and chemical changes in the product.

Nurseries

A *nursery* is a place where young plants and trees are cultivated for sale and for planting elsewhere. In a nursery, most plants are grown in fields. However, greenhouses and shadehouses are often used when plants and trees are first cultivated from seed or vegetative cuttings (stems, roots, or leaves). Once mature enough, these plants are transplanted in fields and managed to various sizes based upon landscaper and consumer needs.

Plants commonly grown in nurseries include:

- Trees—species that mature to greater than 12' (3.7 m) tall; most often single-stemmed, woody, and *perennial* (returns yearly) plants.
- Shrubs—species that mature usually to less than 12' (3.7 m) tall; multi-stemmed, woody and perennial plants.
- Ground cover—plants that create a mat-like growth that spreads to cover the ground; may be woody or herbaceous (includes ivy, ornamental grasses, and vinca).
- Vines—plants that climb other plants, structures, or buildings; may be woody or herbaceous and usually need a support.
- Perennials—flowering or foliage plants of various types (bulbs, tubers, etc.) that have a life span of more than one or two years; often grown in the floriculture industry as well.

Plants are cultivated and harvested differently in nurseries than in the floriculture industry. In the floriculture industry, plants are usually sold in decorative containers. In nurseries, plants are sold as field-grown. This means they are either balled-and-burlapped (B&B), bare root (BR), or pot-in-pot (PNP), **Figure 4-8**. When a plant is harvested using the *balled-and-burlapped* (B&B) method, the root system of the plant or tree is wrapped in burlap

Did You Know?

Harvesting a plant for balled-and-burlap production causes up to 95% of the roots to be lost in the digging process.



A

serato/Shutterstock.com



B

Swellphotography/Shutterstock.com



C

USDA

Figure 4-8. Plants purchased from a nursery may be balled-and-burlapped (A), bare root (B), or pot-in-pot (C). Identify one instance in which each type of “presentation” would be advantageous. What might be some disadvantages to each type?

and tied with twine. This serves to protect the roots during transport. When a plant is harvested using the *bare root (BR)* method, all soil is removed from the plant's root system. The roots may be covered with a plastic bag for shipping purposes. *Pot-in-pot (PNP)* is a method in which a plant is grown in a pot and that pot is placed in another pot that has been sunk into the ground. The system makes watering and moving the plant easier than growing the plant in the ground, and eliminates the problem of the wind knocking over plants in pots sitting on top of the ground.

The method of cultivation depends on what the landscape industry demands and what the public wants. A landscaper may prefer B&B plants because with this method plants or trees of large size can be planted on a landscape site. Bare root plants are easy to ship through the mail to customers across the country. The public may desire plants grown solely in containers because of convenience and transportation issues. The nursery must meet the objectives of all the customers it serves.

Nursery Growers

Nursery growers (often called nurserymen) work in outdoor settings that may include some greenhouse or shade-bearing structures. A nursery grower must understand how to *propagate* (grow plants from seeds or other methods, such as rootings or cuttings), cultivate, and prepare plants for market.

A nursery grower usually manages a team of workers. The job is labor intensive and requires a great deal of lifting and moving of plants. Accurate recordkeeping is critical to a successful nursery. In addition to financial records, growers must keep track of planting, fertilizing, and watering schedules. Growers must be able to reduce or solve problems caused by pests or diseases using proper diagnosis and treatment options.

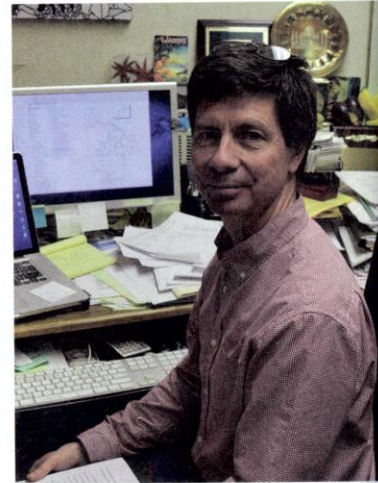
Career Connection

Randy Beaudry

Michigan State University Postharvest Professor

Dr. Randy Beaudry has worked at Michigan State University assessing and improving the quality of harvested fruits since 1989. He works with Michigan fruit growers who cultivate tomatoes, blueberries, strawberries, and apples. Beaudry and his lab members work to develop technology used to improve fruit quality and prolong shelf life. Dr. Beaudry has also performed packaging studies and developed mathematical models to predict performance of packaged produce.

