THE GEOGRAPHY OF THE U.S. NURSERY INDUSTRY: LOCATIONAL CHANGE AND REGIONAL SPECIALIZATION IN THE PRODUCTION OF WOODY ORNAMENTAL PLANTS

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The U. S. nursery industry for woody ornamental plants is a large complex decentralized network of growers across the country. Individual plants are often grown by several different nurseries and shipped hundreds or thousands of miles at each stage in the course of their lives before being planted out. This study examines the locations of wholesale nurseries in the United States, the types of plants they grow, and seeks to explain the changing roles of the most important factors influencing the locations of nurseries.

Map analysis of data from the U. S. Census of Agriculture reveals distributional patterns of sales value, number of plants, and type of plants. The study seeks to explain the role of the main locational factors responsible for these patterns: climate, soils and water supply, transportation, labor supply, and agglomeration advantages. Special attention is paid to the history of the nursery industry, changes in

market demand, and the role of nurseries in the structure of agriculture in metropolitan areas. Data from agricultural experiment stations, the literature of horticultural research and plant physiology, soil and water surveys are used to examine in more detail the roles of climate, soils and water supply as they affect the locations of nurseries that grow containerized plants and deciduous trees.

The results underscore the locational importance of: 1) the form of the product, whether containerized, balled-and-burlap, or bare root, 2) climate, especially limiting yearly minimum temperature and optimal summer temperature and photoperiod, 3) soil texture and permeability for field grown plants, 4) water supply for container grown plants, and 5) market demand, derived from changing preference for plants, regional climate and culture history.

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CHAPTER ONE

INTRODUCTION

In the Florida panhandle one sunny afternoon late in February a five-axle 40 foot semi headed east on Interstate 10 carries flats filled with tens of thousands of rooted cuttings of Kurume azaleas from a propagation nursery in Alabama to a wholesale grower in central Florida. It passes another truck heading west toward Dallas with a load of pin oak seedlings for a large shade tree nursery there. In two years the azaleas will be in the ground around houses near Atlanta and Baltimore after being purchased in plastic containers from the garden centers of a large discount chain store. Some of the oaks will be on their way again by truck to a smaller wholesale nursery outside Wichita where they will grow for another four years before being dug with a root ball and planted out around the club house of a new golf course on the edge of town.

This represents but a small sample of the type of interaction characterizing the production and distribution of woody ornamental plants in the U.S. today. The ornamental nursery industry is a large dispersed but interconnected system of growers of many sizes and specialties located throughout the country. It is one of the most specialized forms of agriculture yet it produces an incredibly broad array of plants, literally thousands of species and varieties, each with its own production requirements and market potentials (Figures 1-1 and 1-2).

Figure 1-1. Olle Olsson Nurseries in Monrovia, California, Produces over $1 Million of Lining-out Stock Annually on Just Eight Acres in the Suburbs of Los Angeles.

Figure 1-2. Carlton Nursery Near Dayton, Oregon, Sells Over One Million Deciduous Fruit, Flowering, and Shade Trees Annually. They are Grown on 1500 Acres Near the Willamette River 30 Miles South of Portland. Seen Here are Three Varieties of Norway Maple (Acer platanoides).

No other form of agriculture approaches ornamental horticulture's diversity, and no other national industry which relies so heavily on interstate transfers for multiple stages of production is so independent and decentralized. The complexity of the spatial patterns of production and distribution and the diversity of species involved make the telling of the geography of the nursery industry a daunting challenge. Yet it is also long overdue. While the geography of most other major commodities is well established with many detailed and technical discussions, that of the ornamental nursery industry is singularly lacking. It is a formidable challenge but an exciting one and this dissertation is a response. It is meant as an introduction to the major geographic elements of the nursery industry, each of which would properly make a monograph of its own. It is my hope that once the ground has been broken others will find it easier to extend and correct my initial attempt.

Why a geography of the nursery industry? It is one of the most fascinating forms of agriculture with its own history and traditions, its own journals and trade associations, its own specialized suppliers and brokers, and above all with its own unique set of locational requirements and opportunities. As a subject of geographic study it is full of rewarding potential. My own interest grew out of a background in both landscape architecture and farm work, given an analytical focus by the study of bio-, cultural, urban, and economic geography.

This then is a geography of the U.S. ornamental nursery industry. It is a study in biogeography, in cultural geography, and in economic geography. The geographic scope of the industry demands all of this and

more. The nursery is one of the most powerful agents in the domestication of plants. The mutual interactions between plant growth characteristics and the limitations and opportunities provided by climate, soils, and water supply are of vital importance to the spatial organization of the nursery industry, and the study of them forms one of the central themes of this dissertaion.

At the same time it examines the role of culture in the process of domestication by showing that these plants, perhaps the most purely cultural of all vegetation, are expressions of a wide array of cultural values and meanings. The role of taste and fashion in shaping the demand for ornamental plants is an integral element in the process of their domestication and is a major factor in the interplay between market demand, plant types, climatic opportunities, and the location of nursery production. The rise to fashionability of conifers in the mid-nineteenth century, for example, stimulated the nursery business in the Midwest, which had been climatically unsuited to the production of most of the deciduous tree species popular at that time. The process continues today influencing the location of the nursery business through its impact on the types of plants in use.

In addition the nursery industry is the source of almost all the ornamental plants used in the landscape today, plants which form one of the most important yet little-studied elements of the cultural landscape.[1] The interest in common and ordinary landscapes now gaining momentum in geography[2] must soon begin to consider the use of ornamental vegetation as one of the most important carriers of symbolic meaning about the role of nature in the human environment. An

introductory description and analysis of the industry which supplies those plants is a useful background to such work.

The nursery industry has a long and interesting history. It is, in a way, a community of people, both in the past and today, who have a sense of identity and a pride in their traditions. It is a business in which individuals have had a great deal of influence on the workings of the whole industry, in which face to face contacts and personal reputations are unusually important. Throughout its history the nursery industry has been supported by the twin poles of those who have followed in the business of their parents and grandparents and those who have set out for new lands and new climates in which to open nurseries of their own. This history is inextricably bound up with the larger history of the national culture, its migrations, economic and technological transformations, and its changing landscape tastes and ideals.

The spatial expression of the interactions between culture, plants, and environment which marks the distribution of nurseries is worked out, however, in the context of profits and losses, of financial success and failure. The constraints and opportunities offered by climatic conditions, soils, water supply , labor, or horticultural technology are all played out in an intense competition for markets, in which the difference in price of a penny or two per plant can mean the difference between selling or dumping a crop of plants.

The economics of nursery locations is most strongly influenced by what I identify as a series of five major locational factors, all of which contribute to production or market advantages which are so important in the location of nurseries: climate, soils and water

supply, transportation, labor supply, and a combination of several interactive factors embodied in agglomeration advantages.

The essential task of this dissertation is to answer the dual question: where are the nurseries that raise ornamental plants in the United States and why are they where they are? To do this it must also examine what different plants are grown in different parts of the country and it must seek to understand how this situation came to be and how it is changing now. Obviously for such a large interconnected but very decentralized system of production involving hundreds of species of plants and scores of divergent markets no simple explanations will suffice. To attempt a mathematical location model would be nearly impossible, although one brave individual has actually made such an attempt.[3] Instead this study will seek to explain the major locational influences, discuss the historical development of the American nursery industry, and put it all in the perspective of its larger cultural context.

The work is divided, like ancient Gaul, into three parts. The first, Chapters 2 through 4, sets out an introduction to the problem. Chapter 2 gives an overview of the structure of the business today: the diversity of plants, the systems of production and distribution, and their various spatial distributions. The third chapter looks at other studies of the geography of agriculture having a bearing on the nursery industry. It looks in particular at studies of agriculture in metropolitan areas, one of the salient features of the nursery industry being its unique role in the dynamic transitions of agriculture in the urban periphery. The fourth chapter discusses the major locational factors in

a summary way, explaining their role in the location of nurseries. Two of these, climate, and soils and water supply, are of such variable impact yet so clearly important that they are given further treatment in separate chapters later.

The middle third of the work is a history of the U.S. nursery industry from its origins in the colonial period up to the beginning of its "modern era," around the year 1950. It looks at the shifting locations of nursery production, the geographic factors at work, and it pays particular attention to the rise of a national system of production. It examines the roles of changing technology and market demand, in large part a creation of larger cultural-historical patterns.

The last third looks at the situation in the modern era: Chapter 9 at recent changes in production locations and in regional specialization in different types of plants, Chapters 10 and 11 at the impact of the major natural environmental factors, soils and water supply and, above all, climate, and Chapter 12 at the changes in market demand that are having an influence on the type of plants produced and through that on the location of nurseries producing them.

A Note on Sources of Information

There are several good sources of information on the nursery industry from which its geography can be constructed, but none of them gives a complete picture and, unfortunately, none of them deal with exactly the same group of plants or nurseries. They are all somewhat incomplete and one rarely can be made to fill in the deficiencies of another. The U.S. Census of Agriculture is the most detailed

statistical source of data. The best source is the decennial Census of Horticultural Specialties which provides data on production by major plant groups and, in the most recent one in 1979, on selected genera. The data from the Census of Horticultural Specialities are unfortunately partially incompatible with those from the regular Census of Agriculture taken every five years. And the 1970 Census of Horticultural Specialties was notoriously deficient, seriously underreporting the number of nurseries and production totals for several of the major plant groups.[4] The 1979 special census, however, is a good source and I have tried to use its every potential.

The Horticultural Research Institute compiles a variety of statistical and economic studies which are very useful. These include growers of more plants than are included in the Census of Horticultural Specialties, though, and comparisons between the two sources is difficult.

Individual states and some counties maintain their own records on nursery production and these have been useful, but the problems of incompatibility are even more apparent with them. California and Florida are the two states giving the most attention to their nursery industries, but many other important nursery states provide almost no systematic coverage. The agricultural experiment stations of many state universities publish research useful to this study. In particular those of the eight southern states participating in the Southern Cooperative Series of bulletins on the nursery industry have been invaluable.

Nursery industry trade associations have published a variety of reports and monographs which have been useful, especially those of the American Association of Nurserymen and the California Association of

Nurserymen. Much of my account of the history of the nursery industry was drawn from their publications.

The scientific horticultural literature is another important source, and I have relied on its journals and monographs for a variety of material on the growth requirements of plants and the working of production systems. Much of my discussion of the role of climatic factors is taken from the broader literature of plant physiology and forestry as well.

Several trade publications for the nursery business, in particular the American Nurseryman and Nursery Business, provide an insider's view of the industry and have allowed me to follow the interests and concerns of growers as well as vicariously visit the many nurseries featured in their articles.

And finally, my own field work visiting nurseries and talking with their owners and operators has given me the immediate contact and feedback necessary to temper some of my initial theoretical hyperbole. I have visited nurseries only in Oregon and California but they included a wide range of sizes and plant specialties which I feel are representative of the nation's nurseries as a whole.

Chapter One - Notes

[1]Landmark studies of ornamental vegetation from a geographic perspective are Thomas R. Detwyler, "Vegetation of the City," in Urbanization and Environment; the Physical Geography of the City, ed. by Thomas R. Detwyler and Melvin G. Marcus, 229-259 (Belmont, California: Duxbury Press, 1972); James A. Schmid, Urban Vegetation, A Review and Chicago Case Study, Research Paper No. 161 (Chicago: University of Chicago, Dept. of Geography, 1975). See also the work of the new field of urban forestry, especially the published Proceedings of the First and Second National Urban Forestry Conferences: George Hopkins, ed., Proceedings of the National Urban Forestry Conference, Vol. I and II (Syracuse, New York: State University of New York, College of Environmental Science and Forestry, 1980); and Deborah L. Gangloff and George H . Moeller, eds., Proceedings of the Second National Urban Forestry Conference (Washington: American Forestry Association, 1983).

[2]D. W. Meinig, ed., The Interpretation of Ordinary Landscapes; Geographical Essays (New York: Oxford University Press, 1979) and John Stilgoe, The Common Landscape of America, 1580-1845 (New Haven, Connecticut: Yale University Press, 1982).

[3]D. R. McDermott, "Logistics Network Design: A Simulation Study of a Nursery Stock Channel." International Journal of Physical Distribution and Materials Management 8 (1977), 62-73. McDermott's model attempts to allocate U.S. nursery production within six regions, but his assumptions are simplistic and the data required are unavailable.

[4]For a general dicussion see David S. Stump, The Census of Horticultural Specialities; Analytical Review and Observations of Thirty Years of Industry Statistics (Washington: Horticultural Research Institute, 1982). A detailed criticism of the failings of the 1970 Census of Horticultural Specialties in coverage of Florida's nursery industry is found in Cecil N. Smith, "Comparative Census Data on the Flower and Nursery Industry," Proc. Florida State Horticultural Society 87 (1974), 449-453.

CHAPTER TWO

AN OVERVIEW OF NURSERY PRODUCTION TODAY

The nursery business is a large and diverse industry, widely scattered across America. To understand the factors responsible for the location of today's nursery production in hundreds of thousands of sites it is necessary to look at such wide-ranging botanical and organizational factors as the varieties of plants, variations in production practices, and diversity in types of economic organization. This chapter will discuss the diversity of plants grown in the nursery business and the role of woody ornamentals in that mix, the organizational structure of the nursery industry, including the various stages of production and distribution, as well as the location of major production areas and the regional specialization in production of different plants.

The Diversity of Plants in the Nursery Business

Many types of plants and plant products are produced by farmers who call themselves nursery growers or who are classified as such by others. The U.S. Census of Agriculture in 1978 included eight types of "nursery and greenhouse products"[1] and the Census of Agriculture's 1979 Census of Horticultural Specialties included thirteen commodity groups in its statistics, Table 2-1. Seven of them are raised primarily in greenhouses or other structures, while the other six are raised mostly in the open. Of these, one is labeled as "nursery products" proper, mostly

Table 2-1. Commodity Groups, Census of Horticultural Specialties, 1979

Commodity Group	1978 Sales ($1,000)
Potted flowering plants (e.g. poinsettia, Easter lily)	418,007
Cut flowers (e.g. rose, carnation, chrysanthemum)	353,415
Unfinished stock (not shown elsewhere)	62,524
Cut cultivated greens (e.g. fern fronds, heather branches)	33,595
Bedding plants (flower or vegetable starts, mostly annuals)	285,520
Foliage plants (e.g. Ficus, Philodendron, Boston fern)	466,913
Sod	206,611
Bulbs, corms, or rhizomes (e.g. lily, tulip, gladiolus)	23,544
Cultivated mushrooms	348,251
Nursery products (woody and herbaceous ornamentals, plus fruit and nut plants)	944,919
Vegetable seeds	37,562
Greenhouse vegetables	26,685
Flower seeds	4,463
	$3,212,002

Source: Census of Horticultural Specialties, 1979, Table 1.

woody plants meant for outdoor planting, but also including fruit and nut plants in addition to ornamentals. This dissertation will focus, as much as the data make possible, on the production of woody ornamentals, but much of the data which are available include other types of plants. The separation is a difficult one, and to a degree an artificial one, both in the available data and in the fields and minds of many nursery growers.

Many growers raise more than one type of plant: shade tree growers often raise fruit trees; evergreen shrub growers may raise bedding and foliage plants in some parts of the country; sod growers may also raise shade trees, etc. On the other hand many growers are specialists, raising only one genus of plant, as for instance with many growers of rhododendrons or roses. The industry covers a wide range of specialization and diversification, in all regions and in all size classes.

Whenever possible in this study woody ornamentals will be separated from the other categories, but where such a separation is impossible or inappropriate the range of plant types covered will be noted as clearly as possible.

The various horticultural specialties do, however, have much in common in their methods of production, their markets, and their scale of economic organization. Many are characterized by great concentration in the hands of a very few producers, or in a limited geographic area. Production of flower seed in the U.S. is concentrated largely in California, with 72% of the crop being grown in Santa Barbara County alone, mostly in the Lompoc and Santa Maria valleys.[2] Mushroom production is dominated by the area around Kennett Square, Pennsylvania

southwest of Philadelphia. Chester County accounts for 25.4% of U.S. mushroom production.[3] Perhaps the outstanding example of such concentration, though is that of tuberous begonias. The Brown Bulb Ranch in Capitola, California, near Santa Cruz, supplies an estimated 90% of the begonia tubers sold in the U.S.[4] Among horticultural specialties woody ornamentals in fact appear to be the least concentrated in production. Production of woody ornamentals is, however, the largest and most diversified of the various horticultural specialties.

Like the other specialites nursery products are often grown in metropolitan ares due in large part to proximity to markets and made possible by the high value of the crops and the relatively small area needed. Some specialty crops such as sod and greenhouse vegetablea are almost exclusively found in metropolitan areas while others are grown far from their markets, such as flower and vegetable seeds and cut flowers. Cut flowers are in fact an item of much international trade, and in recent years the U. S. cut flower market has seen major inroads from abroad, especially from Colombia.[5]

The "nursery business" as it is known today is most commonly taken to encompass growers of woody and herbaceous ornamentals, fruit and nut plants, bedding plants, and foliage plants. These four categories of plants for both indoor and outdoor use are all part of a large agricultural complex, and many growers raise more than one of the categories, though rarely all four.

The wealth of plants included under the designation of woody ornamentals is usually sorted into six major categories: deciduous trees, rose plants, other deciduous shrubs, broadleaf evergreens,

narrow-leaf evergreens, and vines. These are in fact the categories used by the U. S. Census of Agriculture for many years in its Censuses of Horticultural Specialties, from 1929 to 1979. The 1979 Census also included data on various genera of plants within some of these larger categories. They also include information on production of lining-out stock, the young plants propagated from seed or vegetatively reproduced. Table 2-2 shows these various categories. (The 1979 Cencus of Horticultural Specialties has taken to calling them "environmental" plants rather than ornamentals, presumably to reflect the wider range of uses to which such plants are put, including erosion control and crowd control, but I will continue to call them ornamentals here.)

Organizational Structure of the Nursery Industry

> The nursery industry is a business group of many segments. The industry consists of nursery crop growers, landscape firms, landscape maintenance operations, retail nursery or garden centers, agency or distributor operations, mailorder busineses, and specialty nursery operations. A nursery may specialize in wholesale growing or may be active in several segments of the business, such as retail sales, wholesale growing, and landscape operations. The nursery industry also includes a wide variety of company sizes, from million-dollar industry leaders to part-time or seasonal family avocations.[6]

So begins the Horticultural Research Institute's 1982 research summary, Scope IV of the Nursery Industry, examining the wholesale grower segment of the business. The study covered wholesale growers of perennials, bedding plants, bulbs, corms, and tubers, foliage plants, and fruit trees, in addition to woody ornamentals. Taken together, Scope IV and the Census of Horticultural Specialties provide the best statistical overview of the business today.

Table 2-2. Nursery Plants by Category, Number Sold, and Value of Sales in the Census of Horticultural Specialties, 1979 (Table 15)

Category	Number (1,000)	Sales ($1,000)
All nursery plants	1,055,428	$949,919
Lining-out stock	310,031	76,689
Fruit and nut stock	36,630	13,344
Deciduous ornamentals	66,155	17,867
Evergreen ornamentals	207,246	45,479
Plants	745,398	868,230
Deciduous trees	26,567	219,547
Shade trees	14,508	150,965
Maple	3,833	42,448
Ash	2,342	26,090
Oak	2,076	24,870
Other	6,257	57,557
Flowering trees	12,059	68,582
Apple	3,458	18,587
Cherry and Plum	1,849	10,161
Dogwood	1,832	10,324
Peach	1,661	5,785
Pear	906	5,319
Magnolia	694	6,112
Other	1,659	12,294
Roses	30,022	44,668
Other deciduous shrubs	17,036	49,942
Broadleaf evergreens	56,626	169,294
Azalea and rhododendron	22,184	62,827
Holly	8,818	26,240
Euonymus	4,906	17,203
Pittosporum	3,577	8,609
Other	13,141	54,414
Narrow-leaf evergreen	48,100	214,468
Juniper	17,804	68,102
Pine	9,299	42,064
Yew	6,486	37,091
Spruce	3,504	19,638
Other	11,009	47,573
Vines	7,033	9,616
Herbaceous plants	8,094	10,692
Fruit and nut plants	529,030	108,832
Citrus and subtropical trees	4,379	19,922
Deciduous fruit and nut trees	20,006	59,386
Grapevines	10,401	7,690
Small fruit plants	494,244	21,832

Stages of Production

The various stages in the growing and marketing of nursery products all have geographic components. The main focus of this dissertation will be on that of the wholesale growers and they will be discussed at length in succeeding chapters. Here I will look more closely at the other stages in the production and marketing of plants and how they fit in with the growers. Figure 2-1 shows a schematic view of these stages and the transfers between them.

