

Lesson C1–1

Understanding Nursery Production Facilities

Unit C. Nursery, Landscaping, and Gardening

Problem Area I. Nursery Production

Lesson I. Understanding Nursery Production Facilities

New Mexico Content Standard:

Pathway Strand: Plant Systems

Standard: III: Apply fundamentals of production and harvesting to produce plants.

Benchmark: III-A: Apply fundamentals of plant management to develop a production plan.

Performance Standard: 1. Identify and select seeds and plants. 2. Manipulate and evaluate environmental conditions (e.g., irrigation, mulch, shading) to foster plant germination, growth and development. 3. Evaluate and demonstrate planting practices (e.g., population rate, germination/seed vigor, inoculation, seed and plant treatments). 4. Evaluate and demonstrate transplanting practices. 5. Prepare soil/media for planting. 6. Control plant growth (e.g., pruning, pinching, disbudding, topping, detasseling, staking, cabling, shearing, shaping). 7. Prepare plants and plant products for distribution.

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

1. Explain the scope and history of the Nursery Industry.
2. Describe the different types of nurseries.
3. Explain the economic factors involved in selecting a nursery site.
4. Explain the environmental factors involved in selecting a nursery site.
5. Describe the different types of nursery facilities.
6. Explain how a plant hardiness map is used.

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:

Some professional organizations include:

American Association of Nurserymen
1250 I Street NW Suite 500
Washington, D.C. 20005-3994
Phone 202-789-2900
Fax 202-789-1893

American Horticultural Society
P.O. Box 0105
Mt. Vernon, VA 22121-0105
Phone 703-768-5700

The Garden Council
500 N. Michigan Ave. #1400
Chicago, IL 60611
Phone 312-661-1700

List of Equipment, Tools, Supplies, and Facilities

Writing surface
Overhead projector
Transparencies from attached masters
Copies of student lab sheets
Graph paper
Rulers
Nursery catalogs—both for equipment and for plant material
Play paper money
Hardiness zone maps
Plant resource books (from a wide variety of biomes)
Telephone book
Local map
Clipboards
Transportation

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

Broker or re-wholesaler
Cold frame
Cold storage
Commercial production
Competition
Containerized
Drainage
Erosion
Evaporation
Field grown
Garden center nurseries
Hardiness
Head house
Hotbed
Liner plant
Mail order nurseries
Mass-marketers
Moisture
Orchardist
Over wintering
Quarantine
Retail nurseries
Shade houses
Turgid
Wholesale nurseries

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:

Give students paper play money (\$500.00—hundred dollar denominations is suggested). Present them with the problem that they have just bought a new house and they need two shade trees for their front yard. Allow them time to choose two trees. Then have them call or visit to find out the prices of shade trees. Don't forget planting charges and tax. Have them prepare three estimates for comparison. Then, during a class discussion ask them to share their prices. There should be a large variety of prices and students will probably be amazed at the cost of trees. Discuss what is involved in growing trees and what is involved in the nursery industry.

Summary of Content and Teaching Strategies

Objective I: Explain the scope and history of the Nursery Industry.

Anticipated Problem: How has the nursery industry changed and how does it impact our society?