Professor Beaudry was given Michigan State University's service award for his incredible impact on the apple industry in the state of Michigan. He works with growers to help improve their apple crops and the postharvest technologies associated with this American fruit favorite.



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Landscaping

Landscaping challenges horticulturists to produce and maintain visually pleasing and useful environments. To do this, the landscape industry designs, installs, and maintains landscapes for its customers. Career opportunities in landscaping include:

- Landscape architects and designers who create landscape designs to meet the objectives of the customer.
- Landscape managers who facilitate the installation and maintenance of landscape designs. Landscape managers often need to coordinate the work of other contractors and manage all aspects of installation and maintenance contracts.
- Irrigation technicians who design and install irrigation systems to provide water for the plantings.
- Hardscape contractors who design and install *hardscapes* (constructed areas around a building or in a landscape, such as pavers, patios, sidewalks, and retaining walls).
- Water feature designers who design and install water elements (ponds, waterfalls, and pools).
- Snow removal contractors who remove snow from commercial or residential sites using plows and other equipment.
- Landscape lighting contractors who design and install lighting for nightscapes.

These contractors and technicians work together to meet the goals set by the commercial or residential owner of a landscape. They also rely on nurseries to provide quality plant material for establishing successful landscapes.

Landscape work is done outdoors in all types of weather and climates, **Figure 4-9**. Landscape managers and other landscape workers should enjoy working outdoors and with a team of people. Landscape workers usually work long hours during the peak season or during times of a weather-related emergency. One of the best parts of working in the landscape industry is seeing a newly installed landscape and the beauty it provides to a site.

Interiorscaping

Interiorscaping involves the design, installation, and maintenance of plants inside buildings. *Interiorscapes* (indoor landscapes) improve the look and feel of interior spaces. Homes, businesses, classrooms, and hospitals all welcome additions of plants to their spaces.



Joe Dejvice/Shutterstock.com

Figure 4-9. Landscape work is done outdoors in all types of weather. Landscapers often work in teams to accomplish work more efficiently. **What are some advantages and disadvantages to working outdoors?**

Corner Question

Where is the oldest garden center in the United States located?

Studies have shown that interiorscapes provide an abundance of benefits to an interior space:

- Live plants filter the air and produce oxygen.
- Plants are aesthetically pleasing.
- The presence of plants improves employee productivity and discourages absenteeism.

Interiorscaping is a unique division of horticulture. Regardless of what the weather is like, the interior temperature of a building is normally around 70°F (21°C). The plants used in interior designs are usually acclimated to lower light levels and moderate temperatures. They are fed a limited amount of fertilizer to maintain their size and shape. In larger installations, such as shopping malls and large office buildings, the plants are usually changed seasonally and for certain holidays.

Interiorscapers, the people who design and install indoor landscapes, work with designers and architects to create displays that will work with the architecture and interior design of a building. Interiorscapers usually contract with businesses to maintain and/or replace plant materials throughout the year. Interiorscapers have the unique opportunity of installing landscapes in a controlled environment. They may also encounter unusual challenges, such as installing and maintaining plants at different heights and in unusual spaces.

Did You Know?

There are more than 40 million acres of tended lawns in the United States. These lawns sequester more than 13.2 million pounds of carbon each year.

Turfgrass Industry

Turfgrass is a collection of grass plants that form a ground cover. Many people commonly refer to turfgrass as *sod*. The turfgrass industry includes the cultivation of lawn grasses for homes, commercial sites, athletic fields, and golf courses. Sod farms produce turfgrass that can be grown, harvested and sold onsite or shipped to retailers. Sod farms may also be associated with university or corporate research. Companies conduct trials and experiment with varieties of turfgrass to improve insect and disease resistance as well as tolerance to salinity, heat, foot traffic, and drought conditions.

Home Lawns

Turfgrass has been cultivated for centuries all over the world. Lawns have been referenced in British history dating to the 1500s. Aristocratic society coveted a lush, green lawn. The same desire for a beautiful lawn is still coveted today in many societies. In the 1940s, after the workweek was decreased to 40 hours, Americans had more free time. Many chose to use this free time to work on their homes and lawns. When people began having more time to establish a lawn, horticultural companies began advertising the therapeutic benefits of working on the home lawn, **Figure 4-10**.