Propagation

Propagation of new plants is often a specialty activity of some nurseries. It requires methods and facilities which are often very different from later growing-on of plants, and many nursery growers choose to specialize in either propagation or growing-on. Some growers choose to combine both stages of production in their operations with an in-house propagation department, and some of the larger nurseries turn that department into a money making operation by selling liners to other growers in addition to supplying their own needs. Hines Wholesale Nursery, a subsidiary of the Weyerhaeuser Corporation, in Irvine, California is an example of the latter. Their 75 acre propagation department produces millions of liners each year and is currently being expanded to be able to produce 18 million liners per year.[7] In 1983 they were selling 10% of their liners to other growers.[8]

The 1979 Census of Horticultural Specialties found that lining-out stock make up 8.1% of the value of nursery products sold in 1978, but 29.4% of the number of plants sold.[9] Liners are smaller than older

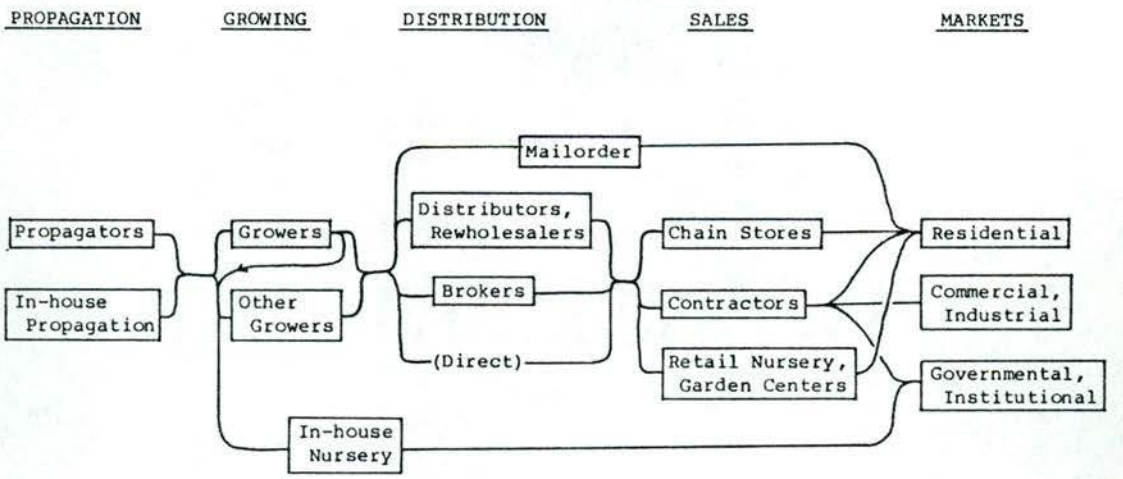


Figure 2-1. Production and Marketing Channels for Nursery Products

plants and generally much less expensive. In addition many are simply seedlings or rooted cuttings which will become rootstock for other varieties grafted onto them at the grower nursery. They are almost a raw material to which value is added by later processing. Even so, liners are valuable enough and the area they require is small enough that their production is profitable, often on some very small parcels of land. Many can be literally backyard operations. The Olle Olsson Nurseries of Monrovia, California began in Mr. Olsson's back yard in 1957. Through acquisition of a neighboring lot it grew to 2 acres, and has recently expanded to another 6 acre site nearby. Yet on those 8 acres are produced over $1,000,000 in plants per year, sold throughout the U. S., with major markets in California, Texas, and Florida.[10]

Lining-out stock is usually very small. Deciduous tree seedlings, for instance, are often sold bare root in bundles and are usually from 12"-36" tall, with root systems of perhaps another 6"-10". Liners of other types of plants are much smaller yet and are usually sold in small pots, 2"-3" in diameter, or in flats of some kind. This makes shipment of them relatively inexpensive, and allows for liner growers to operate relatively far from the growers who are their market. Since liner production is such a specialized operation it is characterized by a much smaller number of growers than for larger stock. For these two reasons the production of liners tends to be much more concentrated, in fewer nurseries and in fewer areas than are other stages of nursery production. Just four growers in California, for example, produced 25.9% of the maple liners and three growers there produced 25.6% of the oak liners in the entire country in 1978.[11]

Production of juniper liners was almost as concentrated. 21 growers in California grew 51.3% of the liners in 1978, and together with 54 other nurseries in Georgia, Pennsylvania, and Oregon, the 65 growers in those four states grew 79.3% of the nation's juniper liners.[12] Figures 2-2 and 2-3 show the degree to which this was concentrated in a few states in contrast to the distribution of production of larger juniper nursery plants. It should be noted that with the exception of Oregon the other three states which led in production of juniper liners all had significantly smaller proportions of the total production of full size plants, and that other states, such as Florida, Oklahoma, and Michigan, which produced large numbers of full size junipers generally had very little production of liners. This emphasizes the degree to which liner production is a specialty operation, concentrated in a few nurseries in a few areas, and the extensive interstate trade which is involved.

Growing

Growing of full size nursery plants is accomplished in a variety of substages, involving various combinations of planting, grafting or budding, transplanting, pruning, root-pruning, etc. When planting stock for growing-on, a grower must have in mind its market and sales size, for the spacing in rows depends on the kinds of machinery required and on the anticipated final size two or more years later. Trees planted 18" apart for sale two years later cannot be left in the ground for three years to be sold at a larger size. Those larger trees should be planted two or three feet apart from the outset.[13] Many nurseries

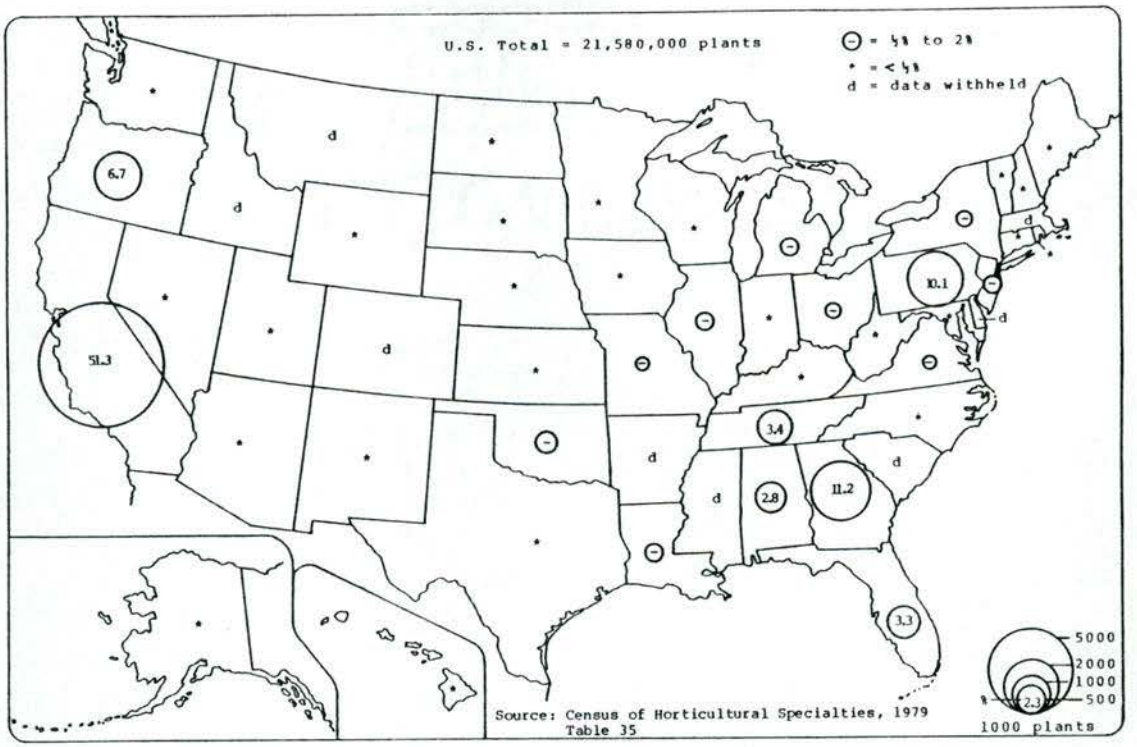


Figure 2-2. Production of Juniper Lining-out Stock, 1978

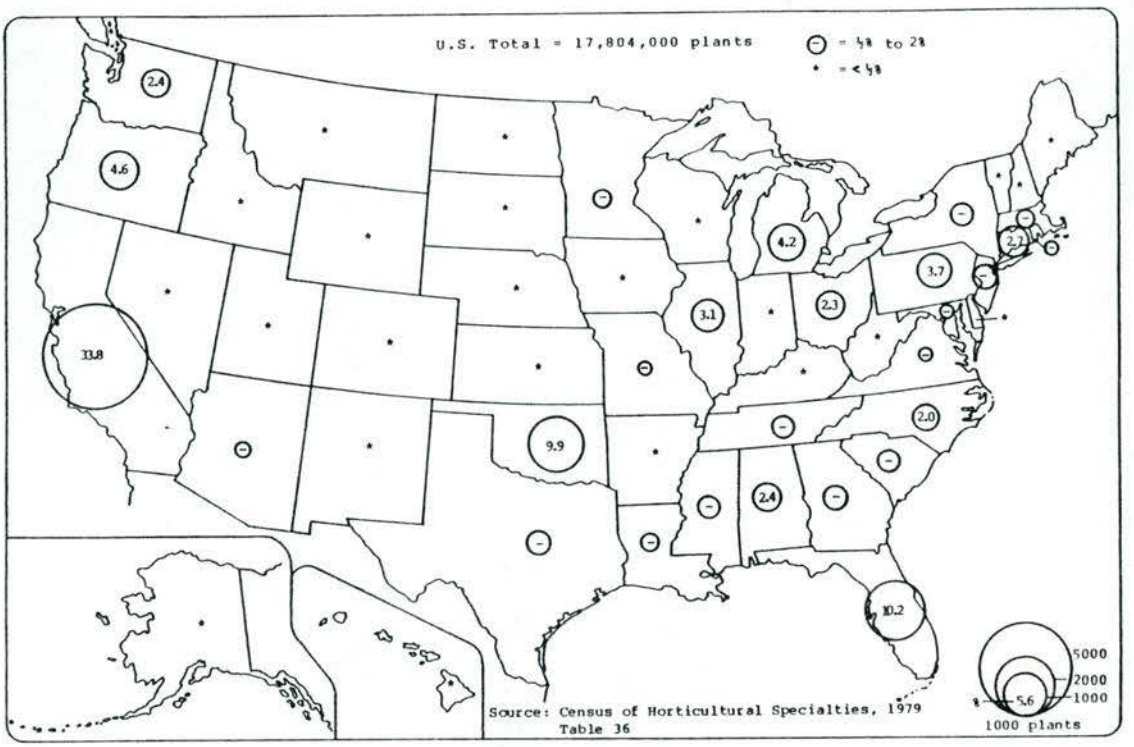


Figure 2-3. Production of Junipers, 1978

specialize in the various substages of growing while others try to produce a variety of sizes and ages of plants.

The older and larger a plant grows the more difficult and expensive it becomes to move. Thus retail nurseries tend to locate near their markets and wholesalers who exclusively supply retailers are in turn relatively close to concentrations of retailers. Wholesalers who grow for other wholesalers sell smaller plants and can be located farther away from their market.

The case of oak trees will illustrate this. Oak liners are produced in relatively few areas in large numbers. Three states, Tennessee, California, and Missouri, grew 61% of them in 1978, Figure 2-4. These were in turn planted by growers in those and other states. These growers are more numerous and more dispersed, as seen by Figure 2-5, and it takes seven states' production to reach 62.2% of the total. Some of these growers raise the trees to full retail sales sizes and sell them to retail nurseries or other retail outlets, the greatest number of which are in the Midwest and Northeast. These retail-size wholesale growers are often on the fringes of large metropolitan areas, as in Kane and Lake Counties, Illinois outside Chicago, or Nassau and Suffolk Counties, New York on Long Island. The nurseries which grow liners on for only another two to three years, including grafting (if any), pruning and root pruning, sell them to some retail outlets which sell small trees and to other wholesalers who grow larger retail-size trees.

A single pin oak tree, then, could be propagated by a nursery in southern California using seed collected in Pennsylvania by a seed

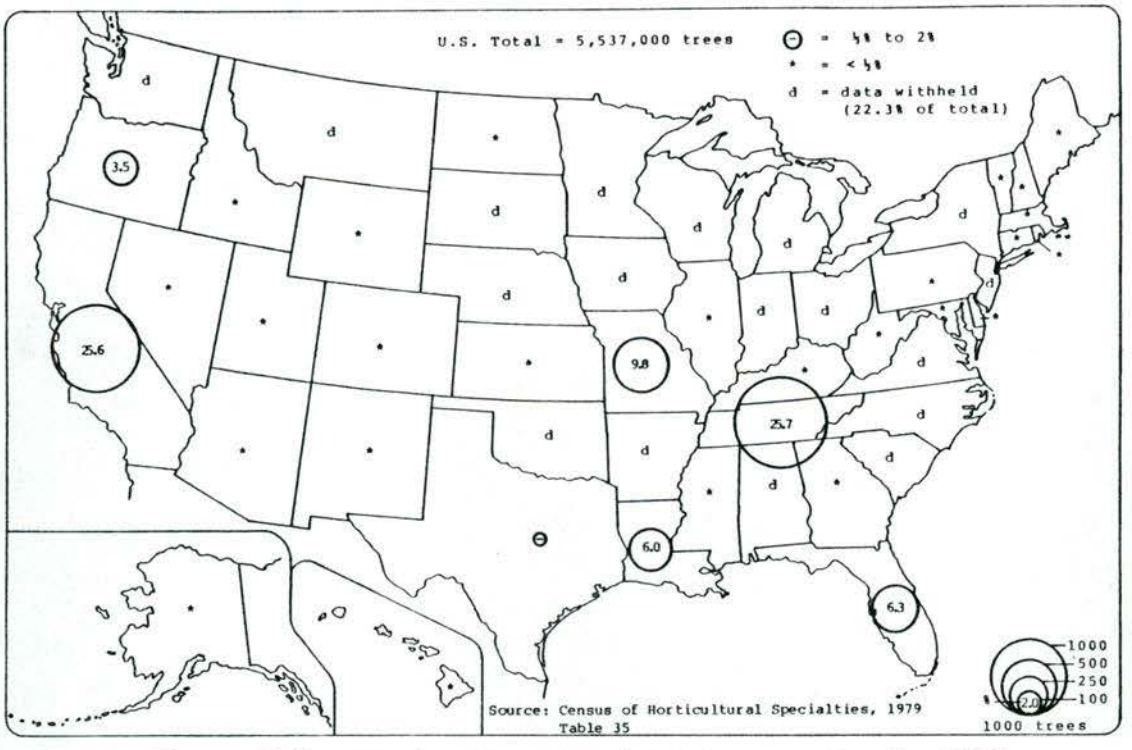


Figure 2-4. Production of Oak Lining-out Stock, 1978

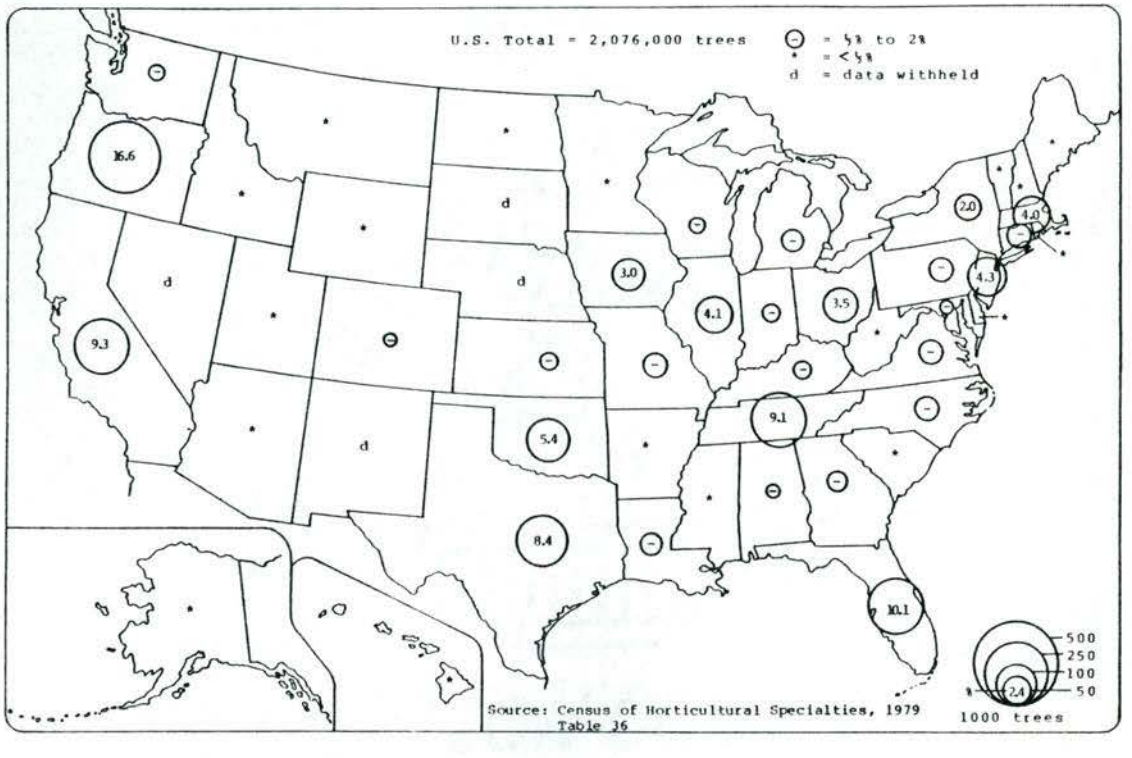


Figure 2-5. Production of Oak Trees, 1978

broker, sold to a nursery in Oregon where it is grown on for two or three years including pruning and root pruning, then be sold to a wholesale grower in southwest Ohio who grows it up to larger size (say, 2 1/2" caliper) for four more years before selling it to a retail nursery near Indianapolis from which a customer buys it to plant in his or her yard.

Many variations on this process exist, however. Some retail nurseries grow their own plants from propagation to final sales; some large wholesale growers in recent years have begun establishing branch operations in different regions for growing different species in areas where the climate permits faster growth; some growers specialize in just one stage of growing for one type of plant while growing others through almost all stages.

The method by which plants are grown and the form in which they are sold has a large influence on the location of nurseries. Field-grown plants require certain soil types, depending on whether they are to be sold bare root or ball-and-burlap (B&B). Bare root plants usually need a sandy or silty loam soil while B&B plants usually require a heavier soil, silty clay or clay loam. Bare root plants are much lighter and easier to handle and can be shipped longer distances. B&B plants are much heavier, due to the weight of the soil ball, and are generally shipped only short distances.

Container-grown plants are free from many of the site soil requirements which limit field-growing locations. Artificially mixed planting media substitute for natural soils and, being generally lighter

than natural soils, make container plants relatively light weight and easier to ship. Table 2-3 shows the forms of growing and the types of plants commonly grown and marketed by the different methods. Scope IV estimated that 30% of nursery sales came from nurseries raising only container-grown plants, 19% from those with only field-grown plants, and 51% from nurseries raising plants both ways.[14] Container nurseries can also be much smaller than field nurseries, an average of ten times smaller in fact, due to the ability to push pots closer together than plants can be safely grown in the field where space must be left not only for lateral root spread but for tractors and other machinery to move.

These growing methods will be discussed more fully in Chapter 4 and in Chapters 10 and 11 under the headings of soils and climate. Suffice it to say at this time that the tendency exists for production of bare root plants to be relatively far from markets and to be concentrated in a few areas. This is particularly true for smaller deciduous plants, such as roses. B&B plants, by contrast, are usually grown closest to retail markets, and there is usually a tendency for dispersal of production locations, relatively close to major market concentrations. Container-grown plants are somewhat in between the other two forms in terms of distance from markets and concentration of production areas. Climatic and water supply factors are also more important as locational factors for container production, as will be discussed later.

Distribution

Distribution and marketing of the plants can go through several

Table 2-3. Growing Method and Product Forms for Woody Ornamentals

Product form	Characteristics	Marketing period	Plant group
Bare root	Soil removed from root system	Dormant season	Deciduous trees and shrubs
Ball & burlap (B&B)	Soil remains around reduced root system in wrapping cloth	Dormant season	Evergreens, large deciduous plants.
Container-grown	Entire root system in artificial soil in container	Any season	Evergreens, many deciduous shrubs, small deciduous trees

Adapted from Furuta, Environmental Plant Production and Marketing, Table 2, page 5.

channels, depending largely on the size of the nursery, its distance from markets, and the presence or absence of other nurseries in the area. The vast majority of nursery plants are shipped by refrigerated truck, mostly on common carriers, although many are still sent via rail and most mailorder plants travel at least part of the way, if not all of it, by unrefrigerated truck as do many plants moving only short distances from nursery to market. Because of the perishability of most plants few are sent by water, although container shipper is used by some foliage growers from both Hawaii and Puerto Rico for shipping to the Mainland.[15]

Distribution for most growers is by direct orders from customers, mainly retail outlets or other growers. A special case is that of mailorder businesses, who sell direct to retail customers. The mailorder business takes up a large part of the production or roses, fruit and nut plants, but overall it accounts for just 2% of the sales of nursery growers and only 12% of all nurseries sell via mail-order.[16] Sales to retail outlets are arranged in a variety of ways, most of which are common to other forms of business, although, unlike the fresh vegetable and fresh cut flower markets, there are no city terminal markets.[17] Especially important to wholesale growers are the contacts made at regional trade shows each year where buyers come from all over the nation to survey availability and prices of stock and often arrange purchases directly with growers or their respresentatives. Table 2-4 lists the eleven trade shows most important for growers of woody ornamentals. Most of these are strongly regional and attended by regional growers except for the largest national growers and distributors

Table 2-4. Major Trade Shows for Woody Ornamentals, 1983

Show	Location	Booths	Attendance
Eastern Regional Nurserymen's Show	Hotel Concord Monticello, NY	465	5,000
Penn Allied Nursery Trade Show	Hershey, PA	383	5,418
Mid-Atlantic Nurserymen's Trade Show	Baltimore, MD	234	2,055
Mid-Am Horticultural Trade Show	Chicago, IL	400	5,469
Central Environmental Nursery Trade Show	Columbus, OH	288	4,823
Southern Nurserymen's Trade Show	Atlanta, GA	700	6,100
Florida Nursery & Allied Trade Show	Orlando, FL	465	5,426
TAN-MISSLARK	Dallas, TX	1157	9,693
Southwest Nursery & Landscape Show	Phoenix, AZ	302	2,500
Pacific Horticultural Trde Show	Anaheim, CA	846	9,354
Farwest Nursery, Garden & Supply Show	Portland, OR	396	7,979

Adapted from "1983 Nursery Business Trade Show Report Card," Nursery Business 28 (November 1983), 38-39.

which generally exhibit at most if not all of the shows.