- I. The nursery industry has had long existence in the U.S. Overtime, it has changed greatly to meet the needs of society.
 - A. The nursery industry was first noted in 1644 in Massachusetts Bay Colony. It was a fruit tree nursery.
 - B. Many nurserymen of the late 1700's and early 1800's were orchardists. An *orchardist* is a specialty nursery worker who deals with fruit trees. Prince Nursery, established in 1737, is linked more closely with our modern day nurseries. In fact, William Prince began by growing trees on his property and selling them to his neighbors; he was so successful that he turned to commercial production. **Commercial production** means to produce for a specific market. He produced a catalog to market his several hundred varieties of fruit trees and other plants. He also began experimenting with plant breeding and was able to introduce a number of new plant varieties. His catalogs were considered the best of the trade.
 - C. Jackson and Perkins, a name familiar to many gardeners today, was established in 1864 as a nursery specializing in small fruits. In 1879, they began selling a few roses, and by 1894 they were selling over 175,000 roses annually. Many nurseries in the Midwest were established in the mid 1800's and had ties with nursery centers in New York. By 1890 there were over 4500 nurseries on over 173,000 acres of land in the U.S. Two thirds of the nurseries were small (2–25 acres) and supplied only their local area, but they grew over 3.4 billion plants—mostly fruit trees. The major production centers were in New York, California, Illinois, Ohio, and Pennsylvania. Over 47,000 men and women worked in this industry.
 - D. In 1912, the first National Plant Quarantine act went into effect. The quarantine prohibited the importation of certain plants into the United States, and this helped the nursery industry to grow. The Parcel Post—the package delivery branch of the U.S. postal service—was also established. This led to the rapid development of the mail-order catalog business
 1. The nursery industry has had a significant impact on the U.S. economy.
 - a. U.S. and worldwide nurseries flourished. By 1974, California was leading the pack, producing over 130 million dollars in nursery stock annually. By 1985, California was up to 435 million dollars and was known as a world leader in the production of nursery stock. Florida, Texas, Pennsylvania, and Tennessee rounded out the top five. Total U.S. production was just under 3 billion dollars annually. U.S. production had risen to over 5 billion in 1992—with California, Florida, Virginia, and Oregon being top producers.

2. Changes in the Industry—There have been many changes in the industry over the years. These changes have increased and improved the efficiency of production. We have moved from manpower, to animal power, to machine power. Hydraulic power, also called fluid power, has led to major changes in our production and transportation methods. New and more effective machinery, fertilizers, and pesticides have also helped to improve plant quality.
 - a. Production—in the 1950's drip irrigation was introduced, in the 1960's fertilizer injection systems were created, and in the 1970's trickle irrigation for the fields was used.
 - b. Facilities—Recently, more energy efficient and environmentally sound building materials have been introduced.
 - c. Materials—New cultivars and plant varieties have been introduced, as well as better fertilizers and chemicals. Patented plants are becoming increasingly popular.
 - d. Market—More rapid delivery, new marketing tools such as computers, and the Internet, and renewed popularity of gardening education—for example home oriented programs and Martha Stewart have led to more informed and demanding consumers.

Display TM: C1-1A and use it to illustrate the types of crops produced by nurseries. Have the class discuss what types of plants they believe are produced by local nurseries.

Objective 2: Describe the different types of nurseries.

Anticipated Problem: How are nurseries classified and why are there so many different types?

II. Nurseries can be classified using a number of different categories.

A. By type of sales:

1. **Retail nurseries** sell products to the homeowner/general public.
2. **Wholesale nurseries** sell to a retail or broker nursery. This is the most rapidly growing segment of the nursery industry.
3. **Mail order nurseries** sell their product through the mail system using catalogs to market their product. These companies may be wholesale or retail.
4. **Broker or re-wholesaler** is a nursery that functions as a middleman to connect buyers with specific plant material. They sell their product at wholesale level prices.

B. By job description:

1. Landscape nurseries specialize in selling and often installing landscaping plant materials. This includes trees, shrubs, groundcover, vines, and herbaceous plant material.
2. Nursery only nurseries only sell landscape plant material.
3. **Garden center nurseries** sell their product retail. Often these nurseries have an expanded product line including garden tools, seeds, fertilizers, craft items, and other horticultural products.