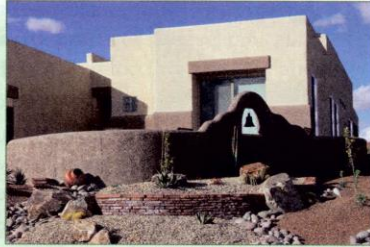
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Figure 4-10. The nursery and landscape industry provides products and services that help create beautiful home landscapes.

Thinking Green

Xeriscapes

Landscaping designs that use plants requiring very little water are called xeriscapes. These designs often include succulents, cacti, ornamental grasses, and other drought-tolerant plants. **In what areas of the United States would this type of landscaping be most appropriate?**



Bruce C. Murray/Shutterstock.com

Athletic Fields

Like the home lawn, athletic fields may be considered beautiful and are often painstakingly maintained. Many grasses have been bred to withstand heavy traffic and to recover quickly after an afternoon of intense practice or play on the field. Baseball, football, and soccer are just a few of the sports that require green grass for play.

Golf Courses

Golf courses are athletic fields that range from a few acres to 200 or more acres of turf, **Figure 4-11**. Specialists in the turfgrass industry have been experimenting and cultivating different turfgrass species for golf courses for years. Golf course turfgrasses must have adequate insect and disease resistance as well as tolerance to salinity, heat, foot and cart traffic, and drought conditions. Additionally, golf course grasses must meet standards that include everything from their color and texture to the way a golf ball rolls when it lands on the green. Golf course turfgrass needs intensive maintenance. Some parts of the golf course get mowed on a daily basis, regularly removing much of the leaf area used for photosynthesis. Often-mowed grasses need extra fertilizer to make up for the removal of their leaf area.

Sod Growers

Sod growers are responsible for planting and growing turfgrass that will be harvested and sold. Sod growers work outdoors with a team of individuals. Sod cultivation requires the use of heavy machinery. A sod

Corner Question

What is a mole cricket?



Safety Note

Walk-Behind Mower

You should mow side-to-side on a hill when using a walk-behind mower. Make sure that the grass is dry before mowing. Wet grass can cause operators to slip and fall into the path of the mower blade, causing serious injury.



cappi thompson/Shutterstock.com

Figure 4-11. Golf courses are maintained by turfgrass workers in the nursery and landscape industry. **How many types of turfgrass are used in a single golf course? How and why are different types used?**



Ingrid Balabanova/Shutterstock.com

Figure 4-12. Laying sod is labor intensive work, much of which must be done by hand. **What types of machinery are used in the cultivation and harvesting of sod?**

beauty and nutrition. Vegetable and fruit plants, trees, and shrubs are beautiful just like ornamental trees and shrubs. Edible plants may be placed:

- In mixed containers.
- In planting beds.
- In landscape borders.
- With flowers and ornamental grasses.



ugorya17/Shutterstock.com

Figure 4-13. This blueberry plant is an excellent edible addition to any garden space. **What types of edibles would you incorporate into a landscape design?**

Corner Question

What is the difference between a reel lawn mower and a rotary lawn mower?

vegetables cultivated at home will also have more nutritional content than those shipped from great distances. Those grown locally or at home are picked when ripe instead of being picked early to allow time for shipping. Eating soon after picking may increase the amount of nutrients available in the food, since there is little time for decomposition. Growing vegetables can help you save money and provide healthy foods.

grower must understand how to cultivate and harvest various types of turfgrass. He or she must be able to lift pieces of sod that can weigh more than 50 lb, **Figure 4-12.**

A sod grower may pursue a degree in turfgrass or have some additional formal education. Sod, like almost all crops, must be fertilized and have a pest management plan in place. Additionally, the turfgrass must be cut to a certain height for proper growth and production.

Combining Edible and Ornamental Plants

When designing and planting a landscape, consider using plants that serve two purposes,

As when considering ornamental plants for a design, you should consider the characteristics of fruit or vegetable plants before inserting them into the design. For instance, *Vaccinium angustifolium* 'Tophat' is a blueberry plant that has been bred to grow in a compact form. 'Tophat' blueberry shrubs reach about 24" (61 cm) tall and wide. The plant is blanketed with small blueberries and is perfect for full sun or partial shade. Like most blueberries, it is a perennial in many areas of the country, **Figure 4-13.**

Using edibles in the landscape adds beauty and can impact your dinner plate and your wallet. Fruits and vegetables grown in the garden may cost a fraction of what they would at a grocery store or farmers market. Fruits and

Organic and Sustainable Production

Plants and crops have been grown for many years using conventional methods. These methods may include using practices or harsh chemicals that can harm people, animals, or the environment. Growing foods organically and using sustainable agriculture are two alternatives to using conventional methods.