Another important channel for sales distribution for many growers, particularly the smaller ones, is the service of brokers and other rewholesalers. Brokers are especially important in major producing areas, where they can locate sources of supply for customers and can assemble groups of orders for shipment to a single destination or adjacent groups of destinations, thus saving on transportation costs for all concerned.[18]

In major market areas are wholesale brokers who specialize in redistribution or rewholesaling. They will characteristically purchase a wide variety of plants from whatever source is most convenient, assemble them into an inventory from which landscape contractors, retail nurseries, or others in the trade can make quick and convenient purchases. They generally do not sell at retail to individual customers. These rewholesalers are an important source of plants to contractors with short deadlines or small retail nurseries which cannot afford to maintain a large inventory of their own.[19]

Retail Outlets and Markets

Retail outlets for final sale of nursery plants vary widely also, from the tailgate of a pickup truck to a large retail nursery and garden center with landscape contracting services and perhaps a garden clothes boutique. The variety of purely retail nurseries is large. Many grow some of their own plants while others purchase all of them from wholesale growers or rewholesalers. Many retail nurseries also provide landscape design and contracting services and some even perform

maintenance services.

Large numbers of plants are also sold through garden departments of large general retail stores, most notably department and drug store chains. The H. R. I.'s Scope IV found that 66% of wholesale nursery sales went to retail garden centers while 8% went to these general merchandisers. For the largest growers, however, the chain stores make up a more important market. Of the $173 million in sales to these general merchandisers, $139 million, or 80.1%, was supplied by nurseries which had annual sales over $1 million per year. This accounted for 19% of the sales of the large growers. By contrast, the million-dollar nurseries had only 41.5% of the sales to retail garden centers and nurseries, smaller nurseries making up the other 58.5%.[20]

Customers who buy the plants make up the final stage in this chain of production and marketing. The three major segments of the retail market are residential, primarily through individual purchases, commercial-industrial, primarily through landscape contractors, and governmental, through a variety of sources including in-house production in governmental nurseries which are not part of the nursery business proper and are not shown in the data.

One of the most important elements in the retail market for plants is what can variously be called market demand, consumer preference, or taste. The shifting desire of the purchasers of plants, by whatever name it goes, has a strong impact on nursery growers. Because of the time lag between planting and sales involved with woody ornamentals, commonly from 2 to 5 years, growers are hard pressed to adapt to any rapid shifts in customer demand. During times of expanding retail sales

supplies of plants can be short for several years until production can catch up with demand. In times of declining sales production will exceed demand for several years, usually driving prices down and forcing many growers to dump or burn large quantities of excess inventory. Sales of ornamental plants are tied closely to cycles of residential construction which are in turn strongly influenced by mortgage interest rates, and throughut much of its history the nursery business has had to contend with those unpredictable cycles.

Taste, and its corollary fashion, are usually slower to change than interest rates but the changes are usually more permanent. The demand for different types of plants has been shifting constantly throughout the last several centuries and has had a strong influence on the production of nurseries and on the location of nurseries. The matter of taste and fashion and the different components of the retail market will be discussed more fully in succeeding chapters.

The location of retail markets for nursery products has, of course, a strong influence on the location of producing nurseries. Large metropolitan areas are the large markets for nursery plants just as they are for most other consumer items. Yet there are relatively wide variations in the rates of sales of plants in different metropolitan areas and in different regions of the nation. People everywhere do not buy the same kind or quantity of plants. Market studies have been done over the years for a variety of aspects of consumer demand in several cities, states, and regions of the country.[21] Unfortunately there have been no studies at a national level, and the best data available are those in the Census of Retail Trade which gives information on sales by states

and Metropolitan Statistical Areas (MSAs) of "retail nurseries, lawn and garden supply stores."[22] These include plants along with many other commodities from insecticides to chain saws. By an estimate of Home and Garden Supply Merchandiser magazine in 1975, outdoor ornamental plants account for just under 25% of retail garden and lawn supplies sold.[23]

Figure 2-6 shows the distribution of the 50 leading SMSAs in 1977 in sales by retail nurseries, lawn and garden supply stores and their ratios of sales per capita in relation to the national average. The largest clusters of such major markets are along the northern Atlantic seaboard, the southern Great Lakes, and in California. It should be noted, though, that there is a wide range in rates of per capita sales and that, as a whole, the metropolitan areas of the northern Atlantic seaboard have lower than average per capita sales while those of the Lakes states and California have the highest per capita sales rates. Figure 2-7 shows retail sales per capita for the states in relation to the national average. The Midwest and the far West are the only two regions consistently above the national average. Elsewhere there is wide variation from state to adjoining state. Much of the South is well below the national average as are many of the Rocky Mountain states. Together these two maps suggest the location of the main retail markets for nursery plants, although the data are so coarse that the picture must be relatively unclear even so.

Many of the northeast and midwestern states are large producers of nursery plants but are also large consumers as well. The relationship between production and consumption is best shown by Figure 2-8, comparing each state's share of the national total for wholesale nursery

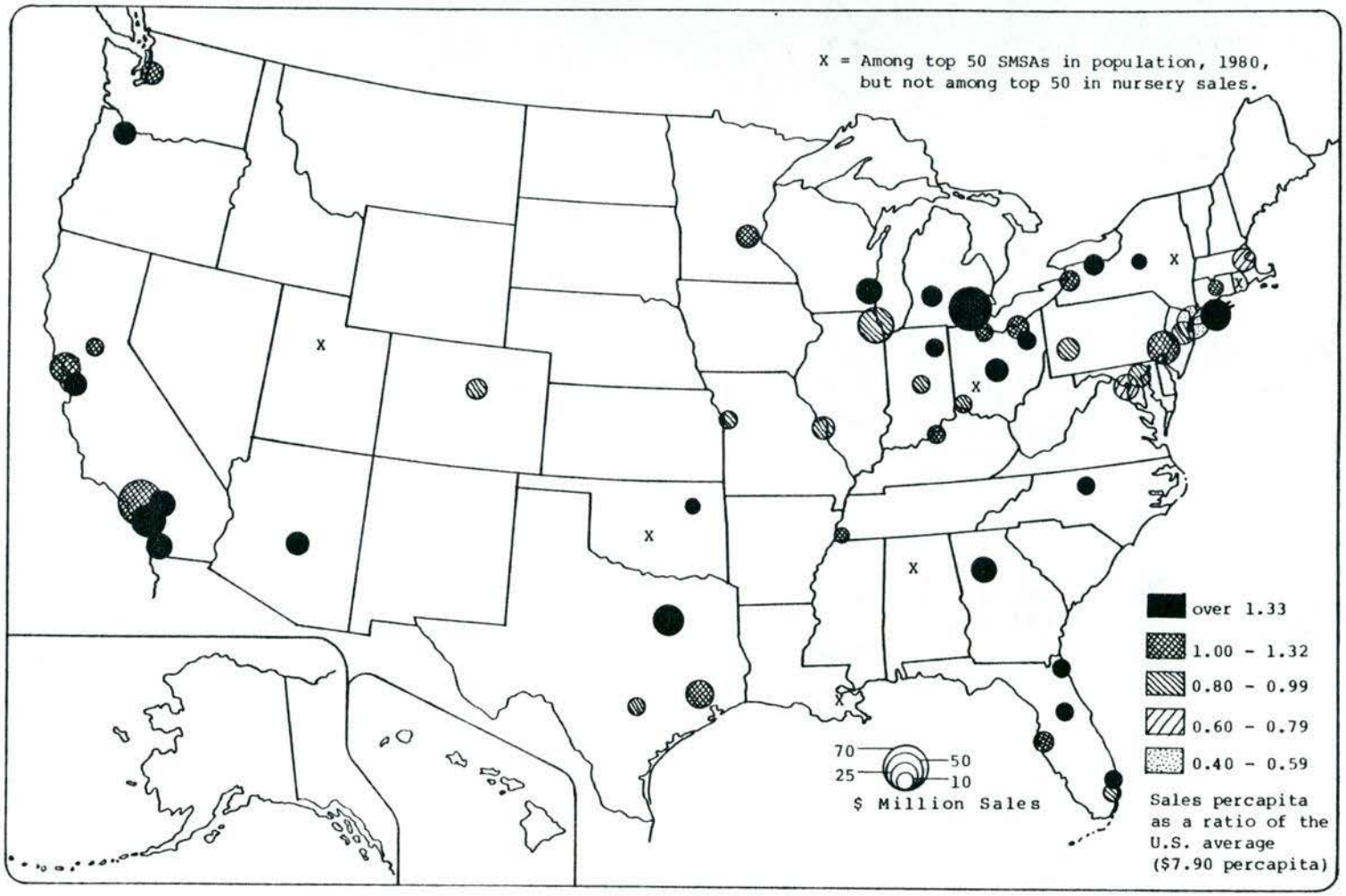


Figure 2-6. Leading SMSAs in Sales by Retail Nurseries, Lawn and Garden Supply Stores, 1978

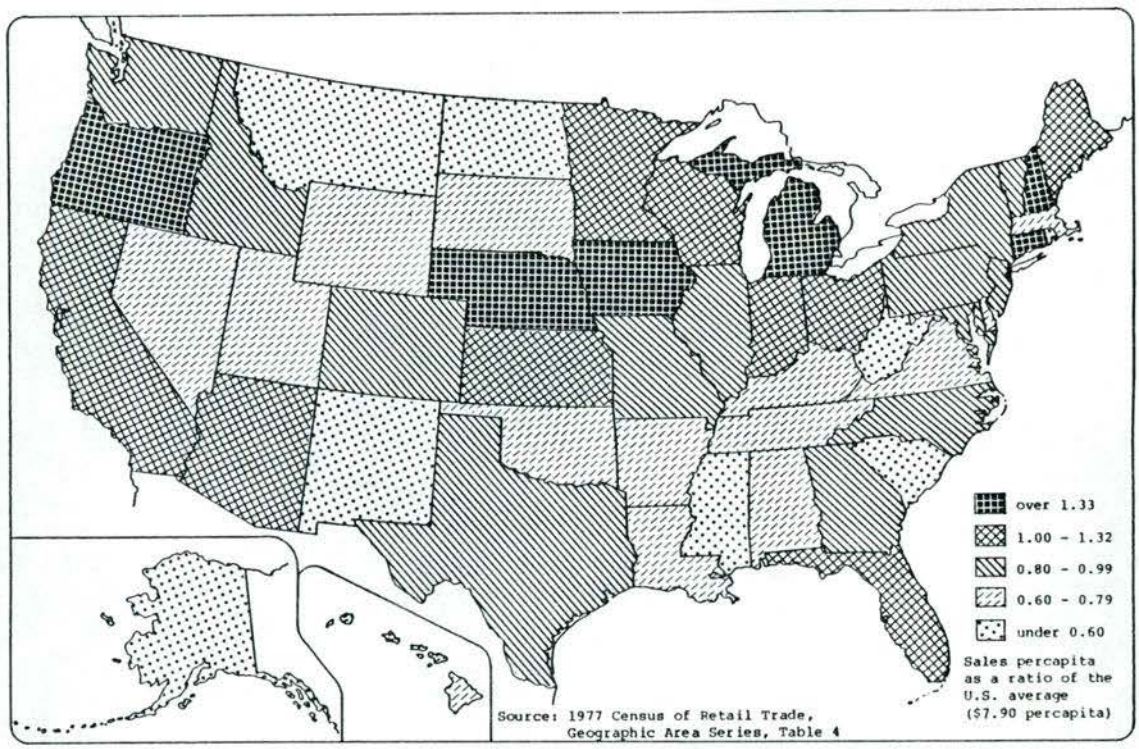


Figure 2-7. Per Capita Nursery Retail Sales by State, 1977

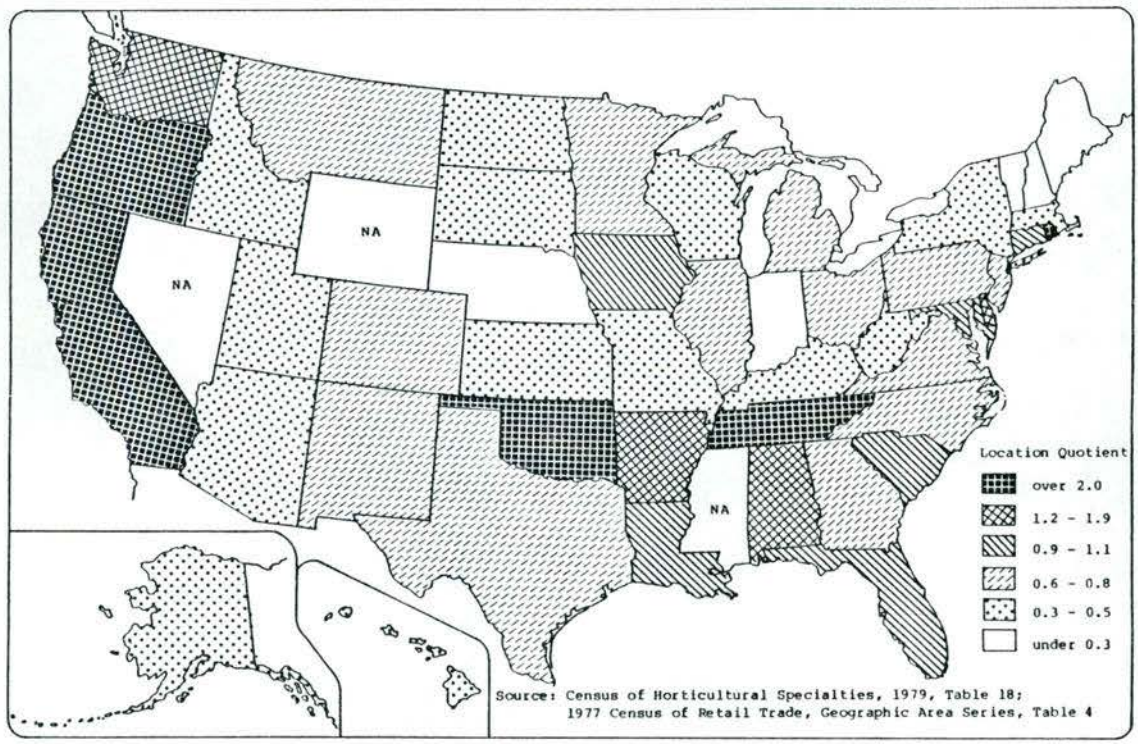


Figure 2-8. Wholesale/Retail Location Quotient, by State, 1977-1978

products sales with its share of the national total for retail nursery, lawn and garden supply store sales. The resultant ratio is a location quotient which describes broadly net producing and net consuming states. This does not exclude the possibility that even the largest net producers also import some plants from elsewhere or that the smallest net producers can supply some of their own needs. It does show, however, that there is considerable regional variation in patterns of production and consumption. The entire Pacific coast and many states in the South are net producers while most of the rest of the nation is net consumers. Outside of the Pacific coast and the South only Rhode Island and Delaware have location quotients above 1.20, and even Michigan, Ohio, Illinois, New York, and Pennsylvania, which are all in the top ten states nationally in nursery growing, are net importers of nursery stock.

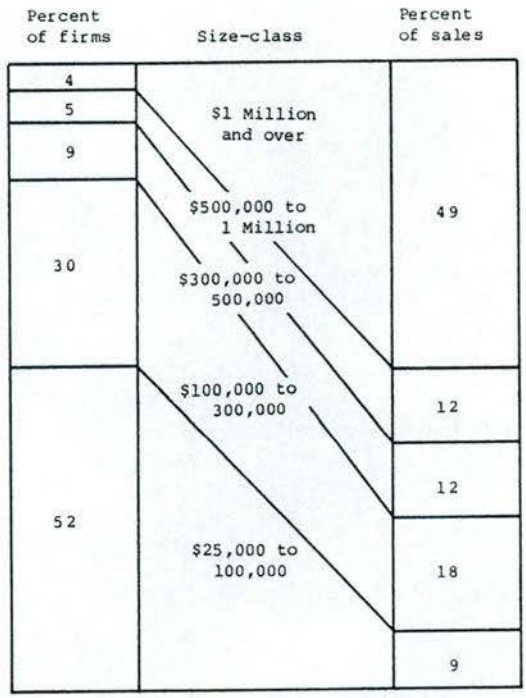
Size-class Distribution of Growers

Like other businesses the nursery business has the bulk of its production in the hands of a relatively few large producers and has a large number of small producers who account for a disproportionately small share of the total. Figure 2-9 portrays graphically the distribution of companies by sales size-classes, using data for 1980 from the H. R. I.'s Scope IV, including growers of foliage plants, bedding plants, and bulbs, corms, and tubers in addition to woody ornamentals, herbaceous plants, and fruit and nut plants. It shows only those nurseries with annual sales over $25,000 per year.[24] Clearly the largest growers, those with sales over $1,000,000 per year, have the

lion's share of the market and the smaller growers have a very small share.

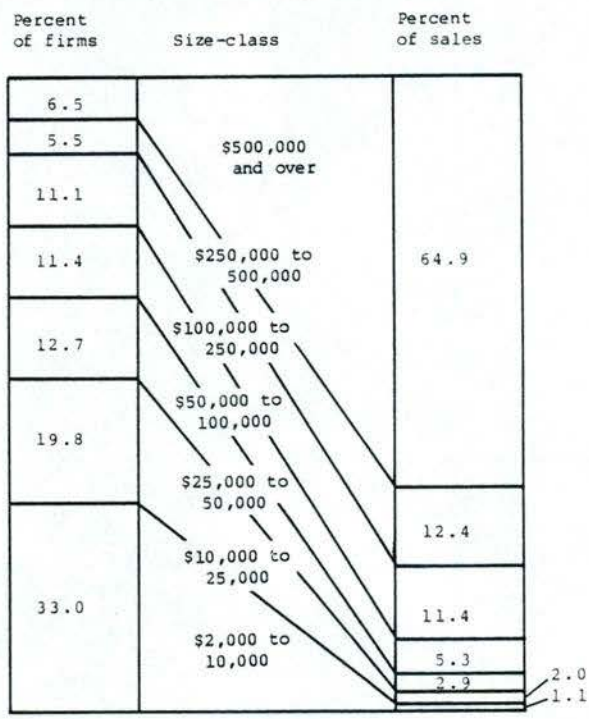
The 1979 Census of Horticultural Specialties provides a similar view, for growers of woody and herbaceous ornamentals and fruit and nut plants, including growers in smaller-size classes, down to those selling $2000 per year, Figure 2-10. Looked at this way the dominance of the large firms is even more striking. The 405 largest growers have almost two-thirds of all the nursery sales. Two classes not covered by the Scope IV study appear here. The smallest growers, in the $2 - 10,000 class are mostly part-time growers, the backyard hobbyists. They account for a third of the number of nurseries but only 1.1% of the sales. The next category, $10 - 25,000 in sales, may be considered the mom-and-pops, perhaps large backyard growers or farmers of other crops raising a few nursery plants for diversification. They make up almost a fifth of the growers but only 2% of the sales.

The pattern of size-class distribution varies from state to state. The percentage of each state's nursery sales which are provided by the largest growers, those selling over $500,000 per year, is shown in Figure 2-11. There are few clear regional patterns. The Midwest is mostly in the 60 - 70% range, close to the national average of 64.9%, while the Northeast has more states in the 40 - 50% range, considerably below the national average. Elsewhere there are relatively strong differences between adjacent states. This perhaps reflects the impact of concentration of production in a few areas, whereby large nurseries in one state supply plants to adjacent ones. At a national level the same apparently applies. Only five states of the 38 for which data are



Source: Horticultural Research Institute, Scope IV,6

Figure 2-9. Size-class Distribution from Horticultural Research Institute's Scope IV, 1980



Source: Census of Horticultural Specialties,1979, Table 2

Figure 2-10. Size-class Distribution from the Census of Horticultural Specialties, 1979