- C. By product produced:
1. **Field grown**—specifically trees, shrubs, or other landscape plants grown in a field to a saleable size.
 2. **Containerized**—plants grown in containers to a saleable size.
 3. Both containerized and field grown.
 4. Specialty crop—examples might include aquatic plants, turf, marsh plants, etc.
- D. By crop produced:
1. Fruit
 - a. General fruit bearing plants.
 - b. Tree fruits, including nuts.
 - c. Small fruits
 2. Ornamental
 - a. Shade and flowering trees—these plants are usually single stemmed.
 - b. Evergreens—includes both narrow leafed and broad leafed plants.
 - c. Shrubs—these plants are usually multi-stemmed and under 20 feet tall.
 - d. Roses
 - e. Groundcover and vines
 - f. Herbaceous perennials
 - g. Indoor plants
 3. Forest and conservation—plants grown for reforestation or the re-establishment of plant material to given areas.
 4. **Liner plants**—plants grown specifically for propagation or production of more plants. Examples include, plants grown for budding, grafting, rootstocks, tissue culture or lining out in a field.
- E. Specialty Nursery Types:
1. Research—A nursery usually established by the government or private industry to research a horticultural problem or product.
 2. **Quarantine**—A nursery usually established by the government as a holding facility for plant material from outside the U.S. or from another state. The plant material is observed for a period of time and then released.
 3. Re-wholesale—or broker nursery—A nursery that specializes in locating a given plant material for a wholesale or retail nursery. They act as a middle man connecting the plant material with a buyer.
 4. Non-for-profit—An organization that produces plant material for non-for-profit; example: an environmental charity.
 5. Educational—A nursery established at a high school, junior college, or college with it's main function being education and training of students.
 6. Governmental—A nursery established by the government for educational, research, non-for profit or ornamental purposes.

Begin by re-defining a nursery. In generic terms a nursery is any place where trees, shrubs, groundcover, vines, or herbaceous plants are propagated and grown. Begin the lesson by having the class generate a list of who might have a nursery and for what purposes. Use TM: C1-1B to help students see the many types of nurseries that exist. Use a local nursery that students are familiar with and use the terms on the transparency to describe it. Most nurseries will fit into many categories.

Objective 3: Explain the economic factors involved in selecting a nursery site

Anticipated Problem: What are the economic factors in selecting a nursery site?

- III. A number of factors should be considered when locating a nursery.
- A. Land cost—This is probably the largest and most important business purchase.
 - 1. Local land value
 - 2. Zoning and taxes
 - 3. Level of current development—Consider what businesses will surround you. Will they be a benefit or a detriment? Will you have space to develop and expand?
 - 4. Level of development needed for your market
 - B. Labor—This is the business workforce. Employee payroll can be over 50 percent of annual business expenses of a typical wholesale nursery.
 - 1. Availability of a labor force
 - 2. Local pay scale/wage—This refers to employees who may be paid, hourly, salaried, commission or piece rate.
 - 3. Seasonal versus year round labor need—Many employees are year round, but during the peak season, spring and fall, worker number may double.
 - 4. Skills of available labor
 - C. Transportation and markets—As realtors say, “Location, location, location”. This can determine the success or failure of the business.
 - 1. Cost, availability, and ease of transportation for both employees and the product—How will you get supplies to your business and your product to market?
 - 2. Customers availability/means—Are you convenient for your customers?
 - D. Utilities and services: availability, cost, type.
 - E. Competition—Any business that may be competing for your customers’ dollars is considered **competition**. It may be another nursery, garden center, or mass marketer. Any given market can only support so many plant businesses.
 - 1. Other nurseries—Consider who may provide competition and where your business will fit in to the market. You can only succeed if you fill a need and can sell your product.
 - 2. Other **mass-marketers**—Businesses other than nurseries or garden centers that retail or wholesale plants.

Begin the lesson with a discussion about what factors need to be considered when establishing a new business. Stress to students that most of these considerations apply to nurseries as well. Use TM: C1–1C to summarize economic factors specific to nurseries. Allow students to read the appropriate sections in the *Introduction to Horticulture* textbook as a review of these factors.

Objective 4: Explain the environmental factors involved in selecting a nursery site.

Anticipated Problem: How does the environment affect the selection of a nursery site?