Organic Edibles

You often hear about eating organic food, but what does that really mean? Most people would agree that *organic foods* are those that are raised using more biological pest control (such as integrated pest management) than chemical control, and without genetic modifications of any kind. The United States Department of Agriculture (USDA) does award a special organic certification to growers after careful evaluation of their farm and growing practices. In part, a farm may be certified if the food's production does not include any synthetic (chemically derived) fertilizers or pesticides. To maintain their organic label after leaving the farm, foods cannot be processed using chemical food additives or industrial solvents. Also, they must not be irradiated to kill bacteria or insects, and they generally cannot be processed using the same machinery as non-organic foods.

There is a general belief among the public that organic foods are safer, and this has fueled the incredible demand for organic food and products. Farmers around the world are working to meet these demands. Unfortunately, organic foods cost the consumer 10% to 40% more than conventionally produced foods because they cost more to produce. Producing organic food is much more labor intensive than conventionally produced food. Organic food production accounts for only 1% to 2% of food grown in the world, but the organic sales market is growing swiftly. Organic food production is the fastest growing division of the food industry in the United States.

Did You Know?

The United States Department of Agriculture (USDA) says that the organic label does not guarantee greater safety, health, quality, or nutritional value for organic foods. The label only ensures that the food was grown organically according to USDA standards.

Safety Note

Food Safety

Just because you are eating something grown locally does not mean you can throw safety aside. Storing foods in the refrigerator is still important. Wash your fruits and vegetables. Cook foods to the appropriate temperatures to kill any pathogens and refrigerate them within two hours after heating.

Thinking Green

Conventional Foods' Carbon Footprint

Conventionally grown food is responsible for 5 to 17 times more carbon dioxide than food that is produced locally or regionally. From where does this additional carbon dioxide come? Make a list of possible sources including those caused by the packaging of seeds to harvesting the produce.

Consider every aspect of crop production when looking for causes of carbon dioxide production. For example, both the combine and the



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truck used to harvest and transport the rice use fossil fuels and generate carbon dioxide.

Corner Question

Does the United States Department of Agriculture (USDA) certify sustainable agriculture farmers?

Thinking Green

Parasitic Wasps

Various types of wasps are used by some farmers as a means of pest control. These wasps lay eggs on pest larvae. When the eggs hatch, they feed on the pest larva. Parasitic wasps are often referred to as predatory wasps.

Which species of wasps are used by farmers as a means of pest control?



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As with everything else, as long as there is demand, there will be growers producing foods to fill that demand, especially when those foods can bring premium prices. There is still a great debate between conventional and organic foods producers regarding the benefits of organic foods. However, consumers are showing through their purchases that they value organic food.

Safety Note

Organic Pesticides

When growing plants organically, it is just as important to garden safely as it is when using conventional methods. When using a pesticide labeled "organic," you must follow the directions for safely using the product.

Sustainable Agriculture

Many farmers do not grow their crops completely organically or completely conventionally. However, most growers do consider their growing practices to be sustainable. *Sustainable agriculture* is farming or producing plant and animal products in ways that promote the health of people, animals, and the environment. Sustainable agriculture employs practices that will conserve natural resources and ensure that future generations will have the opportunity to farm.

Pest Management

Many farmers employ farming practices that are organic, but when needed, they may use pesticides. *Integrated pest management (IPM)* is an approach to managing pests that uses commonsense, economical practices, and results in the least possible hazard to people, property, and the environment. When it is necessary to apply chemicals, only the least harmful methods of application are used, **Figure 4-14**. IPM involves monitoring, trapping, and using other means of pest control, such as natural predators (ladybugs, praying mantis) or crop rotation, before resorting to the use of harsh chemicals. IPM benefits farmers by helping to keep their land and the ecosystem surrounding their farms healthy.



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Figure 4-14. Sometimes, organic farms must use chemicals to manage pest problems or treat disease. In this image, pesticides are being sprayed on a field using a boom sprayer. In what other ways can farmers deter pests and treat disease?