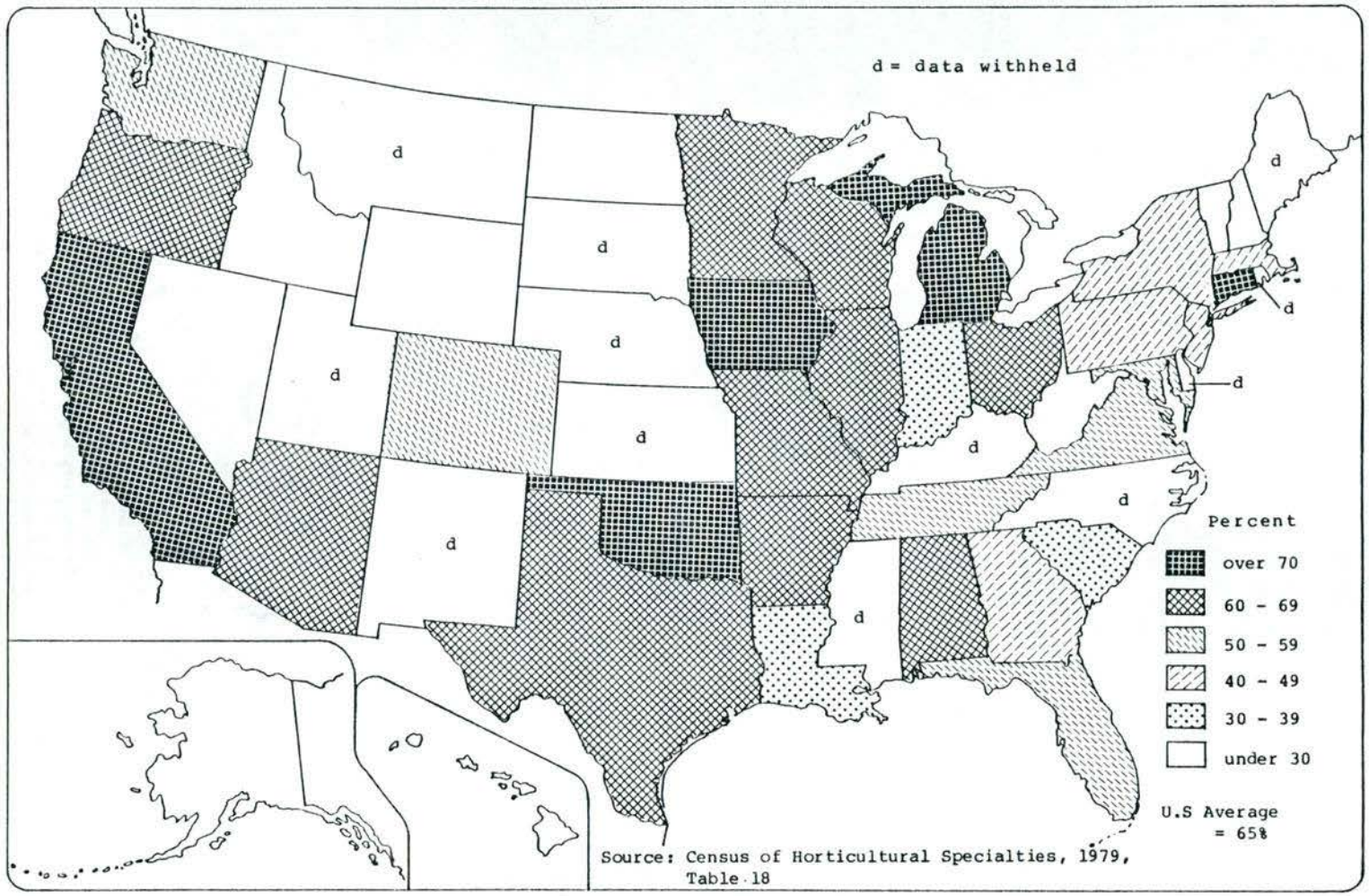


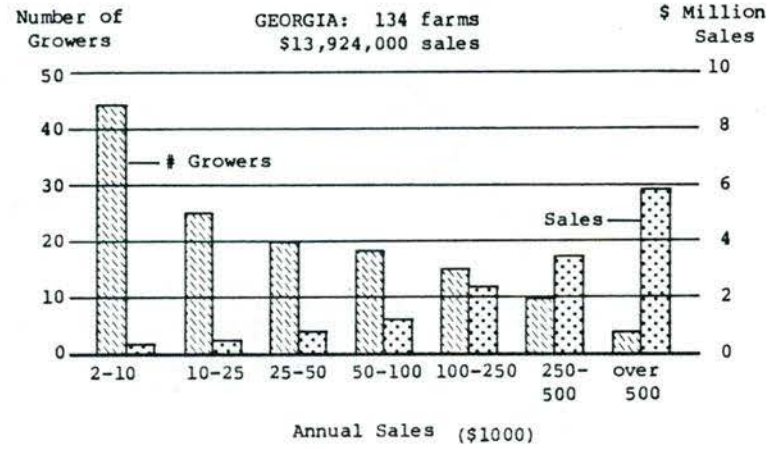
Figure 2-11. Percent of All Nursery Product Sales by Firms Grossing over $500,000 per Year, 1978

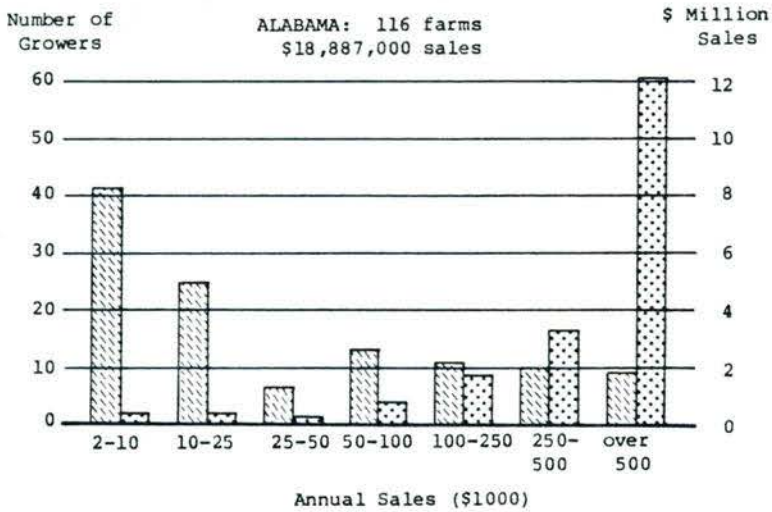
available were significantly above the national average, yet growers there have a strong influence on the national business.

The role of these large growers can be illustrated by comparing individual states. The Census reports that in Georgia there were 134 farms producing just under $14 million in nursery products in 1978. In Alabama 116 farms produced just under $19 million. The difference in sales between the two states is almost entirely accounted for by the difference in sales by the large growers. As Figure 2-12 shows, the eight largest Alabama nurseries produced over $6 million more than the three largest Georgia nurseries. A similar pattern exists comparing Oregon and Pennsylvania, Figure 2-13, where the large growers in Oregon not only made up the difference between the two states' sales but actually produced more than the entire state of Pennsylvania.

The state where the large growers have their greatest numbers and impact, though, is California. There they actually make up the largest class of growers, some 20% of all California nurseries, Figure 2-14. The 114 growers producing over $500,000 per year there make up a quarter of all growers in that class nationwide and had 35.5% of the class's sales. They account not ony for 83.3% of California's sales, but 23% of the nation's total as well.

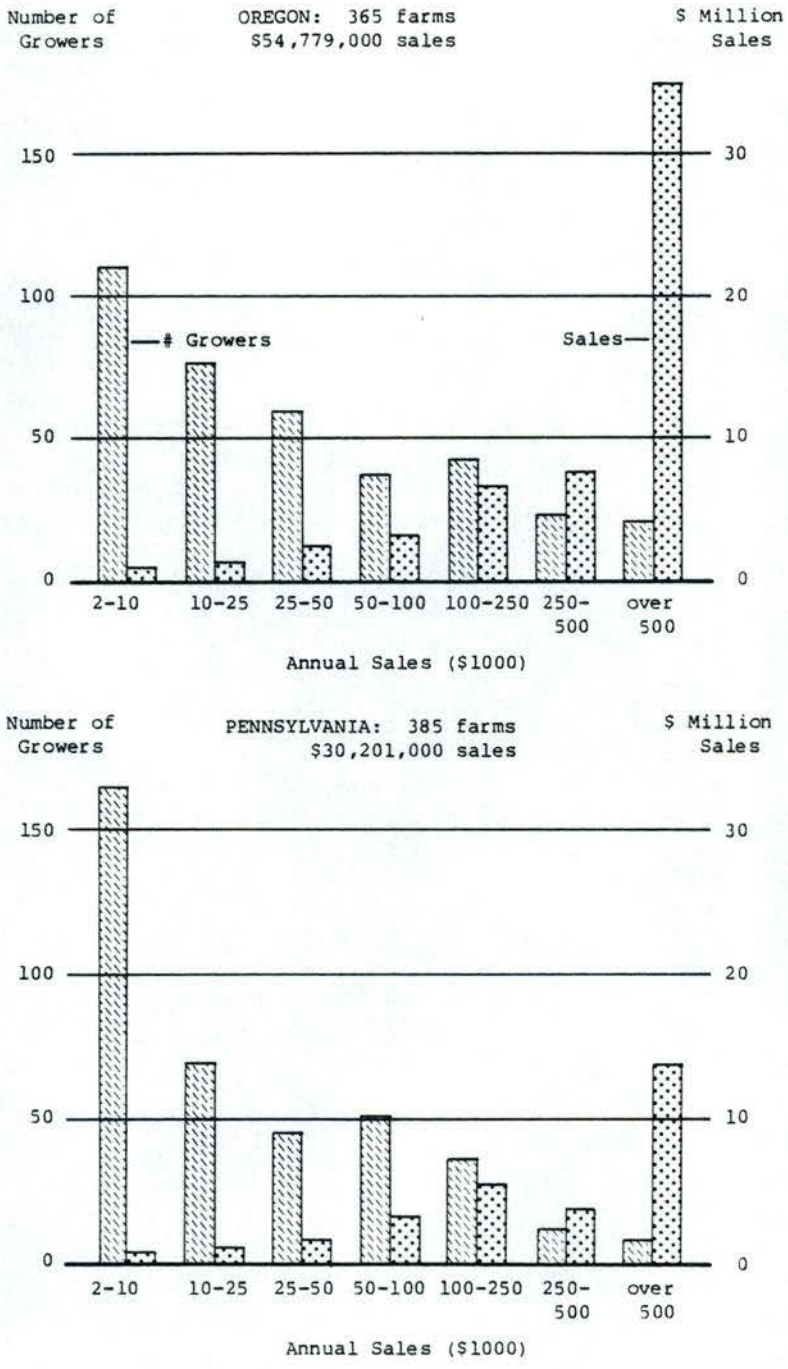
Several of the largest growers have operations in more than one state, and a handful of the very largest are subsidiary operations of large corporate conglomerates. Many of the large growers, though, are still family farms and many of these are not incorporated. In recent years the corporate conglomerates have increased their participation in the nursery business, building national organizations of growers and





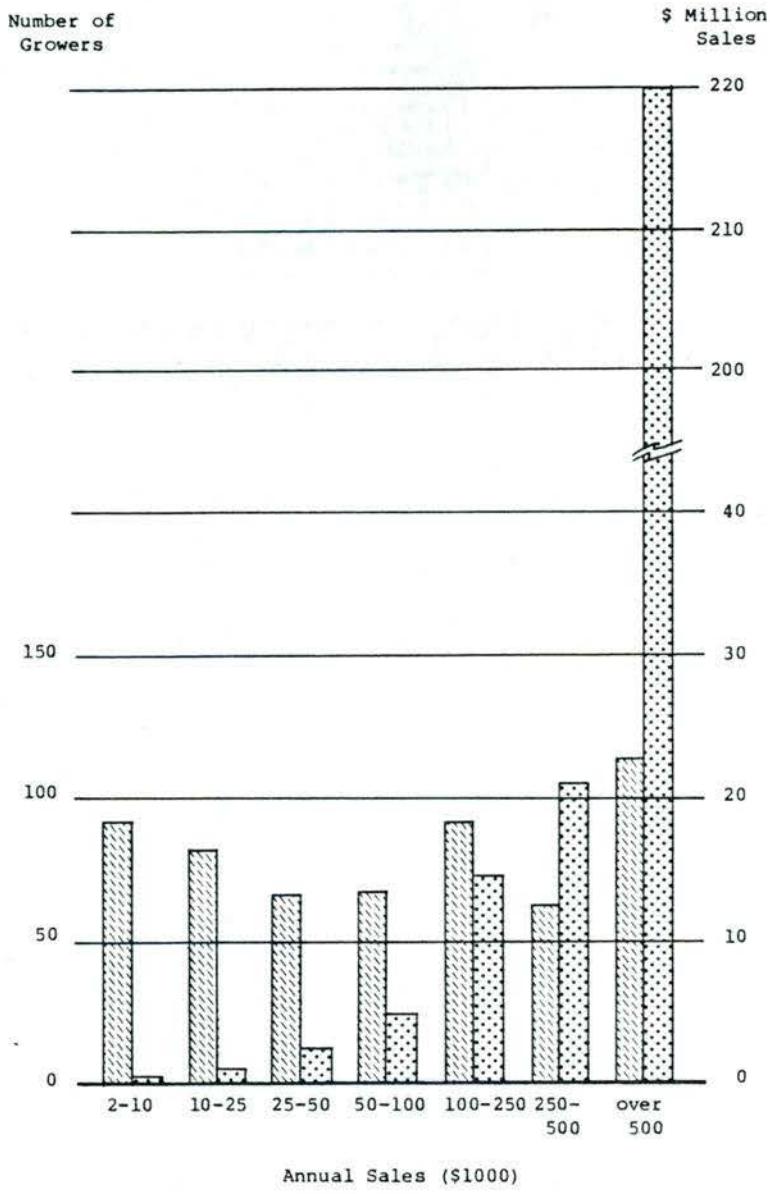
Source: Census of Horticultural Specialties, 1979, Table 18

Figure 2-12. Size-class Distribution of Nurseries in Georgia and Alabama, 1978



Source: Census of Horticultural Specialties, 1979, Table 18

Figure 2-13. Size-class Distribution of Nurseries in Oregon and Pennsylvania, 1978



Source: Census of Horticultural Specialties, 1979, Table 18

Figure 2-14. Size-class Distribution of Nurseries in California, 1978

distributors, mostly by buying up profitable large private operations. This will be discussed in more detail in Chapter 12.

Major Production Locations

Where, then, are the nurseries of the nation located? There are several ways to answer this question depending on the source of information used. Since most of the data available on the nursery business are at least partially incomplete perhaps the best view is a composite of different sources. The 1979 Census of Horticultural Specialties provides total annual sales figures by both states and counties. Figure 2-15 shows the total nursery products sales by states and Figure 2-16 shows the 50 leading counties, plus three others for which data were withheld but which probably had sales equal to or greater than some of those in the top 50. Figure 2-17 shows the location of main offices of the 171 largest member firms of the American Association of Nurserymen, those with estimated sales over $500,000 per year as of 1981.[25] And Figure 2-18 represents the locations of the principal place of business of 90 of the firms listed in "Nursery Business 100" of 1983 (those for which I could find addresses), all of which had sales estimated to be at least $2.4 million in 1982, as published by Nursery Business magazine.[26]

The A.A.N. and Nursery Business maps show single locations for each firm while in fact many large nurseries have more than one growing location, often in different states. They also both show growers of foliage and bedding plants plus bulbs, corms, and tubers, in addition to those categories shown by the Census. The Census maps reflect total

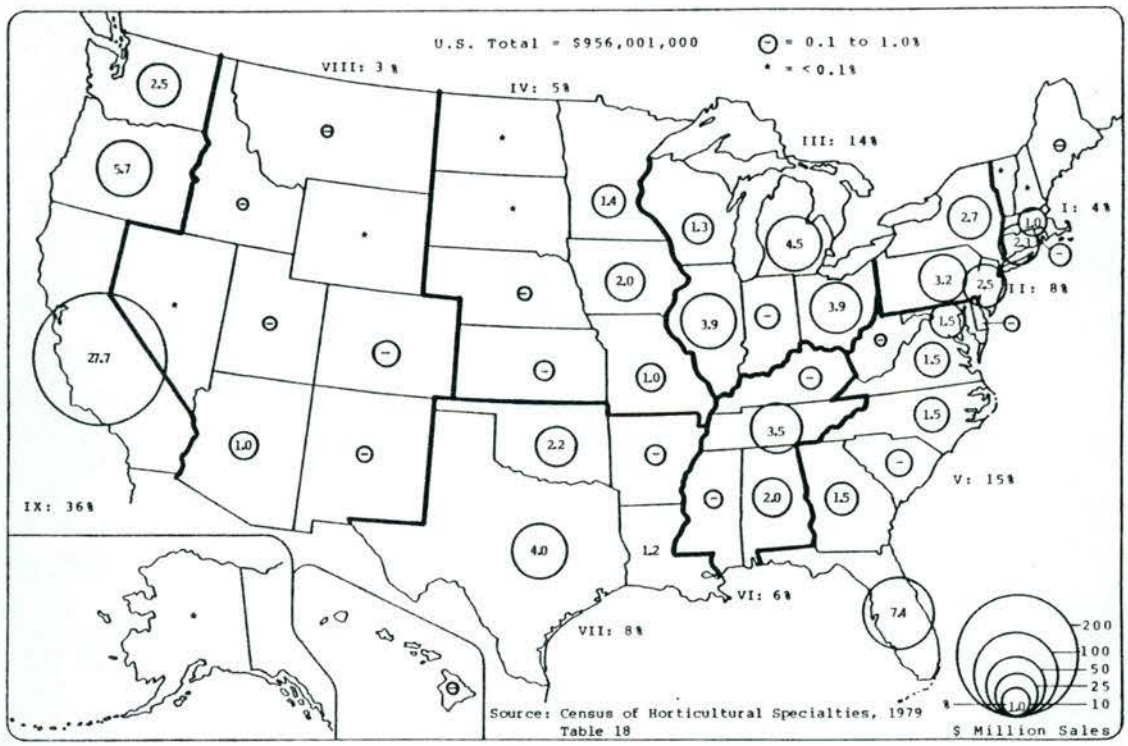


Figure 2-15. Nursery Product Sales by States, 1978

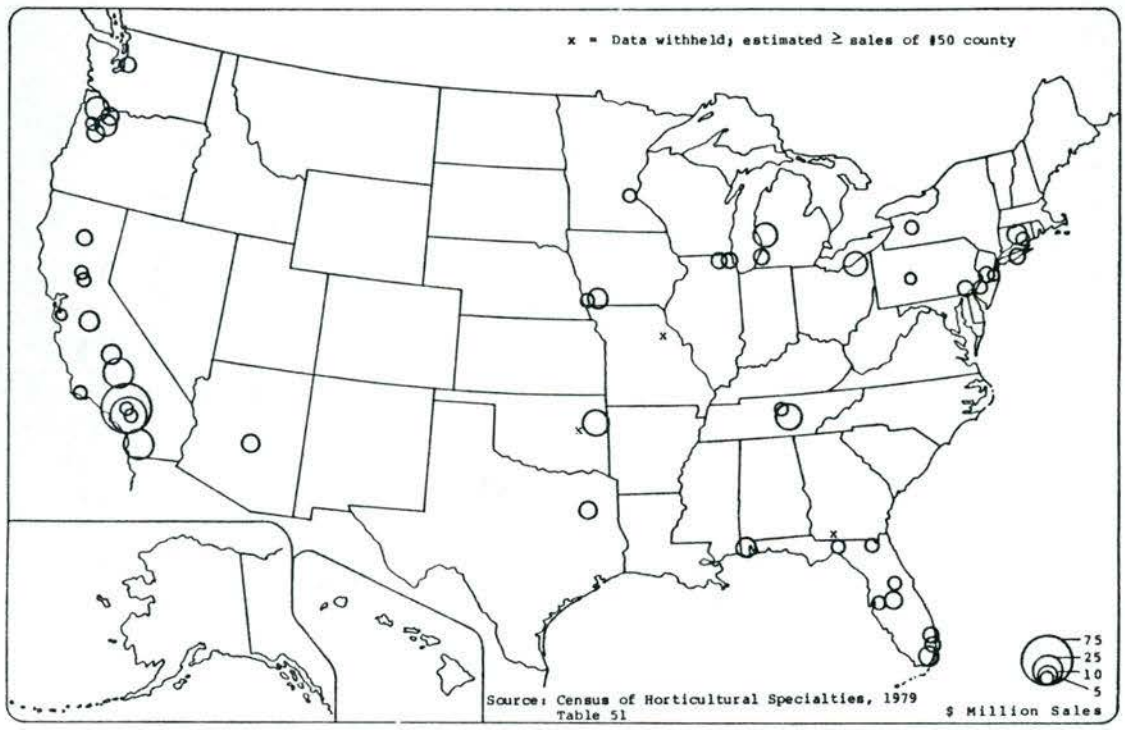


Figure 2-16. 50 Leading Counties in Nursery Product Sales, 1978

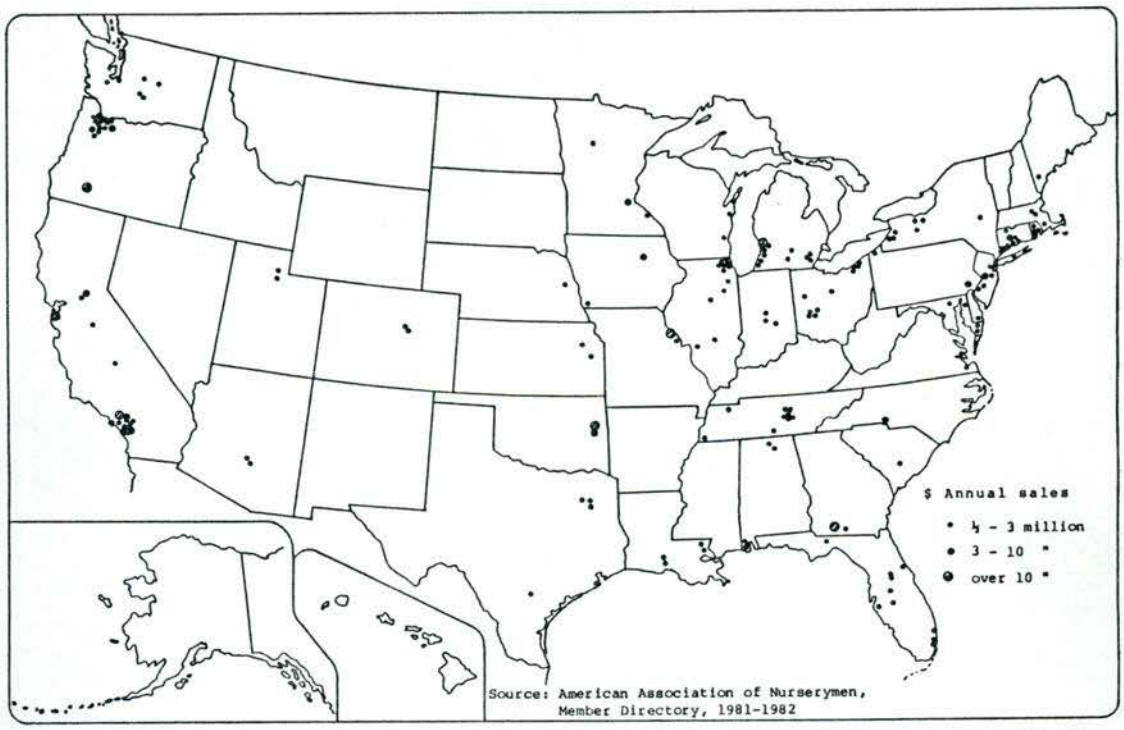


Figure 2-17. Locations of American Association of Nurserymen Members with over $500,000 per year in Sales, 1981-82

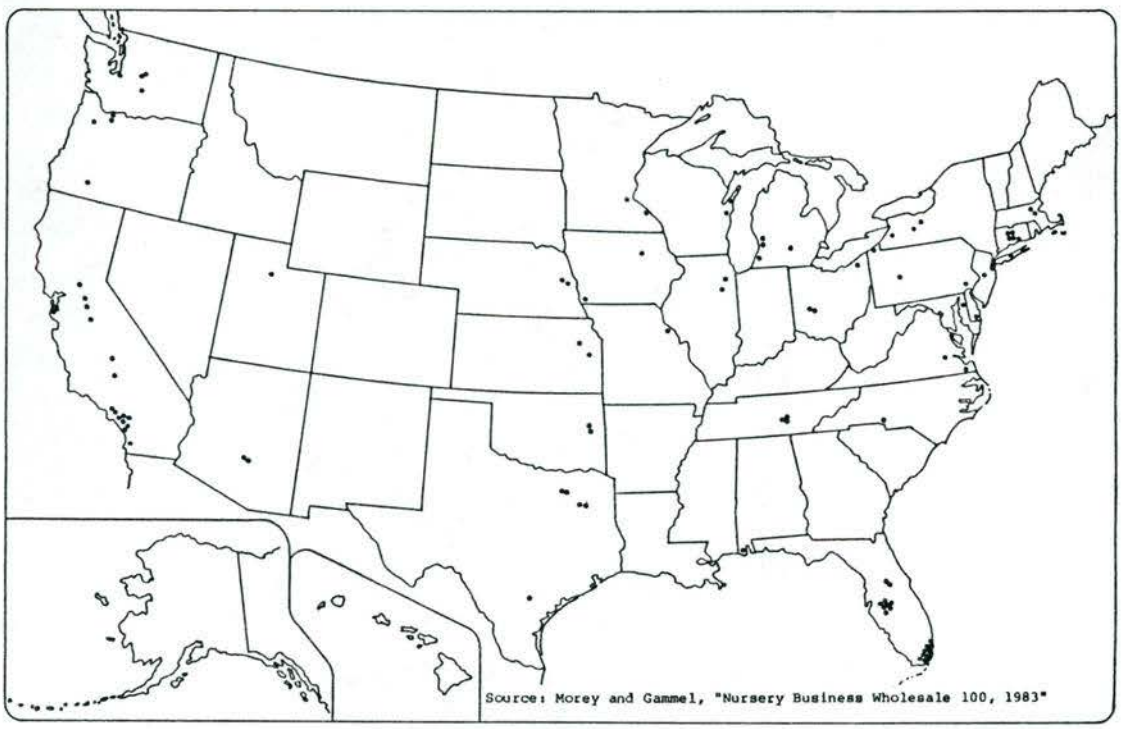


Figure 2-18. Locations of 100 Leading Nurseries, 1983

sales generated within each state or county regardless of the location of the home office of the nursery. They also show sales of all producers in a geographic unit, not just the largest ones. Thus the two sets of maps do not agree. Some large corporate nurseries may have headquarters far from their growing areas, as for example, Jackson & Perkins, the large rose grower which is headquartered in Medford, Oregon, but which has its growing operations in Wasco, California.