- IV. Environment—The factors in the physical environment that inhibit or stimulate plant growth. The main factors affecting the aboveground or belowground sections of the plant are temperature, moisture, wind, “soil” media, air quality, plant pests, and light.
- A. Temperature is measured in degrees and is normally regulated by wind, solar radiation, and humidity. **Hardiness** refers to a plant’s ability to withstand cold temperatures.
1. Maximum—highest average temperatures in your growing zone.
 2. Minimum—lowest average temperatures in your growing zone.
 3. Average—the average temperatures in your growing zone.
- B. Moisture—**Moisture** is water either in the form of rainfall or irrigation. It is responsible for many plant functions, and processes. Plant cells need to be filled with water to remain turgid. **Turgid** refers to water pressure that supports the plant physically.
1. Distribution—Heavy rainfall during the growing season can cause many problems including: a slowdown in plant harvesting and cultivation, damage to young plants, an increase in certain pathogens, a stimulation of weed growth, a leaching of soil nutrients. It can also cause other growth and cultivation problems. Lack of rainfall during the growing season can cause equally devastating problems.
 2. Quality—The water can be tested for pH, fertility, and chemical properties.
 3. Quantity—Concerns both how much is applied and how often or when it is applied
- C. Wind—The wind can cause soil erosion, damage to plants, increased transpiration and evaporation. **Evaporation** is when water changes from a liquid to a gaseous state. **Erosion** is when the land surface is worn away or transported elsewhere.
- D. Soil type and topography—The type of nursery determines which qualities are the most important in soil and topography. Field soil should be carefully evaluated. It should have good physical and chemical qualities, and some organic matter (2–5+) should be present. Topography affects many elements of nursery management, including, drainage, equipment usage, installation of facilities, roads, and irrigation systems, what crops can be planted and how they are harvested, and how much of the land can be productive.
1. **Drainage**—the removal of excess surface or ground water.
 2. The pH—a rating referring to the alkalinity or acidity of a given soil.
 3. Holding capacities—specifically how much water or air can the soil hold and for how long.
- F. Air quality—This factor is greatly affected by pollution.

- G. Plant pests—This factor includes insects, animals, humans, weeds, and diseases.
- H. Natural light

Begin the lesson with a discussion about what plant growth factors need to be considered when growing a plant. Stress to students that most of these considerations apply to nurseries as well. Use TM: C1–1D to summarize environmental factors specific to nurseries. Allow students to read the appropriate sections in the Introduction to Horticulture textbook as a review of these factors.

Objective 5: Describe the different types of nursery facilities

Anticipated Problem: What kinds of specialized facilities are used in nurseries? What are their functions?

- V. Nurseries use a number of specialized facilities to produce and grow plants.
 - A. Propagation—Facilities used specifically for the production of new plants.
 1. **Cold frame**—A wooden or concrete block frame with a glass or polyethylene cover that is heated by the sun. It is used for germinating seeds, rooting cuttings, overwintering plants or hardening off plants for sale.
 2. **Hotbed**—A structure similar to a cold frame but has additional heat supplied by electric cables or hot water pipes. It is used for germinating seeds, rooting cuttings or overwintering more temperate plants.
 - B. Production—Facilities used to bring a crop to a saleable size and to market it.
 1. **Shade houses**—These structures protect plants from wind, temperature extremes, rain, hail, and sun. They are constructed of wood lath or shade cloth. They can also be used for propagation and can usually be altered for overwintering by covering with polyethylene.
 2. Over wintering houses—These structures provide a space for overwintering plant materials. **Over wintering** is keeping plants safe and unharmed aboveground over the winter. The structures are usually permanent and covered annually with polyethylene.
 3. **Cold storage**—Briefly stated, these facilities provide a cold storage area for nursery crops. They can also be used for cold stratification treatments.
 4. Potting areas
 5. Shipping/receiving—This is a centrally located area to shelter and store plant materials for pick-up and delivery.
 6. **Head house**—This area of the nursery functions as a storage and work area. It allows for work to occur in a dry, protected area. Pesticides and fertilizers can be stored and mixed, equipment can be repaired, plants can be potted, etc. Larger nurseries may have separate structures for potting, repairing, or chemical preparation.
 7. Storage areas for storing production materials in a protected site.
 8. Business offices for the business management activities of the nursery.

Use TM: C1–1E to introduce these facilities. Visiting a nursery to see these facilities would be beneficial. Have students read the appropriate sections in the *Introduction to Horticulture* textbook for a more detailed description of these facilities.

Objective 6: Explain how a plant hardiness map is used.

Anticipated Problem: How do nurserymen use the plant hardiness zone map and why is it a useful tool?