Soil Nutrition and Conservation

Sustainable farming also involves bettering the soil. Certain methods of crop rotation and growing cover crops can be

Corner Question



How many farmers markets are in the United States?

Thinking Green 

Market Baskets

Taking a basket or reusable bag to the farmers market is a good idea. You will be able to carry produce without damaging or bruising it, and you will not be adding another plastic or paper bag to a landfill.

How many plastic bags does your family acquire from a month's grocery shopping?



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Farmers markets were once prevalent across the country, but they lost popularity as convenience, big box, and chain grocers gained acceptance. Farmers markets are finding their place again as a key food supplier in city squares and parking lots across the country.

When visiting a farmers market, you have the opportunity to speak to growers and distributors that know where, how, and when the produce was cultivated and harvested. The seller can provide information about the produce that most grocers cannot.

Purchasing produce from a farmers market gives you the power to better control the nutritional content of the food you consume. Produce purchased from a local grower has not been shipped or been in storage for as long as most of the produce at other supermarkets.

Did You Know?

CSA farms are usually family-operated, range from 3 to 300 acres, and deliver food for 10 to more than 200 households. CSA farms are highly diversified and usually grow more than 40 different vegetables, herbs, and fruits.

Community Supported Agriculture (CSA)

Another venue for purchasing locally grown food is through *community supported agriculture (CSA)*. CSA is a farming practice in which people pay in advance for shares of produce that is delivered at harvest. This arrangement has been a popular way to buy locally grown food for years. A farmer sells "shares" to the public that represent boxes of seasonal vegetables and fruit that are delivered or can be picked up at a location on a schedule. CSA plans are beneficial to both the farmer and the CSA plan members. The grower is given the opportunity to develop relationships with buyers, educate them about the produce and growing methods, and spend less time marketing the food. The members eat fresh and nutritious food, know the cultivation practices used, may get to visit the farm, and are exposed to new types of produce and recipes.

The farmers and the members are both invested in the CSA and the farm and recognize the benefits as well as the risks involved. Members pay for their shares up front. If there is a drought or an infestation of pests and there are slim harvests, the farmer does not reimburse its members for the cost of the shares they purchased. In this way, CSAs are a type of crop insurance for farmers.

The Green Industry

The environmental horticulture industry is also referred to as the green industry. This industry consists of several products and services associated with landscape and nursery production, **Figure 4-16**. Businesses and organizations related to the green industry include:

- Wholesale and retail nurseries.
- Compost, soil, and media producers.
- Sod growers.
- Lawn care services.
- Landscape designers and architects.
- Landscape managers and maintenance firms.
- Greenhouse growers.
- Urban foresters and arborists.
- Masons.
- Public gardens.
- Lawn and garden departments of large stores.
- Landscape and garden suppliers.
- Landscape equipment suppliers.

Members of the green industry specialize and have expertise in growing, maintaining, and managing plants, landscapes, and all components associated with gardening of ornamental plants.

Regardless of global location, the green industry provides biological, environmental, aesthetic, and economic benefits through ornamental plant cultivation.

Thinking Green

The Omnivore's Dilemma

Written by Michael Pollan in 2006, *The Omnivore's Dilemma* was considered a catalyst for consumers to join CSA plans and eat locally grown food. Many people think that this book drove the rise in CSA and farmers markets across the country.

Did You Know?

The state of Virginia has planted more than 500 acres of wildflowers along its highways.



Figure 4-16. Green industry business activities range from seed production to landscaping. A—Turfgrass worker watering newly installed sod. B—Working in a greenhouse and taking care of geraniums, an annual bedding crop. C—A woman installing a hardscape composed of brick pavers. D—People enjoying the plants at a botanic garden.
 Can you list five green industry applications you passed on your way to school today?

used to improve and preserve the soil's nutrients. Sustainable farmers often practice no-till farming, which also helps to conserve soil.

These methods just briefly outline the mission of sustainable agriculture. Farmers who grow their foods for consumers also grow foods for their families and themselves. Sustainable agriculture practices can ensure that there will be farming tomorrow, while providing food for today.

Eating Local

Have you ever really thought about the freshness of grocery store produce? Traditional paths for fresh fruits and vegetables include a postharvest life of one to two weeks, in addition to a trip of an average of 1500 miles:

- Harvesting, washing, packaging and transportation to a supermarket (five to seven days).
- Storing at the supermarket (one to three days).
- Storing in your refrigerator (for an average of up to seven more days).