From all accounts, however, certain fundamentals emerge in agreement. California, particularly Los Angeles and Orange Counties, is the largest single producing area in the nation. Together these two counties made up 12.5% of the nation's sales in 1978. The third and fourth counties are Kern and San Diego, also in California, which together with the first two made up 17.9% of the national total. The state as a whole had 27.5%.

Florida was the second leading state in 1978, with production mainly in two distinct areas, the center and the southeast. Florida is also the largest producer of foliage plants, which is reflected in Figure 2-18. The northern Willamette Valley of Oregon is another major producing area, with two of the top 10 counties and three others in the top 50, and Oregon was third in state sales in 1978.

In the Great Lakes area and the northern Atlantic seaboard are two slightly more diffuse regions of production. Michigan, Ohio, and Illinois were the 4th, 5th, and 6th states respectively, with production located mainly near the shores of Lake Michigan and Erie but also dispersed in other parts of each state. Along the Atlantic seaboard from the Chesapeake Bay to southern New England are a large number of

nurseries and seven of the 50 leading counties. Elsewhere nursery production is less concentrated, though several important areas stand out, especially southwest Iowa, eastern Oklahoma, northeast Texas, and east- central Tennessee.

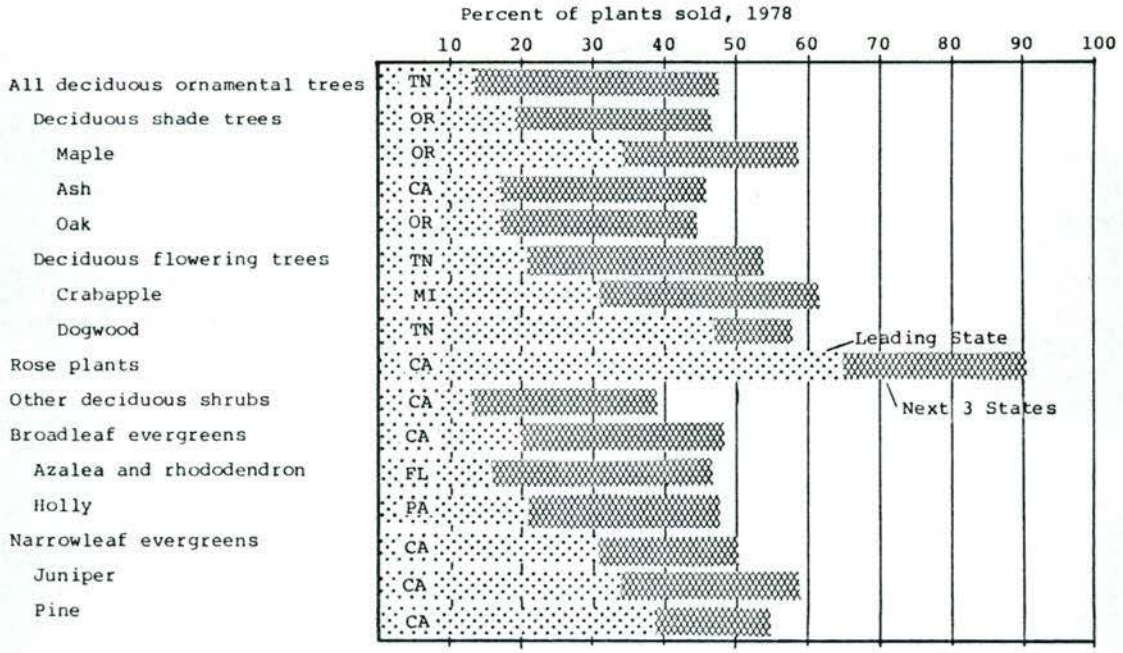
The concentration of production in coastal areas of the two oceans and the Great Lakes is directly tied to climatic factors of growing conditions, mainly milder winter temperatures and longer growing seasons. These will be discussed in more detail in Chapters 4 and 11. Nursery production is noticeably smaller in the Rocky Mountains, Great Plains, northern New England, plus Alaska and Hawaii. This is mainly due to both climatic factors and distance from markets.

One basic principle of nursery locations, which this study will elaborate, is that nurseries can prosper far from major markets only if they are in an area which enjoys significant production advantages, and that these derive largely from climatic factors though other factors are also important. Areas with difficult climates, those with harsh or long winters especially, are important nursery areas only near major markets, and in the absence of more favored climatic areas nearby. Thus Wisconsin, Minnesota, and Iowa have important nursery production despite harsh winters partly because they are near large urban markets of the Midwest; the Rocky Mountain states do not, due to both harsh winters and distance from markets; and northern New England does not, even though close to major markets due to competition from growers in climatically-favored southern New England.

Regional Specialization

Climate and market demand also play a role in the specialization of nursery production by plant type across the nation. As discussed earlier some plants, especially lining-out stock and young bare root and container plants, can be shipped relatively inexpensively over long distances, compared to B&B plants and larger bare root and container stock. It costs roughly only 13¢ to ship a one gallon azalea from Mobile, Alabama to Chicago, Illinois, and roughly 24¢ to ship a 5'-6' bare root maple tree from Portland, Oregon to Chicago.[27] Growers who can save that much on production costs due to any combination of factors in Alabama or Oregon can thus compete with the growers in Illinois for the Chicago market. The advantages for production are not the same for different types of plants in each region, however, and Alabama grows far fewer maple trees than does Oregon while the two states both produce about equal numbers of azaleas. Across the country are many striking regional differences in production of the various types of plants.

Data from the Census of Horticultural Specialties are the only ones which detail production by plant groups and genera for the whole nation, although only at the level of whole states and not of counties. They show a pattern of regional specialization for several genera of plants and relatively weak regional specialization for others. Figure 2-19 shows the degree to which production is concentrated in one or a group of states. It shows the percentage of the number of plants sold in 1978 from the leading state and the leading four states for each of several



Source: Census of Horticultural Specialties, 1979, Table 36

Figure 2-19. Production Concentration by Plant Type and Leading States

groups or genera

It is apparent that the broad categories of plant groups, such as deciduous trees, broadleaf evergreens, etc. are all less concentrated than are most of the individual genera within them. Some of the genera are also less concentrated than the larger group, though, or than other genera in their group. Concentration can be defined here in any number of ways, but in most cases several conditions coincide: the leading state produces over one third of the total, it produces more than the next three states combined, and the top four together produce over half of the national total.

Much of this has to do with the product form the plants take and the cost of transporting them to market. Oak trees are more commonly grown B&B than bare root, and evergreen azaleas and rhododendrons were, in 1978 at least, more commonly grown B&B than in containers though this is probably no longer the case. This sharply limits the distances they can be profitably shipped and encourages dispersion of production areas, as can be seen in Figures 2-5 and 2-20.

The most concentrated plants are roses, Figure 2-21, which are marketed as small, heavily pruned, bare root plants, perhaps the cheapest of all woody ornamentals to ship. They are followed by junipers, Figure 2-3, which are sold in greatest numbers in one gallon containers mostly, and by maple trees, Figure 2-22, which are sold in large numbers by the leading states as relatively small bare root plants while also being sold B&B in larger sizes by many other states nearer the major urban markets. The distinctions based on product form, however, do not explain all of the concentrations, as dogwoods, Figure

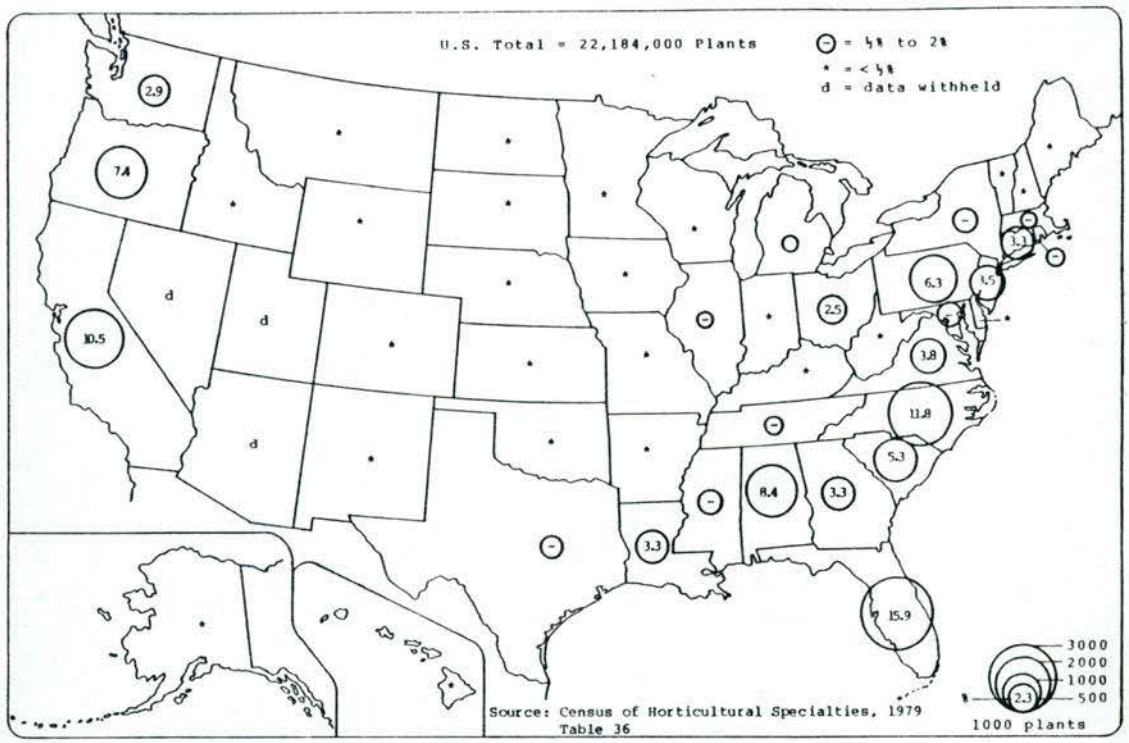


Figure 2-20. Production of Evergreen Azaleas and Rhododendrons, 1978

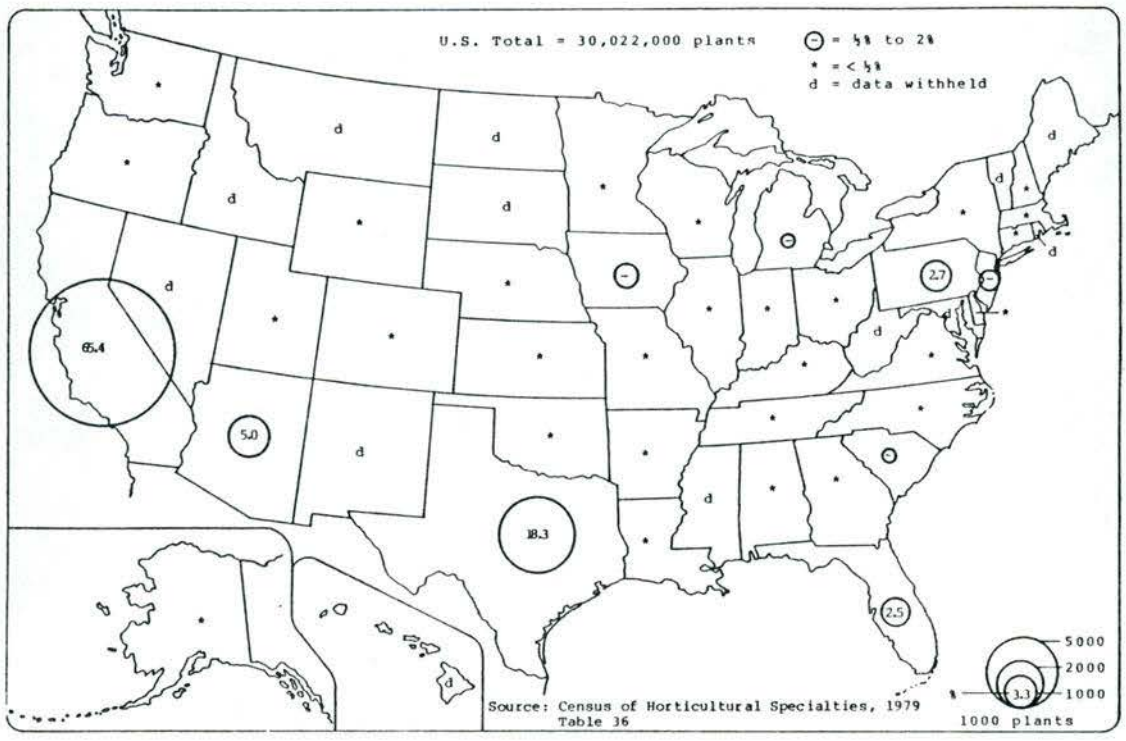


Figure 2-21. Production of Rose Plants, 1978

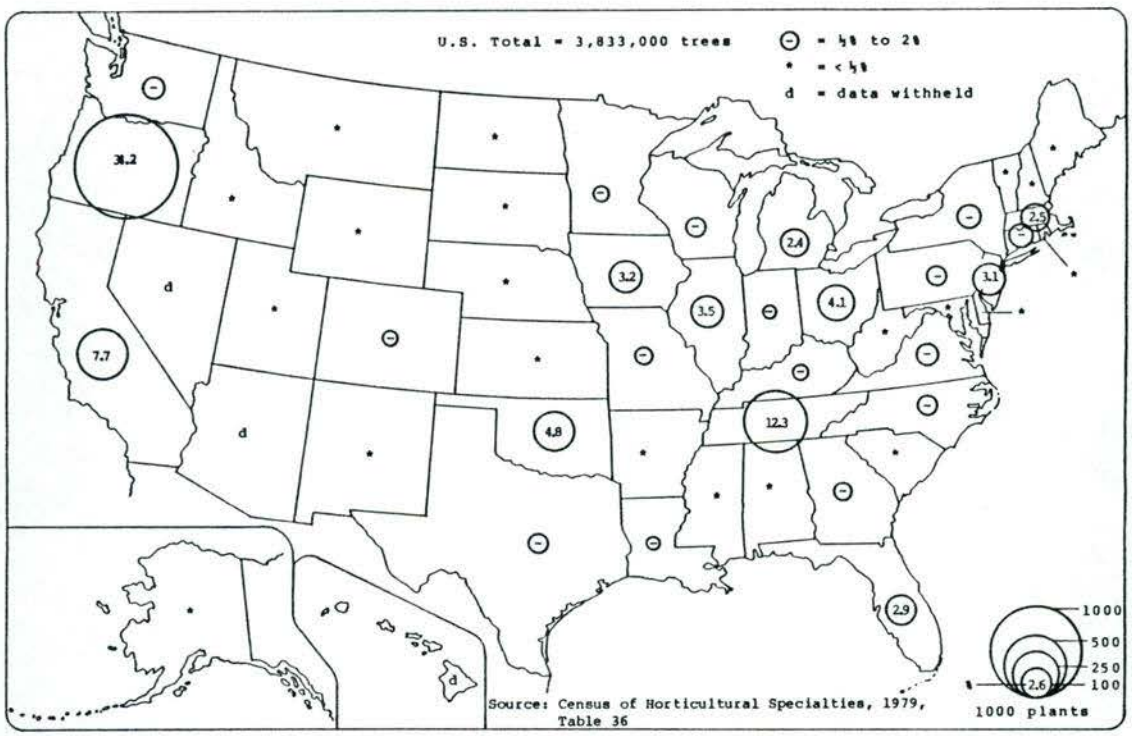


Figure 2-22. Production of Maple Trees, 1978

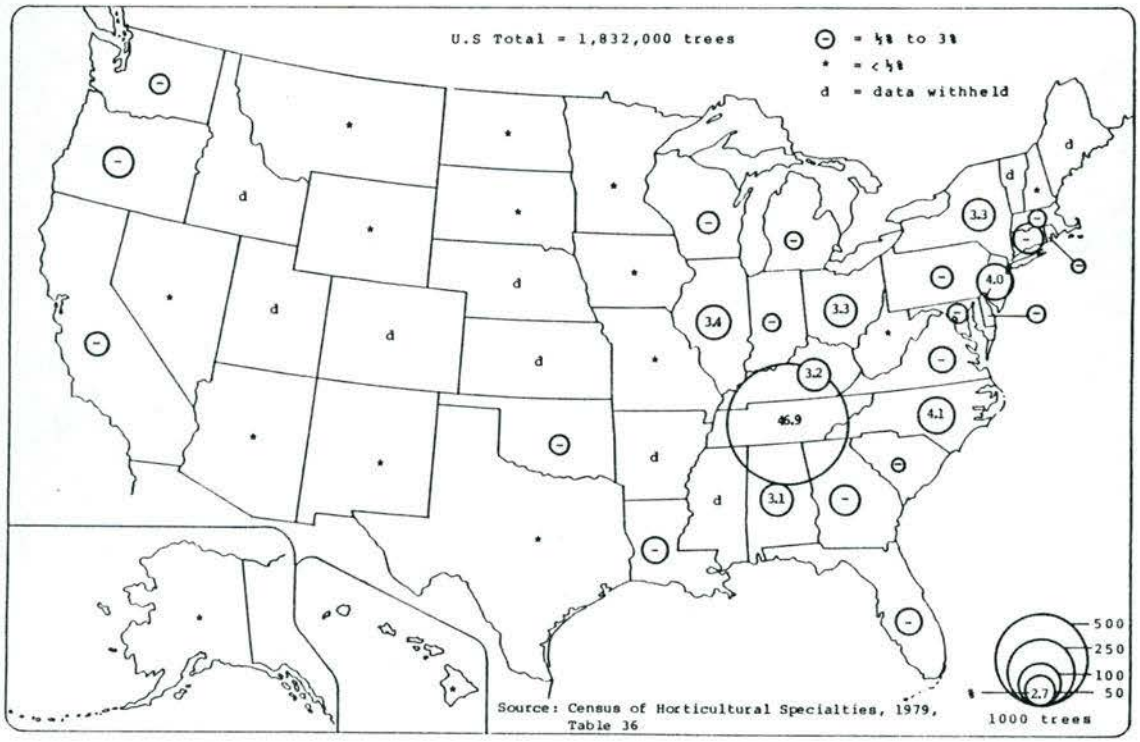


Figure 2-23. Production of Dogwood Trees, 1978

2-23, are grown mainly B&B especially in Tennessee, yet they are among the most concentrated of deciduous trees.

But product form and attendant transportation costs can be seen to be an important factor in making concentration of production possible. Other factors, of course, make it profitable and among these the most important is climate, which will be discussed in more detail later.

Chapter Two - Notes

[1]The eight categories were: Bedding plants, Bulbs, Cut flowers and cut florist greens, Foliage and flowering plants, Nursery products, Vegetable and flowers seeds, and Greenhouse vegetables, plus, of course, "other."

[2]U. S. Bureau of the Census, Census of Horticultural Specialties, 1979, Table 56. Of the national total of $4,462,000 in flower seed sales, California accounted for $4,183,000, or 93.7%. Santa Barbara County had $3,213,000 or 72.0%.

[3]U. S. Bureau of the Census, Census of Horticultural Specialties, 1979, Table 50. Of the national total of $348,251,000, Pennsylvania accounted for $154,981,000, or 44.5%. Chester County had $88,431,000, or 25.4%.

[4]Charles J. Burr, "How Capitola, California Became the Begonia Capital," Pacific Coast Nurseryman and Garden Supply Dealer, 40 (Oct. 1981), 24-28.