- VI. Plant hardiness maps are used by nursery operators to productively grow plants.
- A. The plant hardiness map is a map identifying 11 zones in the United States by the average annual minimum temperatures in each zone.
 - 1. It is produced by the USDA.
 - 2. It has been recently updated to show a more complex range of temperatures.
 - B. The plant hardiness map is important for several reasons.
 - 1. Young plants and plants in containers are more sensitive to rapid temperature changes.
 - 2. It helps with plant selection. As an example plants that are not winter hardy below 20°F will suffer or die in zones 1–8 unless they are properly protected or taken indoors.
 - 3. The zone your business is located in will determine which plants can be successfully grown in your nursery and what precautions you need to take to overwinter them.

Display TM: C1–1F and use it to illustrate the plant hardiness map and its applications to plant production. Have students identify which zone they are located in. Bring plants to class and have students determine which zones they are best suited for.

Review/Summary. Focus the review and summary of the lesson around the learning objectives. Call on students to explain the content and particularly the vocabulary associated with each objective. Use their responses as the basis for determining any areas that need re-teaching. Questions at the end of the chapters in the recommended textbook may also be used as review.

Application. LS: C1–1A—Your Local Nursery Firms
LS: C1–1B—Nursery Facilities Layout
LS: C1–1C—Using a Plant Hardiness Map

Evaluation. Student performance on the sample test and lab sheets will be good bases for evaluation.

Answers to Sample Test:

Part One: Matching

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

Part Two: Completion

1. economic and the environmental
2. Hotbeds and cold frames
3. retail, wholesale, and broker/re-wholesaler
4. educational
5. hourly, salary, commission, or piece rate
6. availability, cost and type.

Part Three: Short Answer

1. What are the different types of nursery facilities? List them and state their function.
 - a. Cold frame—It is used for germinating seeds, rooting cuttings, overwintering plants or hardening off plants for sale.
 - b. Hotbeds—It is used for germinating seeds, rooting cuttings or overwintering more temperate plants.
 - c. Shade houses—These structures protect plants from wind, temperature extremes, rain, hail, and sun. They can also be used for propagation and can usually be altered for overwintering by covering with polyethylene.
 - d. Overwintering houses—These structures provide a space for overwintering plant materials. They are usually permanent and covered annually with polyethylene.
 - e. Cold storage—briefly stated these facilities provide a cold storage area for nursery crops. They can also be used for cold stratification treatments.
 - f. Potting areas—A special area for putting plants into containers.
 - g. Shipping/receiving—This is a centrally located area to shelter and store plant materials for pick-up and delivery.
 - h. Head house—This area of the nursery functions as a storage and work area. Storage areas—for storing production materials in a protected site.
 - i. Business Offices—for the business management activities of the nursery.
2. Temperature, moisture, wind, soil, and topography, air quality, plant pests, and natural light
3. Cold frames, hot beds, shade houses, cold storage, potting areas, shipping, and receiving, head house, and business offices.
4. It allows them to more accurately determine which plants will grow in their area. It also helps them to determine what nursery overwintering practices they need to do.

Test

Lesson C1-1: Understanding Nursery Production Facilities

Part One: Matching

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

- | | |
|--------------|----------------|
| a. hardiness | d. shade trees |
| b. retail | e. mail-order |
| c. wholesale | f. roses |

- _____ 1. Major crop of the nursery industry.
- _____ 2. Nurseries that sell to the general public/consumers.
- _____ 3. Nurseries that rely on catalogs to sell their product.
- _____ 4. A plant's ability to withstand the cold.
- _____ 5. Plants that are multi-stemmed and do not grow over 22 feet tall.
- _____ 6. Nurseries that sell only to landscaping firms/retailers.

Part Two: Completion

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

1. It is important for nurserymen to consider both the _____ and the _____ factors when selecting a site for their nursery.
2. _____ and _____ are both facilities used in propagating woody plants.
3. The three types of nursery sales are _____, _____, and _____.
4. Your school nursery would be an example of an _____ nursery.
5. Employees may be paid _____, _____, _____ or _____.
6. When considering utilities, you need to consider _____, _____, and _____.