By the time you eat the fruits or vegetables, your once nutritious and fresh produce has potentially less nutritional value. To increase the amount of nutrition consumed in fresh fruits and vegetables, buy them locally and eat them within a short time.

Harvesting

How produce is harvested and stored impacts the shelf life and nutritional content significantly. When harvested mechanically, produce can be damaged easily. It will quickly begin to decay and lose its nutritional content at a higher rate. Every part of the harvest and postharvest process plays a role in the nutritional and health benefits of a fruit or vegetable.

Locavores

Many consumers are interested in eating locally grown food because of its wealth of benefits, from less packaging and transportation to supporting local farmers. These individuals are known as *locavores*. Locavores are passionate about buying local ingredients or eating at restaurants that use locally cultivated produce. The common understanding of *local* is within 100 miles.

Farmers Markets

One of the easiest ways to obtain fresh, nutritious, and local produce is to visit your local farmers market, **Figure 4-15**.

Thinking Green

Bacillus thuringiensis (Bt)

Bacillus thuringiensis (Bt) is a soil-borne bacteria that has been used since 1901 and now is important to the organic food industry. This bacteria attacks soft-bodied larva such as caterpillars and helps to save crops from their damage.



Arina P Habich/Shutterstock.com

Figure 4-15. By purchasing locally grown foods, consumers can be assured that less petroleum and fewer carbon emissions are being released due to their choice to buy local. It is a great idea to take your own basket for better transport and less damage to the produce at farmers markets. **Do you and your family use reusable bags or containers when you shop?**

Did You Know?

Trees can cool the surrounding environment by 10 degrees through shading and evapotranspiration.

Biological and Environmental Impacts

Plants play a major role in any ecosystem. Plainly speaking, without plants, an ecosystem could not exist. The plants that are used in the green industry have biological and environmental impacts as they:

- Act as a food source for other organisms.
- Help to add nutrients to the soil through decomposition.
- Control erosion by holding soil intact with their root systems.
- Add oxygen to the air through the process of photosynthesis.
- Sequester carbon that is emitted into the atmosphere.
- Provide shade.
- Reduce temperatures through the process of evapotranspiration in leaves.

Evapotranspiration is the release of water through plant leaves, which then evaporates and helps cool the air. Plants are essential to the environment and their impacts and benefits are realized by all creatures within that bionetwork.



tommaso79/Shutterstock.com

Figure 4-17. Green spaces do not have to be elaborate to provide aesthetic and health benefits to an urban landscape.

Aesthetic Impacts

Although beauty may be in the eye of the beholder, most people realize the lack of natural beauty in a concrete landscape. Aesthetically, a simple plant on a concrete canvas can make a huge difference in making a space seem more inhabitable and welcoming. As people have recognized both the aesthetic and health benefits of plant materials, there have been many efforts to promote green spaces in urban settings, **Figure 4-17**. Cities often require new construction to include public green spaces as part of a building's design. Many cities and towns are also incorporating green spaces by converting empty lots into public gardens, promoting the installation of rooftop gardens, and by planting trees and plants along public roads.

Thinking Green 

Tree Gators

A Tree Gator® is a self-watering tree bag that efficiently waters newly established trees. The bags are made of plastic and have very small holes at their base. The bag wraps around the tree's trunk and slowly releases water over a one- to two-week period, depending on the weather. *What do you think inspired someone to invent this product?*



Spectrum Products Inc.

Thinking Green

Living Roofs

A green or living roof is one that is partially or completely covered with soil, vegetation, and a waterproof membrane. Aside from being beautiful, living roofs provide insulation, reduce water runoff, and create a habitat. However, roofs must be supported well, as green roofs, especially when wet, are extremely heavy.



Alison Hancock/Shutterstock.com

Studies have shown that human interaction with a beautiful space can improve behavior and mental health. Green spaces can:

- Restore a mind of mental fatigue and help a person focus.
- Help children develop emotional, cognitive, and behavioral connections.
- Encourage creativity and intellectual development.

Economic Impacts

The green industry contributes significantly to the economy of the United States. In recent years, billions of dollars were contributed through annual revenue to the US economy by the green industry. Although many jobs may be seasonal, the landscape service sector of the green industry employs the most workers with more than 1 million employees throughout the United States.