[5]For a comprehensive view of the U. S. cut flower business see D. C. Goodrich, Flower Marketing (New York: Lebhar-Friedman, 1980) and Gary L. McDaniels, Ornamental Horticulture (Reston, Virginia; Reston, 1979). For a look at the inroads of foreign flower growers see Russell Levitt, "Billions in Blossoms," Fortune 103 (18 May 1981), 68-75.

[6]Horticultural Research Institute, Scope IV of the Nursery Industry, A Study Involving the Firms Composing the Wholesale Grower Portion of the Nursery Industry in the United States (Washington: Horticultural Research Institute, 1982), 5.

[7]Dick Morey, "Hines Believes in Variety!" Nursery Business 27 (Nov. 1982), 52-53.

[8]Interview with Judy Hefley, customer service respresentative, Hines Wholesale Nursery, Irvine, California, September 1983.

[9]U. S. Bureau of the Census, Census of Horticultural Specialties, 1979, Table 15.

[10]Interview with Carl Rhode, production manager, Olle Olsson Nurseries, Monrovia, California, September 1983.

[11]U. S. Bureau of the Census, Census of Horticultural Specialties, 1979, Table 35.

[12]Ibid.

[13]See, for example, the recommendations of Harry G. Ponder, Charles H. Gilliam, and Ronald L. Shumack, "Growing - The Second Step in Shade Tree Production," American Nurseryman 153 (15 June 1981), 14-15, 44-58.

[14]Horticultural Research Institute, Scope IV, 13.

[15]Jeff Morey, "The Hawaiian Connection - Can Agratech Succeed at Exporting Hawaiian Grown Foliage when Amfac Failed?" Nursery Business 29 (August 1984), 46-48, 60; and "Ornamentals: A Growing Agricultural Business," Puerto Rico Business Review 8 (June 1983), 2-5.

[16]Horticultural Research Institute, Scope IV, 15.

[17]See Sidney R. Jumper, "Wholesale Marketing of Fresh Vegetables," Annals of the Association of American Geographers 64 (1974), 387-396. Jumper writes of the changes now taking place in the marketing system, whereby such terminal markets are declining in importance.

[18]One example is Nursery Brokers of Tennessee, Inc., located in McMinnville, Tennessee, one of the leading nursery ares in the nation. In their 1983-84 catalog they claim access to supplies from over 300 growers.

[19]Dick Morey, "Re-Wholesaling - The Answer to Supplying the Landscape Trade," Nursery Business 28 (July 1983), 43-48, 62, 64.

[20]Horticultural Research Institute, Scope IV, 16.

[21]Alvi Voight, A Guide to Nursery Marketing Research (Washington: Horticultural Research Institute, 1978), contains the most extensive bibliography, although many of the items are more than 20 years old.

[22]U. S. Bureau of the Census, Census of Retail Trade 1977, Table 4 (Geographical Area Series), and Table 5 (Geographical Area Series).

[23]Home and Garden Supply Merchandiser, National Retail Panel, special report, June 1975; cited in Voight, Guide to Nursery Marketing Research, 5.

[24]Horticultural Research Institute, Scope IV, 6.

[25]Taken from the 1981-82 Member Directory of the American Association of Nurserymen, Washington, D. C.

[26]Dick Morey and Walter A. Gammel, Sr., "Nursery Business Wholesale 100," special supplement to Nursery Business 28 (September 1983), no pp.

[27]Based on shipping costs of $1.00 per mile for fully loaded 40ft. tractor-trailer, 6200 one gallon azaleas per load and 10,000 maple trees per load. For a study of costs of shipping azaleas, see Technical Committee S-103, Factors Affecting Southern Regional Production Advantages for Kurume Azaleas, Southern Cooperative Series Bulletin 241 (Knoxville, Tennessee: Univ. of Tennessee, Agricultural Experiment Station, 1979). Size of maple shipment based on interview with Norbert Kinen, Vice President, J. Frank Schmidt & Son Co., 18 October 1983.

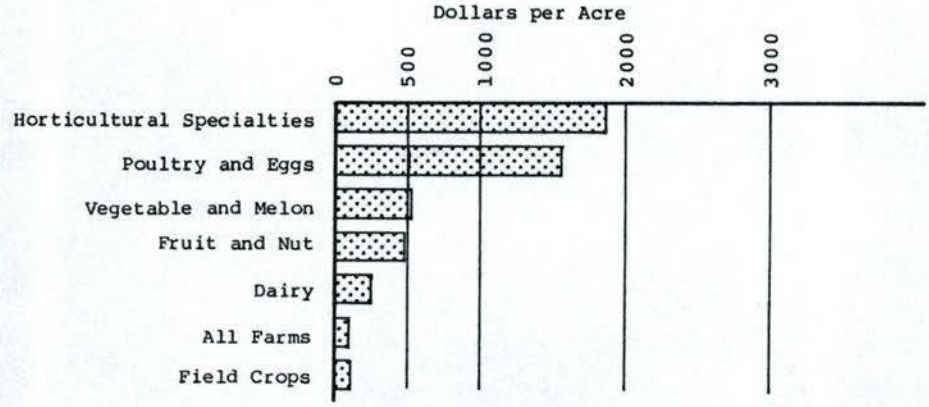
CHAPTER THREE

NURSERY PRODUCTS IN THE GEOGRAPHY OF AGRICULTURE

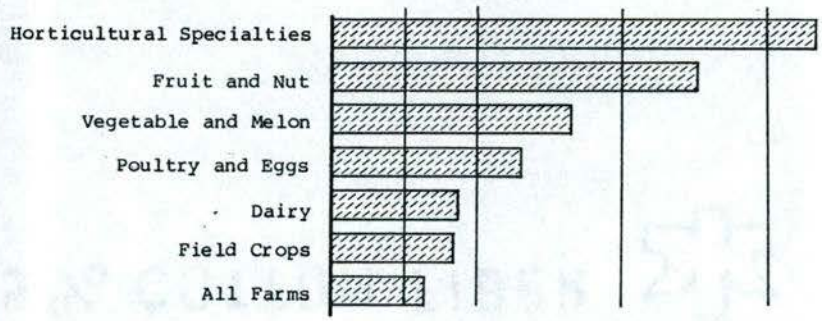
Nursery growing is one type of agriculture, part of the larger type, horticultural specialites, and has with it certain characteristics which distinguish its geography from that of other forms of agriculture. Nursery farming is an intensive form of agriculture, in terms of its inputs of capital, labor, machinery, energy, etc. It produces one of the highest value products of all crops and does so on relatively small areas. But given the weight of the final product shipping charges can be relatively high as a percentage of the value of the crop. This often encourages production close to markets. Because of these and a few other factors, nursery products are one of the forms of agriculture most commonly found close to metropolitan areas, although a large part of the national crop is grown well away from cities as well. In this chapter I will examine some of the most important ways in which nursery farming, or ornamental horticulture as it is also known, is a distinctive form of agriculture and how it compares to other farm types in its geograpy.

Nursery Growing as Intensive Agriculture

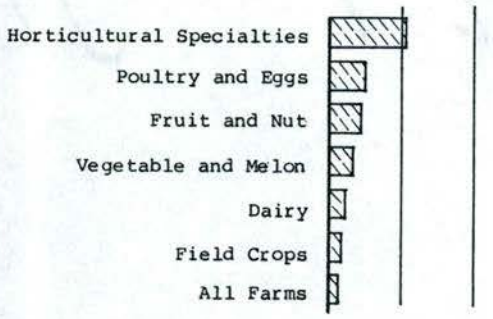
One of the distinguishing features of nursery farming is the intensity of production inputs per unit of land area and the high value of the crop produced. Census data on different farm types grouped by Standard Industrial Classification can be used to compare horticultural specialty operations with other types of farms.[1] Keeping in mind the



a) value of sales



b) value of land and buildings



c) value of machinery and equipment

Source: 1978 Census of Agriculture, Vol. I, Pt. 51, Table 35 (U.S. Data)

Figure 3-1. Sales and Assets per Acre for Selected Farm Types

wider range of plants included as horticultural specialties, beyond just nursery products, this can provide some basis for characterizing the intensity of nursery production. Figure 3-1 shows three measures of this intensity: the value of sales per acre of farmland, the average value of land and buildings per acre, and the value of machinery and equipment per acre.

Horticultural Specialties clearly leads in all three categories. It is, however, a type characterized by the smallest farms of these categories, and the value of sales or assets per farm are not necessarily the highest. Table 3-1 lists the components of farm production expenses for the leading categories of production expenses of various farm types in 1974. Horticultural Specialties is distinguished by larger shares of expenditures for hired labor and for seeds and plants, as well as the second highest shares of expenditures for gas and oil, among the farm types shown here. At the same time it is characterized by lower than average expenditures for fertilizers and chemicals. The intensity of production which characterizes horticultural specialty operations, then, is greatest in its use of labor, plants, and energy and is applied to smaller areas yielding higher densities of sales and of capital assets than for most other types of farming.

Horticultural specialties is also the most specialized of all the farm types, with the least crop and livestock diversification of the several types of farms, as seen in Table 3-2. It is also a crop type of little importance to other types of farms as seen by the percentage of nursery products and greenhouse products sales in the total sales values for the various other farms. In many ways horticultural specialties is

Table 3-1. Selected Farm Production Expenses by Standard Industrial Classification, 1974

Expense	Percent of Total Production Expenses						
	All farms	Cash grain	Vege-tables	Fruits and nuts	Hort. spec.	Dairy	Poultry
Fertilizer	8.4	17.2	10.4	7.2	1.9	6.0	0.6
Gas and oil	5.0	8.7	3.6	3.5	5.6	4.3	1.6
Chemicals	2.9	5.4	5.6	6.8	1.2	1.3	0.2
Hired labor	7.6	5.1	25.6	27.7	35.8	6.4	4.2
Contract labor	0.8	0.4	5.8	7.6	0.8	0.2	0.2
Machine hire & customwork	2.2	3.9	2.8	4.0	0.5	1.4	0.2
Seeds and plants	3.0	5.8	3.8	1.0	12.3	6.0	0.6
Animal-related expenses	39.4	9.8	1.0	1.2	0.4	44.9	81.7
All other expenses	30.7	43.7	41.4	41.0	41.5	35.5	11.2

Source: 1974 Census of Agriculture, Vol. II, Pt. 4, Table 6.

Table 3-2. Specialization of Production by Commodity Type, 1978

S.I.C. Group	Percentage of sales in main specialty commodity	Percentage of sales in nursery/greenhouse products
Gash grain	85.0	0.002
Vegetables	85.6	0.5
Fruits & Nuts	95.5	0.2
Horticultural Specialties	98.1	98.1
Dairy	82.4	0.007
Poultry	95.0	0.03

Source: 1978 Census of Agriculture, Vol. I, Pt. 51, Table 35.

a unique form of agriculture. Among the various farm types it is also characterized by the highest rate of female farm operators, 9.4%, the second highest rate of non-white operators, 5.7%,[2] and perhaps most striking of all it has the highest rate of incorporation as a form of financial organization. Overall some 16% of horticultural specialty farms are incorporated, compared to 3.9% of the next highest category, poultry farms, and only 1.8% for all farms, in 1978. Of the incorporated nurseries, though, 87% were family owned and only 13% were other than family owned corporations.[3]

These characteristics are accompanied by some interesting locational attributes for nursery farming. Figures 2-15 through 2-18 showed the location of main producing areas for nursery plants, but they do not indicate the relative importance of ornamental horticulture as a part of the agricultural economy of those or other areas. Figure 3-2 and Table 3-3 do show this, as the percentage of each state's sales of all agricultural products contributed by nursery products alone (not all horticultural specialties) in 1978.

Overall nursery products accounted for only 0.74% of U. S. agricultural sales in that year, but in several states they made up significantly more. It can be seen that the states of the Northeast are mostly above the national average with those on the northern Atlantic seaboard leading the others in percentage values. These are also among the most highly urbanized and most densely populated states in the country. In fact the four leaders in the relative importance of nursery product sales, New Jersey and the three southern New England states, are also the four most densely populated states in the nation. Beyond them,

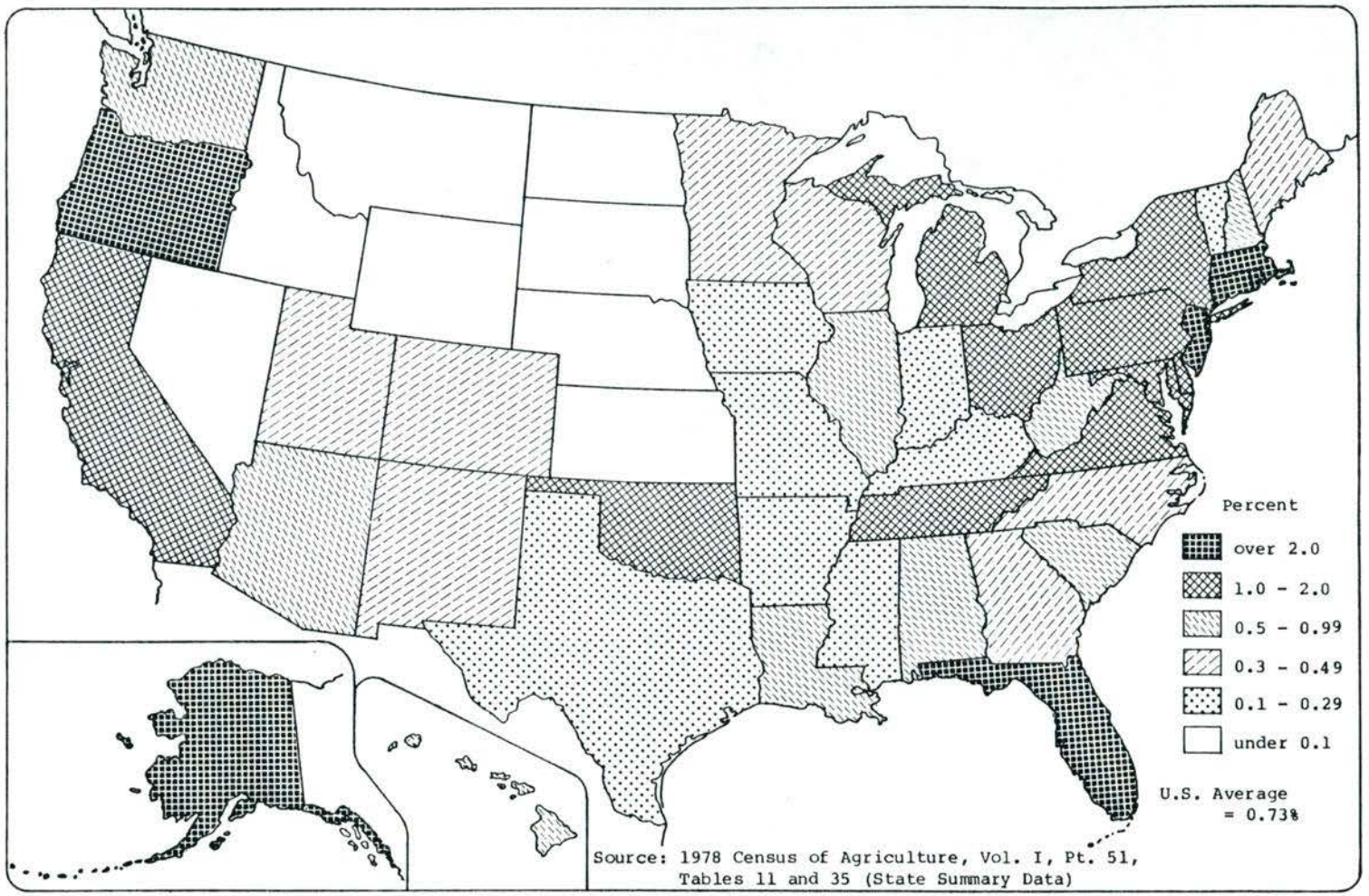


Figure 3-2. Nursery Product Sales as a Percentage of Each State's Sales of All Agricultural Products, 1978

Table 3-3. Nursery Products Sales as a Percentage of Sales of All Agricultural Products, 20 Leading States, 1978.

	All Ag. Prods ($1,000)	Nsy. Prods ($1,000)	Nsy. % Total
RI	26,448	5,335	20.17
CT	229,105	16,371	7.15
NJ	359,024	22,012	6.13
MA	214,675	8,296	3.86
OR	1,285,016	41,906	3.26
FL	3,047,231	65,585	2.15
AK	8,225	173	2.10
CA	9,324,378	183,475	1.97
TN	1,425,865	27,963	1.96
MI	1,941,095	34,799	1.79
VA	1,304,164	23,182	1.78
MD	806,014	11,635	1.44
PA	2,189,594	30,825	1.41
NY	1,890,533	24,585	1.30
OK	2,367,696	30,318	1.28
OH	2,876,936	32,930	1.14
DE	326,003	3,523	1.08
NH	89,273	807	0.90
WA	2,096,510	17,468	0.83
AL	1,575,462	12,230	0.78
USA	108,113,519	792,972	0.74

Source: 1978 Census of Agriculture, Vol. I, Pt. 51, Table 11 and Table 35 (State Summary Data).

however, there seems to be only a slight correlation between population density and relative importance of nursery products, at the state level.

Outside the Northeast the only region which stands out in the relative importance of nursery products is the Pactific coast, particularly Oregon and California, both well above the national average. There, as elsewhere scattered in the South and Midwest, the leading states in relative importance are also among the leaders in total value of nursery sales. Thus, while nursery production is not of great importance to the national agricultural economy as a whole, it is of some significance in a number of individual states and two regions. Other aspects of these patterns of relative importance will be discussed in the remainder of this chapter in the context of other studies.

Nursery Products in Other Studies of U. S. Agriculture

Almost nothing has been written on the geography of nursery production in this country, but several studies which looked at the geography of agriculture here have included nursery products or horticultural specialties among those types of farming they examined. Winsberg in his "Concentration and Specialization in U. S. Agriculture,"[4] studied the degree to which production of various types of farm commodities was concentrated in a few states, the similarity in locations of the different types relative to each other, and the degree to which they were associated with population concentrations. He found nursery products to be slightly below average for concentration in a few states, much less so for instance than tobacco and cotton and even less

than for vegetables or fruits and nuts. Thus the picture of relative importance in just a few states shown in Figure 3-2 is not very unusual. He also found that nursery products were most similar in their locations to fruit and nut farms and vegetable farms, but were even more closely associated with population concentrations than either of these, equal to that of dairy products another commodity traditionally produced relatively close to urban markets.

In another study, "Agricultural Specialization in the United States since World War II,"[5] Winsberg found that nursery products were increasingly being produced in "specialty counties," those in which more than half of all farm sales came from only one commodity. The percentage of national nursery sales coming from specialty counties increased from 6% to 11% between 1949 and 1974, and there was an increase in the number of such counties, from 15 in 1949 to 25 in 1974. Of these 25 counties in 1974 fifteen were in the Northeast, the most densely populated region of the country, including six of the ten new specialty counties added over the period. Considering that nursery products accounted for only some 0.7% of all farm sales nationwide in 1978, one of the lowest of all commodity groups, it is striking that there are as many as 25 counties where nursery sales exceed 50% of the total. But as seen by Figure 3-2 the concentration of such counties in the Northeast should come as no surprise.

Howard Gregor in "The Large Industrialied Crop Farm: a mid-latitude plantation variant,"[6] studied the characteristics of large farm operations, as of 1959. He found that among the various kinds of industrialized farms (defined as those employing more than the

equivalent of five full-time year-round paid workers), those raising horticultural specialty crops and forest products, as one category, were the third most important in terms of both sales and number of such large farms. This was in contrast to the category's position among farms of all sizes where it was sixth in rank for both those characteristics. Horticultural specialties, then, appear to be more important as large operations than they do as small ones, and show the greatest contrast between large farms and farms of all sizes among the various commodity groups he studied.

Gregor also noted that in 1959 there were 12 states in which horticultural specialty and forest product farms were the leading type of large industrialized farm. These states stretched in a near-continuous band across the Midwest and Northeast from South Dakota to Massachusetts (but not including Wisconsin, Michigan, New York, or Connecticut). This differs from the picture of the relative importance of nursery products grown on all sizes of farms as shown for 1978 in Figure 3-2. One is led to assume that the large industrialized nursery farm is proportionately more important in the Midwest than in the Atlantic Northeast. This is also borne out by the relative importance of large nurseries (those with annual sales of $500,000 or more) as shown previously in Figure 2-11.

Along somewhat similar lines, Smith, in looking at "America's Richest Farms and Ranches"[7] found that horticultural specialty operations were well represented among them. He notes that the headquarters of these operations show a striking affinity for urban locations, not only in the Midwest and Northeast as one might suspect

from information presented here so far, but also in the Pacific Northwest, California, Colorado, and Florida. This agrees well with the general picture for nursery production locations provided by both the American Association of Nurserymen's Directory, Figure 2-17, and the "Nursery Business 100" list, Figure 2-18.

In fact, of the 50 leading counties in nursery production in 1978, shown in Figure 2-16, fully 39 of them were counties which were parts of Standard Metropolitan Statistical Areas at that time. Among these 39 SMSA nursery counties were some wholly containing many major cities, including Los Angeles, San Diego, Portland, Seattle, Phoenix, St. Paul, and Miami, plus others in the immediate suburbs of New York, Chicago, and Philadelphia.

Nursery Products and Metropolitan Agriculture

Clearly there is a strong connection between nursery growing and metropolitan areas. What is the nature of this connection and how does it differ from those for other types of agriculture? Most studies on the nature of agriculture in metropolitan areas have tended to look mostly at the process of conversion of agricultural land to other uses and have done so, by and large, without regard to specific changes in the structure of agriculture, changes in the types of commodities produced and in the value of agricultural sales.[8] The urbanization process is a very varied and heterogeneous one, however, and its effects on agriculture are highly selective. While there is undoubtedly a general decline in the total land area commited to farming in most expanding metropolitan regions the change in area and in value of

production is very unevenly distributed among the various commodity types. Some may even gain in value or in area in conjunction with urban growth.