NURSERY CROP SALES

Crop	% of total sales
a. Shade and Flowering Trees	21
b. Broadleaf Evergreens	20
c. Conifers	19
d. Deciduous Shrubs	8
e. Indoor Plants	7
f. Groundcover and Vines	6
g. Herbaceous Annuals and Perennials	3
h. Roses, Bulbs, Specialty Plants	3

TYPES OF NURSERIES

A. By type of sales

1. Retail
2. Wholesale
3. Mail-order
4. Broker or re-wholesaler

B. By job description

1. Landscape
2. Nursery only
3. Garden center

C. By product produced

1. Field grown
2. Containerized
3. Both containerized and field grown
4. Specialty crop

D. By crop produced

1. Fruit

- a. General fruit bearing plants**
- b. Tree fruits, including nuts**
- c. Small fruits**

2. Ornamental

- a. Shade and flowering trees**
- b. Evergreens**
- c. Deciduous shrubs**
- d. Groundcover and vines**
- e. Herbaceous perennials**
- f. Indoor plants**

3. Forest and conservation

4. Liner plants

5. Specialty Nursery Types

- a. Research**
- b. Quarantine**
- c. Re-wholesale or broker nursery**
- d. Non-for-profit**
- e. Educational**
- f. Governmental**

ECONOMIC FACTORS

- **Land Cost and Availability**
- **Labor Cost and Availability**
- **Transportation and Markets**
- **Utilities and Services**
- **Competition**