Future of the Green Industry

The green industry continues to be the fastest growing segment of the national agricultural economy. As people express more interest in eco-friendly landscaping and sustainable ways to maintain it, the green industry will continue to grow. Ways in which green industry businesses can capitalize on this opportunity include:

- Cultivating and promoting water-wise plants (plants that use less water).
- Incorporating edibles into landscaping designs.
- Encouraging rainwater harvesting and use.
- Installing sustainable landscapes.
- Using integrated pest management (IPM).
- Offering organic or chemical-free services.
- Promoting new technologies such as permeable pavers.
- Designing affordable, green outdoor living spaces, **Figure 4-18**.



Scott E. Feuer/Shutterstock.com

Figure 4-18. As the number of homes increase, so will the demand for the green industry's services, products, and professionals.

Corner Question

What automobile manufacturer planted 454,000 square feet atop its roofs?



Corner Question



How many states have colleges or universities that offer agricultural or green industry degrees?

Green industry businesses will continue to grow by providing these types of services, designing and marketing products that support these services, and developing even more sustainable agricultural applications.

Careers

In the next decade, the Bureau of Labor Statistics foresees a growth in horticulture industry jobs by 18%. An increase of that size means that there will likely be more jobs than there are qualified employees. There will be many jobs in the horticulture industry for people entering the workforce. Developing unique skills, such as being bilingual or having extensive computer skills, will undoubtedly give prospective employees a competitive advantage in the horticulture industry.

To help you develop your own skills, employment opportunities and skill development are discussed throughout this textbook. Each chapter also features real-life career profiles focusing on people currently involved in different aspects of the horticulture industry.

Continuing Education

Successful people pursue learning opportunities, even after getting a degree and beginning their careers. Learning opportunities include formal and informal classes, professional presentations, industry conferences, and other methods of learning. The main purpose of continuing education is to keep your skills current and to learn about the latest breakthroughs and ideas.

Horticulture Organizations

Professional organizations or societies are groups that seek to promote a particular career area and help or inform people in that career. They can provide friendship, networking opportunities, job leads, learning experiences, professional development, and personal growth. Millions of people are employed in horticulture, and many of them participate in professional organizations. Some of these organizations are described here.

American Horticulture Society

For more than 90 years, the American Horticulture Society (AHS) has catered to nearly 20,000 gardeners and horticultural professionals. The AHS connects people to gardening and the most current research. Through publications and educational workshops here and abroad, the AHS fosters the science and art of horticulture.

American Society of Horticultural Science

The American Society of Horticultural Science (ASHS) is the world's leading horticultural science professional society. There are thousands of members from over 60 countries throughout the world. The organization took root in 1903 and has worked side by side with academic and industry researchers in the field of horticulture. The society wishes to reach academic professionals, industry stakeholders, government employees, and consumers with research, education, and extension activities.

International Society of Horticulture Science

During the nineteenth century, horticulturists around the world recognized the need to exchange information to ensure a global understanding of plants. Thus, they established the first International Horticultural Congress in Belgium in 1854. In 1959, the organization officially became the International Society of Horticulture Science (ISHS).

Today, more than 7500 members around the world participate in ISHS. The organization's objective is to inspire research and education in all branches of horticultural science and to spread knowledge on a global scale through symposiums and publications. Membership is open to all researchers, educators, students, and horticultural industry professionals.

National Association of Landscape Professionals (NALP)

The National Association of Landscape Professionals boasts 100,000 professional landscape and lawn care industry members. The NALP provides industry education, safety education, networking, and business development opportunities. The organization also hosts webinars, conferences, days of service (volunteer opportunities), and industry conventions, **Figure 4-19**.

AmericanHort

In January 2014, AmericanHort was founded by the merger of the American Nursery and Landscape Association and the Association of Horticultural Professionals. This organization represents all horticulture areas and includes students, educators, researchers, breeders, retailers, distributors, greenhouse and nursery growers, interior and exterior landscapers, florists, manufacturers, and all others who are part of the industry. AmericanHort claims to be the leading and the largest association for the horticulture industry. The mission of the organization is to unite members across the country, be influential advocates, support plant businesses, and promote healthy communities.



Marcin Balcerzak/Shutterstock.com

Figure 4-19. Sod workers are installing turfgrass in an NALP project. **Are there any NALP projects in your area? Are there other horticultural organizations in your area looking for volunteers?**

Corner Question

Which horticulture organization is housed on 25 acres on a historic estate in Virginia?