A small but growing body of geographical literature is studying the effects of urbanization on the types of agricultural commodities produced. Seminal to the discussion was Robert Sinclair's "Von Thunen and Urban Sprawl."[9] Sinclair proposed a restructuring of Von Thunen's model of concentric zones of land use around a city to reflect what he saw as the effects of urban sprawl on agricultural land use on the urban fringes of American cities. He felt that urban sprawl disrupted the Von Thunen pattern of decreasing intensity of production with distance from the city, even reversing it in many cases. He found examples primarily in the Midwest of an increase in low value crops (grains, pasture, and hay, primarily) on the urban fringe as cities grew into their rural surroundings. He attributed this to several factors, most important of which was the effect of real estate speculation: productive land was held in semi-idleness in anticipation of resale in the near future, with land owners being reluctant to make any investments in agricultural production beyond those necessary to return some income on a yearly basis. Sinclair did note a few exceptions to this pattern, in California primarily, but felt that the majority of urban areas would show a shift of high intensity agricultural production away from the city (aided greatly by recent reductions in transportation costs) and the creation of a temporary, but persistently expanding, zone of low intensity farming on the urban growth fringe.

David Berry in two studies[10] noted that urbanization was

closely correlated with a decline in dairying, in both the Northeast and near Chicago. He attributed the decline to the reluctance of dairy farmers to continue making necessary capital investments required periodically by dairying, because of an uncertainty over their ability to recover their investments when and if they sold their land to developers in the near future. He noted that cash grain farmers required little capital investment for property improvements and were able to continue farming longer in the uncertain real estate markets of Chicago's urban fringe.[11]

Berry also found, however, that idling of farm land on the fringes of Philadelphia's metropolitan area was most pronounced on poorer soils and that farming continued relatively unchanged on better soils.[12] This latter finding in part disagrees with Sinclair's revised Von Thunen model, while the analysis of dairy decline tends to support it and offers a partial explanation.

Other studies have found, on the other hand, that some types of agriculture can in fact continue in the urban periphery and even increase their productivity. Moran analyzed "Spatial Patterns of Agriculture on the Urban Periphery: the Auckland Case,"[13] in New Zealand in a specific test of Sinclair's model. He found that there was little or no decline in orchards, vineyards, market gardens, or dairying on the fringe of Auckland. In many cases there was an increase in both labor and capital inputs, including such heavy capital investments as construction of glasshouses for market gardening. Important to the survival of metropolitan agriculture in Auckland was a system of differential tax rates which protected farmers from high tax burdens

associated with increases in the speculative value of their land.

Krueger studied "Urbanization of the Niagara Fruit Belt" in southeastern Ontario[14] and found that urban growth took place at the expense of peach and cherry orchards mainly because of a competition for light textured, well drained soils, most suitable as building sites but also required by the stone fruits for root aeration. The area in vineyards and orchards of other fruit species which were able to grow well on heavier soils was almost unchanged.

These studies raise the question, first mentioned by Sinclair himself, whether his reverse Von Thunen model might be unique to the American Midwest or is applicable to urban areas elsewhere in the U. S. and the world. In an earlier study I attempted to answer this question for the U. S. by examining changes in the value of sales for different commodity types in seven metropolitan areas of a variety of sizes in the U. S. between 1949 and 1978.[15]

U. S. Census of Agriculture data by counties on the value of sales by commodity type yielded information on the changing mix of agricultural products in 1949, 1959, 1969, and 1978 for fifteen counties in seven metropolitan areas, Table 3-4 and Figure 3-3. The product categories of the census are 1) field crops (including grains, field seeds, hay, forage & silage, cotton, and tobacco among others),[16] 2) vegetables (including sweet corn and melons), 3) fruits and nuts (including berries), 4) horticultural specialties, 5) dairy products, 6) poultry and poultry products, 7) cattle and calves, 8) hogs and pigs, and 9) sheep, lambs, and wool. This study examined figures for categories 1 through 6 and included categories 7 to 9 plus any unclassified

Table 3-4. 15 Counties in 7 Metropolitan Areas

Metropolitan Area	Counties Studied
Portland, OR	Multnomah, OR Clackamas, OR Washington, OR
Los Angeles, CA	Los Angeles, CA
Dallas-Ft. Worth, TX	Dallas, TX Tarrant, TX
Des Moines, IA	Polk, IA
Chicago, IL	Cook, IL DuPage, IL Kane, IL Lake, IL
New York, NY	Queens, NY Nassau, NY Suffolk, NY
Baltimore, MD	City of Baltimore, MD Baltimore Co., MD

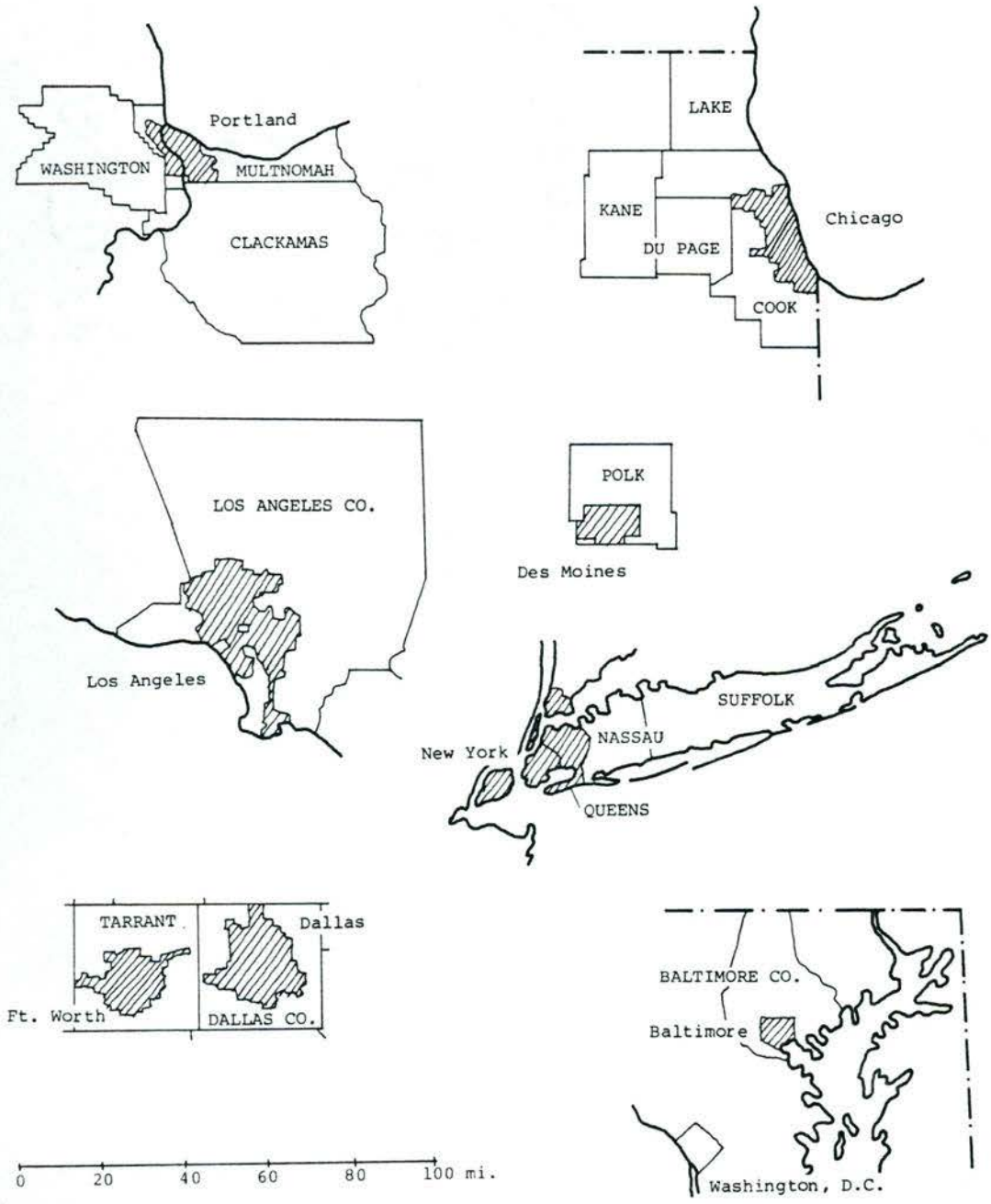
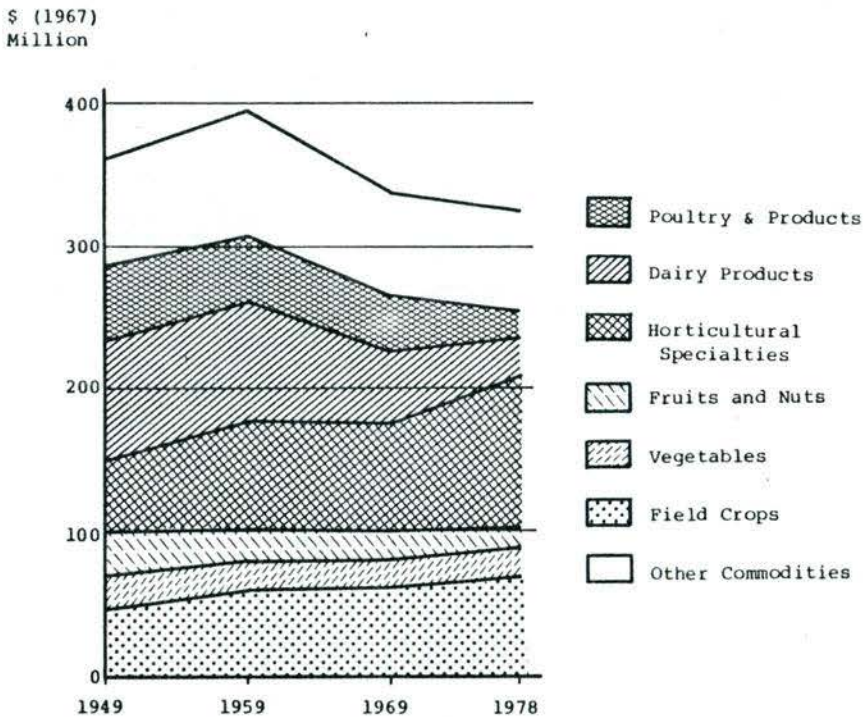


Figure 3-3. Fifteen Study Counties in Seven Metropolitan Areas

crops or livestock as "other." The product mix was graphed for the six commodities and the total value of all agricultural commodities by total constant (1967) dollar value of products, using the Producer Price Index for Farm Products to adjust price changes to a constant value.[17]

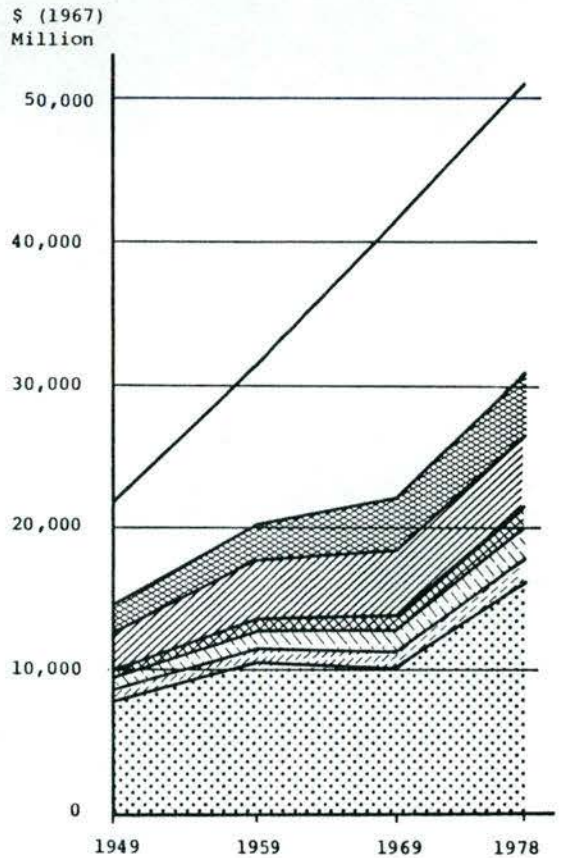
The results show some striking trends which seem more clear than those which Sinclair observed. For the 15 metropolitan counties as a whole the change in value by commodity type, Figure 3-4, shows a steady growth for both field crops and horticultural specialties, a steady decline for dairy and poultry, and a small decline in vegetables as well as fruits and nuts. Since production value did not change markedly from 1949 to 1978 in these counties together, the percentages of each commodity in the total mix showed essentially the same trends. This contrasts sharply with the trends for the nation as a whole during the same period, Figure 3-5, which show a steady increase in all commodities by constant dollar value but little change in the percentage mix of the various commdities. (The biggest variable seems to be meat prices which were up sharply in 1969).

In the individual metropolitan areas, though, these general trends take on much different patterns. In all of the 15 counties without exception dairy and poultry products declined from 1949 to 1978 both in dollar value and as a percentage of the total. This in spite of the fact that a few counties had one decade of growth during the period: dairy in both Los Angeles and Baltimore Counties between 1949 and 1959, and poultry in both Clackamas and Suffolk Counties between 1959 and 1969. In all counties horticultural specialties grew in percentage of the total over the period. They declined in dollar value only in those



Source: Censuses of Agriculture: 1949, County Table 7; 1959, County Tables 5 and 12; 1969, Table 13 (County Data); 1978, Table 2 (County Data

Figure 3-4. Value of Agricultural Products, 15 Metropolitan Counties



Source: Censuses of Agriculture: 1950 Vol.II Ch. 9 Tables 2 and 3; 1959, Vol. II Ch. 9 Table 1; 1969, Vol II Ch. 7 Table 5 (U.S. Data); 1978, Vol. I Pt. 51 Table 10 (U.S. Data)

Figure 3-5. Value of Agricultural Products, United States

counties where total agricultural production value declined. For the 15 counties as a whole horticultural specialties showed by far the largest increase.

Fruits and nuts and vegetables showed the least change in most of the counties: a slow decline overall but often with some decades of growth. The only large changes in these two categories were the steady decline in fruits and nuts in Los Angeles County throughout the period and the virtual elimination of both categories in some counties where they were only a small percentage of the total, such as Queens county and Polk County, although in the four Chicago area counties and the two Texas counties these small percentages were maintained throughout the period.

It is in the relative place of field crops that the various metropolitan counties showed the most diversity. For the 15 counties as a whole field crops went from 4th out of the 6 categories in 1949, with 13% of the sales value, to 2nd place in 1978, with 22% of the total; in constant dollar value they increased from some $46 million in 1949 to some $70 million in 1978. The pattern was different in different parts of the country, though. In the three Portland area counties, the three New York area counties, the two Dallas-Ft. Worth ones, and in Los Angeles County field crops held steady or declined slightly throughout the period. In the four Chicago area counties, Polk County, Iowa and in Baltimore City and County, however, they showed a steady rise both in total value and in percentage, with an especially large increase from 1969 to 1978, probably reflecting to some degree the grain export boom in the years after 1972. There thus appers to be a regional basis for

the relative importance of field crops in the changing mix of commodity types in metropolitan agriculture.

The trends indicated by these 15 metropolitan counties and their intensity of production both reinforce and contradict parts of previous views on change in metropolitan agriculture. The increase in field crops in the Midwestern counties and in Maryland supports Sinclair's findings in the Midwest and may indicate, as he theorized, a turning to low itensity, low investment uses of the land in the face of urban growth and a speculative land market, but not in all regions of the nation. The decline in dairying in all counties agrees with Berry's findings in the Northeast and near Chicago and seems to indicate that this is indeed a nationwide phenomenon. This may well represent a decline in a high investment commodity in the face of an "impermanence syndrome." Berry does not address the relatively low areal intensity of the use of the land in most dairy operations, however, and when we look at horticultural specialties we see another high investment commodity surviving and apparently thriving in the urban growth zone, one which is distinguished by very high intensity of both inputs and returns per acre.

Another way to look at the whole picture is to assume that all types of agriculture are under pressure in urbanizing counties and that the survival of any farm commodity depends on its resistance to urban, anti-agricultural, pressures. Berry began a catalogue of such pressures which make up his impermanence syndrome, including changes in farmers' status in their communities (as they become a minority among a suburban majority); nuisance complaints directed by new residents against odors,

noises, and chemicals; higher taxes and assessments for public improvements accompanying suburban development; vandalism and harassment; air pollution damage to crops; and the uncertainties of land values in a speculative land market, where the farmers themselves are often active participants. One could then identify the various ways in which the different commodity types of farm operations are able to resist these pressures, or in some cases actually take advantage of them.

The 15 counties represented in this study show a clear dominance in production value in 1978 by two commodities, horticultural specialties and field crops. It appears that these are the most resistent to or able to take advantage of the situations created by urban sprawl. Both are relatively "clean" in chemicals used and odors and noises generated, in comparison to vegetables and fruits and nuts for the former and to poultry and dairy for the latter. But they have very different capital and land intensity patterns which interact with very different aspects of the economy of an expanding metropolitan area. It would seem that field crops are best able to take advantage of speculative pressures on land prices, possibly by offering a convenient shelter for investors and a low expenditure holding pattern for farmers waiting to cash in on their nest egg. Horticultural specialties may, on the other hand, be simply more resistant to the financial pressures which are driving other types of commodity production from the urban area: by using very little land they avoid large tax burdens; by returning large incomes per acre they can actually compete with many other types of urban land use.

The idea of resistance to decay gains a new value when applied to the cases of those counties in which agricultural production has been

declining throughout the decades studied, such as Los Angeles, Cook, DuPage, Nassau, and Queens Counties. In all these counties horticultural specialties increased greatly in percentage of the declining total, including even some decades of growth in total dollar value. In fact it is intriguing to speculate on a "life-cycle" for metropolitan agriculture in which these counties of declining production represent the last stages.

The various counties studied here represent historically different stages of such a life-cycle. As one proceeds outward from the core of a metropolitan area to its periphery one finds a spatial sequence of land use and changes in agricultural production which are broadly similar, in reverse order, to those occurring as a temporal sequence at any one place in the metropolitan area. In the same way these 15 counties can be grouped into various stages of a hypothetical life-cycle of metropolitan agriculture. An early stage, represented by Lake County, Illinois, Figure 3-6, consists of initial suburban expansion out onto farmland with a mixture of commodity types. In the strongly speculative real estate market the biggest changes occur in dairying which declines and in field crops which increase. Horticultural specialties also increase.

A second stage, represented by Multnomah County, Oregon, Figure 3-7, consists of increasing suburbanization but with a less volatile real estate market, one in which both farmers and developers are better able to anticipate and plan for change. Changes in commodity production are steady but not as pronounced as in the earlier stage. Dairy and poultry products continue to decline and horticultural specialties

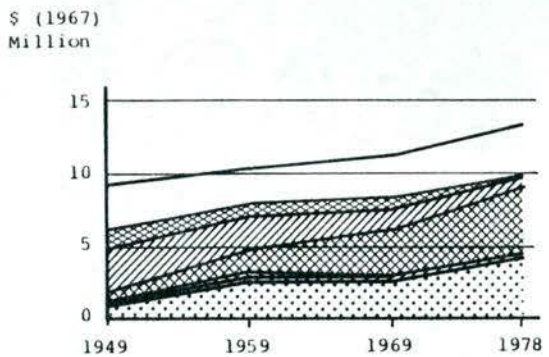


Figure 3-6. Value of Agricultural Products, Lake County, Illinois

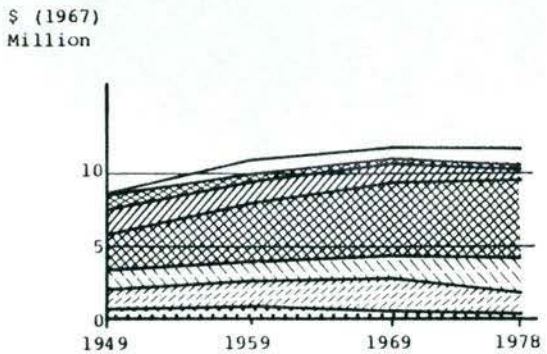


Figure 3-7. Value of Agricultural Products, Multnomah County, Oregon

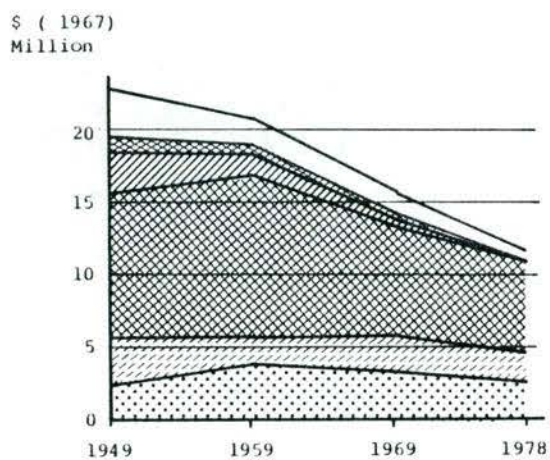


Figure 3-8. Value of Agricultural Products, Cook County, Illinois

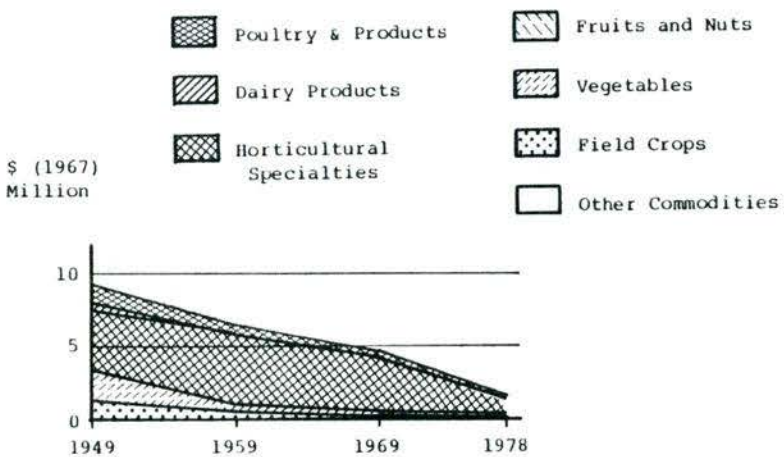


Figure 3-9. Value of Agricultural Products, Nassau County, New York

increase. Changes in field crops depend on regional factors, and in this instance they remain relatively unimportant.