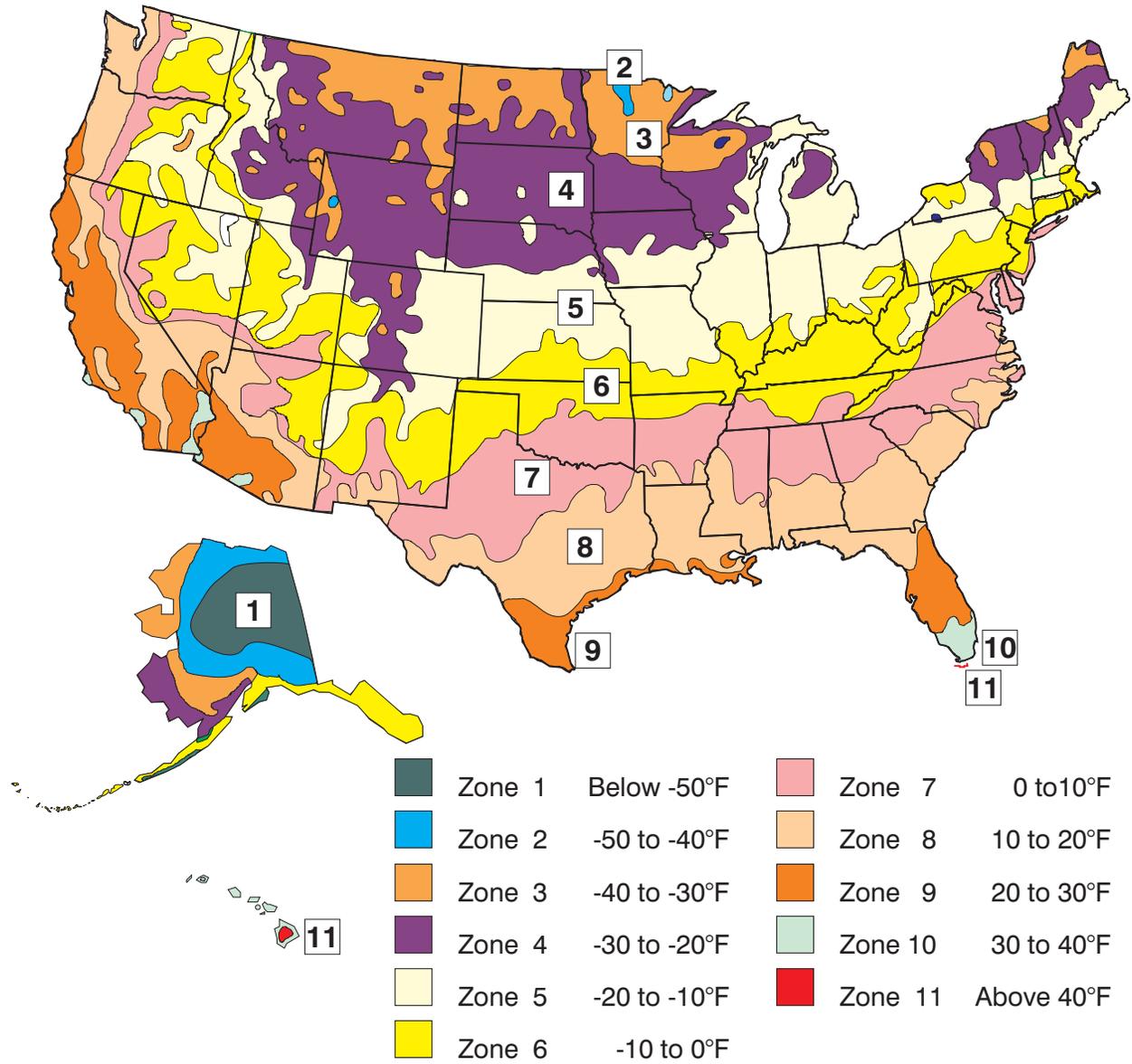
ENVIRONMENTAL FACTORS

- **Temperature**
- **Moisture**
- **Wind**
- **Soil and Topography**
- **Air Quality**
- **Plant Pests**
- **Natural Light**

NURSERY FACILITIES

- A. Propagation—facilities used specifically for the production of new plants**
- Cold frame
 - Hotbeds
- B. Production—facilities used to bring a crop to a saleable size and market**
- Shade houses
 - Overwintering houses
 - Cold storage
 - Potting areas
 - Shipping/receiving
 - Head house
 - Storage areas
 - Business Offices

TM: CI-IF



(Courtesy, USDA)

Lab Sheet

Your Local Nursery Firms

The nursery industry is continually growing and changing and there are a variety of different nursery firms. Most communities can support a number of firms. This lab is designed to help you become familiar with your local nurseries.

Objective:

Investigate the local nursery industry and note the variety of firms operating.

Materials Needed:

Telephone books
local map
markerpen and paper
Telephone access

Procedure:

1. Students should generate a list of local nursery firms—including their name, address and telephone number. Determine what kind of firm they are (retail, wholesale, etc.).
2. Create a chart showing this information.
3. On a local map, locate the nurseries you have selected.
4. If possible, visit or contact each firm.
5. Write a brief description of each nursery.
6. As a class, share your information and create a community listing of your local nurseries.

Questions:

1. How many nurseries are in your local area?

2. How many garden centers?

Lab Sheet

Nursery Facilities Layout

At any given nursery you may find a variety of facilities used to produce a crop. Each nursery is different and has different needs. This lab is designed to help you become familiar with the typical facilities found in nurseries.

Objective:

Investigate and be able to identify the different facilities used to produce plants.

Materials:

Nursery supply catalogs
graph paper
pencil
ruler

Procedures:

1. Students should choose a nursery type and crop to be produced.
2. Using the graph paper, draw and label a nursery facility layout.
3. Use a nursery catalog to find out the prices of appropriate equipment.
4. Prepare a cost sheet for the establishment of your nursery.

Questions:

1. What are the common facilities found in nurseries?

2. Why would growing different nursery crops affect the facilities needed? Give two reasons.

Lab Sheet

Using a Plant Hardiness Zone Map

This lab sheet is designed to help you learn to use a plant hardiness map and plant resource texts.

Objective:

Correctly use a plant hardiness zone map to choose plant material.

Materials:

Hardiness zone maps for students or hardiness zone map overhead
Plant resource books (for a wide variety of biomes)
paper and pencil

Procedure:

1. Students should page through plant resource books and choose 10 plants that they like. Try to choose a variety of plant material.
2. Note the name and hardiness zone for each plant chosen.
3. Using the map, locate which zones each plant would be able to grow in.
4. Design a chart that will present the above information.
5. Contact three nurseries. Note their name, location, and what plant types they sell specifically.

Questions:

1. What did you consider when choosing plant material?

2. What are some other considerations when choosing what to grow?