In the third stage, represented by Cook County, Illinois, Figure 3-8, agricultural land becomes increasingly scarce and all commodities decline, but horticultural specialties decline most slowly, being able to function well on small parcels and able to compete economically in the urban land market. By the final stage, shown in Figure 3-9 by Nassau County, New York, all commodities are declining to little or no production as agricultural land is almost totally taken over by other uses.

The life-cycle model shown as a whole in Figure 3-10 is here highly generalized, stretching over an arbitrary period of time. The relative proportion of the various commodities is likewise arbitrary. What is important is the change each undergoes relative to the others and to the total for all products. What begins as a mixed farm economy on the outer fringe of an urban area sees the selective decrease and increase in various commodities as the area becomes increasingly built up. There is even an increase in the total value of sales for a while, although this may well be a historical artifact, part of the general increase in productivity which has come to almost all phases of American agriculture in the past several decades.

There can be no doubt that the area in farms decreases throughout the period, however. As seen in Figure 3-11, the land in farms for the 15 urban counties studied shows a marked and steady decline in all categories of land. Yet over the same period the area in horticultural sepcialty crops actually increased, from 17,808 acres in 1949 to 21,244

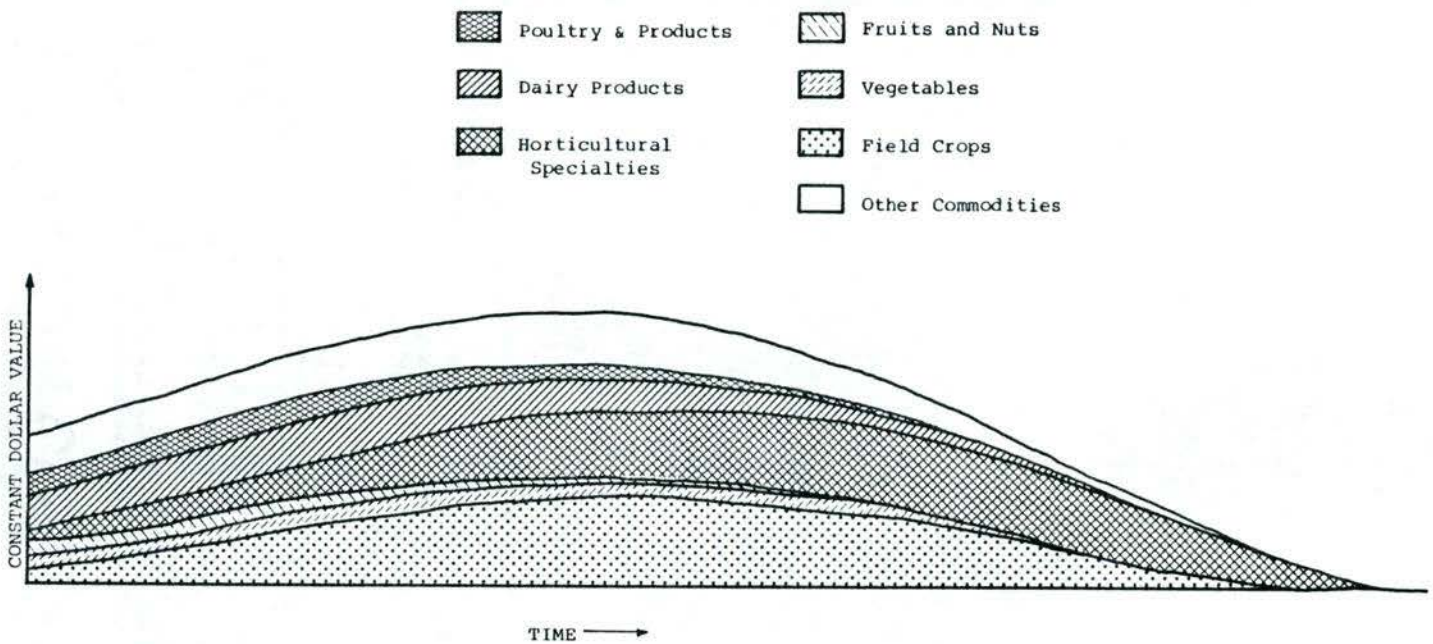
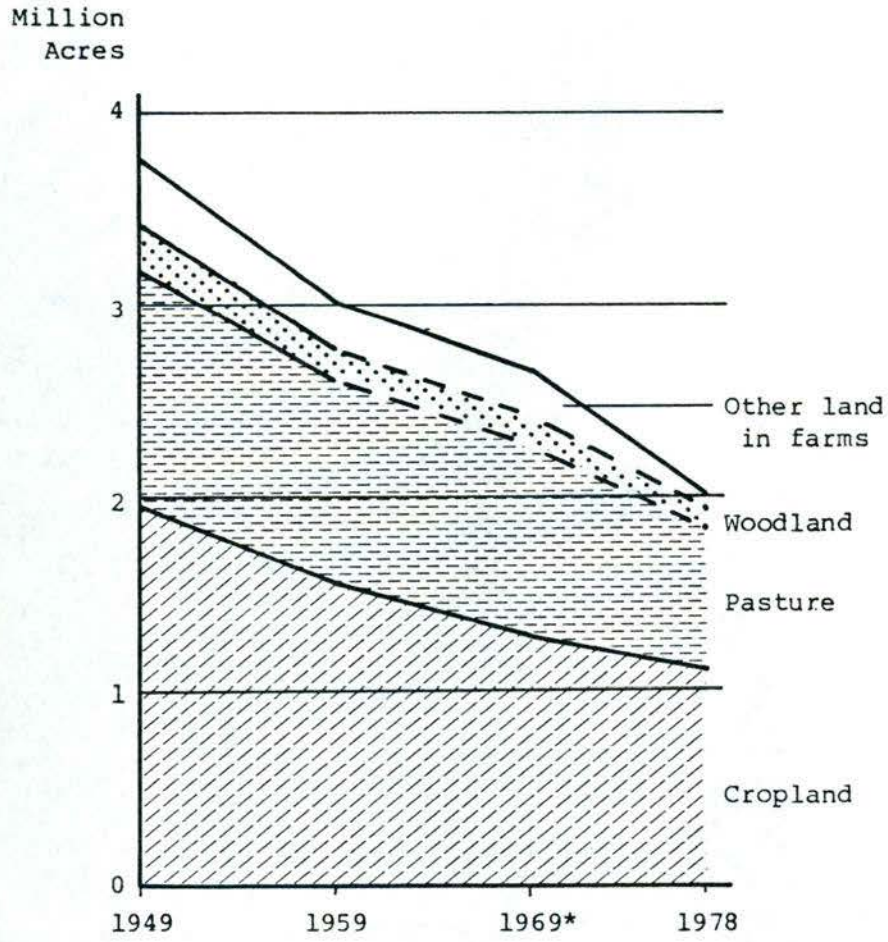


Figure 3-10. Life-Cycle Model for Metropolitan Agriculture



* Figures for Pasture, Woodland, and Other land in farms undifferentiated for 1969.

Source: Censuses of Agriculture: 1949, County Table 1; 1959, County Table 1; 1969 Table 1 (County Data); 1978 Table 1 (County Data)

Figure 3-11. Area of Land in Farms, 15 Metropolitan Counties

acres in 1978, although as with the value of crops produced there was a diversity of changes in the individual counties. In the long run, though, most of these counties will probably undergo the same process shown by Nassau County unless urban growth halts or is contained. There are in fact a number of land planning methods in widespread use today, in several of the 15 study counties as well, which are undoubtedly going to have an impact on slowing the decline in metropolitan agriculture.[18] Most of them had not been in practice long enough to have had much effect by 1978, though, and it remains to be seen which commodities will benefit most from the various forms of protection afforded by the different planning measures.

The role of horticultural specialties in metropolitan agriculture thus appears to be a crucial one. Nursery and greenhouse crops can often become, in sales value, the leading form of agriculture in urban areas. They offer the potential for continued agriculture in the face of urban expansion and may well be the most viable alternatives to total urbanization of the countryside. The particular role of nursery products in the mix of horticultural specialties in urban areas is not as easy to identify. Nurseries usually take up more land than most other horticultural specialties, especially those raising bare root or B&B plants. Container nurseries can often be as intensive if not more so than other horticultural specialties. In the end, though, all must feel the pressures of urban encroachment just as other farmers do.

A common pattern is for nurseries to continue at a site even though increasingly surrounded by non-agricultural land uses but only so long as they do not need to expand. Expansion of a nursery operation in an

area of rapid urban growth is very difficult. Purchase or leasing of new land nearby is usually prohibitively expensive, newly established building codes can hinder construction of new facilities, and other expenses and risks inevitably increase. Most nurseries which want to expand usually seek out new locations on which to do so. Selling their old land is usually profitable enough to finance the purchase of new land farther out as well as pay for much of the new construction. Most move out just beyond the existing urban development fringe and in time may be surrounded again by the expanding urban fringe.

This is not a new situation for the nursery business, however. The pattern has been working this way for centuries in this country, from the time of the first nurseries near New York, Philadelphia, Baltimore, and Charleston. An especially notable example is that of the nurseries near Rochester, New York. For several decades in the mid to late nineteenth century they were the leading growers of nursery plants in the nation, with a combined production estimated by one observor to be at least half of the national total.[19] During the latter decades of the nineteenth century, though, expansion of the suburbs of Rochester led one after another of the nurserymen to sell their land. Many moved farther out or to nearby towns, but in the long run most eventually went out of business. Blake McKelvey's description of the process could well describe similar events repeated throughout the nation from Boston to Honolulu:[20]

> Meanwhile the subdivision of the older nursery grounds was speeded up. A forty percent growth in population during the seventies was followed by a fifty percent growth in the eighties, and in 1874 the city more than doubled its area by annexations. The boundaries were

> pushed out on all sides, and many of the nurseries were by this action brought within the city limits . . . .
>
> The nurserymen enjoyed the advantage of being able to keep their lots in profitable use while the street pattern was being laid out and a few scattered dwellings erected. New acres were acquired on the outskirts where the nurseries had a chance to take root while the greenhouses and other equipment were being transferred and the old plots attracted home builders . . . . Those who could wait long enough were finally rewarded, as the city not only spread over all the earlier additions but pressed outward again on several occasions, notably in 1891, 1913, and 1918. Many of the second and third generation nurseries, so to speak, were then brought within the city limits, and in time the pressure of the growing population transformed these areas as well into home sites.

Although not yet well studied in the U. S., ornamental horticulture appears to have a unique geography among the various types of farming. It differes markedly from other types of farming in many of its locational attributes. Among these is its special role in the changing mix of metropolitan agriculture, in which it seems to be the most resistent to competing pressures from other kinds of non-agricultural land use. Much of this is due to the intensity of inputs and sales values per acre which make nursery farming so productive. Regionally nursery farming is most important on the Atlantic and Pacific coasts, especially in the most densely settled portions of both. Yet several nursery growing areas of major importance lie well outside metropolitan areas as well, in several regions of the country, as seen in Chapter 2. The various factors which influence the locations of nurseries, at the national scale will be discussed, summarily, in the next chapter. Succeeding chapters will examine several of these locational factors in greater detail: the early history of the nursery business and its locational legacy for the present in Chapters 5 through 8, soils and

water supply in Chapter 10, climate in Chapter 11, changing demand for plants and development of new varieties in Chapter 12.

Chapter Three - Notes

[1]U. S. Bureau of the Census, 1978 Census of Agriculture, Vol. I, Pt. 51, Table 13 (U.S. Data). Data are for farms by S.I.C., where over 50% of sales were from any one 3-digit S.I.C. commodity group.

[2]Sex and ethnic patterns from 1978 Census of Agriculture, Vol. I, Pt. 51, Table 35 (U.S. Data). "Summary by Standard Industrial Classification of Farm: 1978." Ethnic patterns in nursery production are interesting but beyond the scope of this dissertation. Notable non-Anglo groups are important regionally as growers: Japanese-Americans in California, Dutch-Americans in Michigan, and Italian-Americans in several Northeast seaboard states. Laborers are often characterized by certain ethnic groups in some regions: Mexican- Americans and Mexican nationals in California, Oregon, Washington, Arizona, Colorado, Texas and Oklahoma, blacks and Puerto Ricans in much of the South and eastern states.

[3]1978 Census of Agriculture, Vol. I, Pt. 51, Table 35.

[4]Morton D. Winsberg, "Concentration and Specialization in United States Agriculture," Economic Geography 56 (1980), 183-189.

[5]Morton D. Winsberg, "Agricultural Specialization in the United States since World War II," Agricultural History, 56 (1983), 691-701.

[6]Howard F. Gregor, "The Large Industrialized American Crop Farm: A Mid-latitude Plantation Variant," Geographical Review, 60 (1970), 151-175.

[7]Everett G. Smith, Jr., "America's Richest Farms and Ranches," Annals of the Association of American Geographers 70 (1980), 528-541.

[8]For three of the best general studies of metropolitan agricultural land-use see: Richard J. C. Munton, "Farming on the Urban Fringe," in Suburban Growth; Geographical Processes at the Edge of the Western City edited by James J. Johnson, 201-223 (London: Wiley & Sons, 1974); Robert E. Coughlin, "Agricultural Land Conversion on the Urban Fringe," in Farmland, Food and the Future, edited by Max Schnepf, 29-47 (Ankeney, Iowa: Soil Conservation Society of America, 1979); and Owen J. Furuseth and John T. Pierce, Agricultural Land in an Urban Society, A.A.G. Resource Papers in Geography (Washington: Association of American Geographers, 1982).

[9]Robert Sinclair, "Von Thunen and Urban Sprawl," Annals of the Association of American Geographers 57 (1967), 72-87.

[10]David Berry, "Effects of Urbanization on Agricultural Activities," Growth and Change 9 (July, 1978), 2-8; and "The Sensitivity of Dairying to Urbanization: A Study of Northeastern Illinois," Professional Geographer, 31 (1979), 170-176.

[11]Berry, "The Sensitivity of Dairying to Urbanization."

[12]Berry, "Effects of Urbanization on Agricultural Activities."

[13]Warren Moran, "Spatial Patterns of Agriculture on the Urban Periphery: The Auckland Case," Tijdschrift voor Economische en Social Geographie 70 (1979), 164-176.

[14]Ralph R. Kreuger, "Urbanization of the Niagara Fruit Belt," Canadian Geographer 22 (1978), 179-194.

[15]Henry W. Lawrence, "Changes in Agricultural Products in Metropolitan Areas," paper presented at the 46th Annual Meeting of the Association of Pacific Coast Geographers, Eureka, California, September, 1983.

[16]Potatoes were included with "field crops" in the Census until 1978 when they were placed in the category of "other vegetables." I have followed the 1978 census groupings for that year for all of the counties studied except Suffolk County, New York, the only one in which potatoes made up a significant share of agricultural sales. For Suffolk County data for 1978 I have put sales values for potataoes in the category of "field crops" to maintain data comparability with previous years.

[17]Separate Producer Price Indices exist for several of the individual commodities studied but not for others. To maintain some consistency of treatment I have chosen to adjust all figures by the single Farm Products Producer Price Index.

[18]Robert Coughlin and John C. Keene, eds., The Protection of Farmland: A Reference Guidebook for State and Local Governments (Washington: National Agricultural Lands Study, 1978) covers a variety of state and county programs including among the 15 counties studied here: a state program in Maryland and a county one in Suffolk County, New York for purchase of development rights and Oregon's Land Conservation and Development Commission. The four Chicago area counties studied here are treated in Ingolf Vogeler, "Effectiveness of Differential Assessment of Farmland in Metropolitan Chicago," Geographical Survey (Ball State University, Indiana) 7 (July, 1978), 23-33.

[19]Blake McKelvey, "The Flower City: Center of Nurseries and Fruit Orchards," Rochester Historical Society Pubications 18 (1940), Pt. II, 149.

[20]Ibid., 164.

CHAPTER FOUR

INTRODUCTION TO THE MAJOR LOCATIONAL FACTORS

The locations of nurseries and of important nursery areas reflect limitations and opportunities offered by several major factors. While any one nursery is the continuing result of a variety of interdependent idiosyncratic factors, many of them bound intimately to the personal life of the owner, in the aggregate some factors stand out as individually important to the locations of nurseries in general. This chapter will briefly introduce these most important factors, and subsequent chapters will look at two of them in greater detail.

The physical basis for plant life requires certain minimal conditions which vary with different plant species. Among these climate, soils, and water supply are the most difficult to change by human action and thus most constrain nursery locations. The ability to modify these natural conditions is, of course, limited by the marginal utility of the profit to be gained. Some crops bring a high enough price in the marketplace that it pays, sometimes very handsomely, to build elaborate climate modification systems such as heated greenhouses, or to create artificial soils and pipe in water from great distances. For most woody ornamentals, however, the return is not great enough to permit such intensive modifications. Among the various horticultural specialties nursery products occupies only a middle place in terms of the value of the final product. Within nursery products, though, there is some variation, and container-grown plants can bring in enough return to

support relatively intense modifications of the natural environment: covered greenhouses or shadehouses, elaborate irrigation systems, and the creation of artificial soilless planting media. Even so container growing is dependent on and able to take advantage of a variety of natural environmental factors. Field-grown plants, on the other hand, are more closely tied to the physical environment, especially soils. In their locational criteria they more closely resemble other types of crop farming than does container-growing.

Water supply can be a limiting factor as well, particularly in the West. Container-growing uses more water than field-growing, and in recent years some large container nurseries in the West have had to adopt innovative water-saving practices to stay in business. Rainfall is important more as a benefit through reducing need for irrigation than it is as a limiting factor or a major advantage.

Labor supply for nurseries is rarely a strongly limiting factor, but it can provide some locational advantage in certain areas. Nurseries are relatively labor intensive operations, with less seasonality to their work than other types of farming. What seasonal peaks do occur in their labor demand are usually at different times of the year from those of most other crops. These all give nursery labor supply a unique role as a locational criterion.

The cost of transportation is, of course, a vital locational element for nurseries as it is for producers of other commodities. Refrigerated trucks carry most of the plants to market and are generally quick and reliable. The major locational factors are the cost of transportation relative to cost-saving advantages from other production

factors, and its accessibility, in the form of interstate highways and an available pool of carriers.

Many of the advantages which accrue to some nursery locations are those provided by other nurseries in the area. The agglomeration of many nurseries in one area provides a pool of labor, transportation facilities, skilled management personnel, suppliers, etc. All of these help make all the nurseries in an area more competitive with those elsewhere. These agglomeration advantages form a fifth important locational criterion for nurseries. They also give added strength to the viability of older nurseries' in areas that might otherwise have lost some of their locational advantages through changes in transportation technology, shifts in market demand, etc. Each of these factors is thus individually important and can interact with the other factors to create an agglomerative effect.

Climate

The importance of climate as a locational variable for the growing of nursery plants cannot be overemphasized. Even in this modern age of mechanized containerized nurseries where soils and water are losing some of their previous locational importance, climate remains of vital concern to all nursery growers. Many factors are involved, and for different types of operations and different types of plants they have varying ramifications. Perhaps the most vital single factor is minimum temperature; low temperature injury whether from freezing or mere chilling can cripple or kill nursery plants. Being year-round crops nursery plants must contend with winter conditions, unlike the annuals,

but like other perennials or woody plants such as orchard trees. Less vital but important to the relative growth of plants and hence to the location of nurseries, are summer temperatures, day length, length of growing season, time of first and last frosts, rainfall, humidity, and severity of violent storms.

The most important easily measurable single climatic factor is average annual minimum temperature, from which have been constructed zones of plant hardiness. Average annual minimum temperature refers to the lowest temperature of the entire year, rather than to that more commonly used in other climatic studies, average daily minimum temperature. The importance of the average annual minimum lies in the potential for damage which can be done to plants by even a short time below certain critical threshold temperatures. While normal growth of plants responds to conditions over longer periods of time, injury can occur from very transient conditions. One very cold morning can destroy three years worth of crop.

Injury to plants from low temperature can come in a variety of ways. Chilling can disturb growth processes of plants at temperatures above freezing. This is most common for tropical and subtropical plants. Winter killing can result from dessication rather than freezing per se when evapotranspiration continues while soils are frozen and plant roots cannot absorb water. The most important type of injury, though, is freeze damage. Many different factors are involved in freeze injury: the absolute temperature, the duration of that temperature, varying degrees of hardiness in different parts of a plant, stage of dormancy, etc. Although the exact mechanisms by which freezing causes

injury to plant cells is still not clearly understood, it is known that "death occurs as a result of a specific freezing event," rather than from a gradual series of low temperature events.[1]

Different species of plants, of course, differ in their cold hardiness and can be grown safely only in those areas where annual minima are higher than their individual thresholds. Many species extend in nature over a wide area involving very different conditions, and it has been shown that the hardiness of the local type within the species varies with the geographic origin of the plant.[2] While more work obviously needs to be done to determine accurately the range of hardiness of different plants horticulturists have, through trial and error, learned the minima tolerated by most individuals of most species of ornamental plants.

The most convenient way to map the hardiness of plants is by mapping the zones of average annual minimum temperatures and assigning each species a minimum zone in which it can be expected to survive the winter. Two systems of such zones are now in use, both based on the same original data. The U. S. Department of Agriculture has devised a Plant Hardiness Zone Map[3] which shows ten zones in the U. S. and Canada, each with a range of 10°F, Figure 4-1. The zones are further subdivided into "a" and "b" sections based on 5°F differences, Figure 4-2.

The second system is that used by the Arnold Arboretum of Boston[4] and adopted by many horticultural writers and some nurseries, especially on the east coast. It is based on the same 5°F isotherms as the U.S.D.A. map but divides the zones into some uneven intervals, Figure

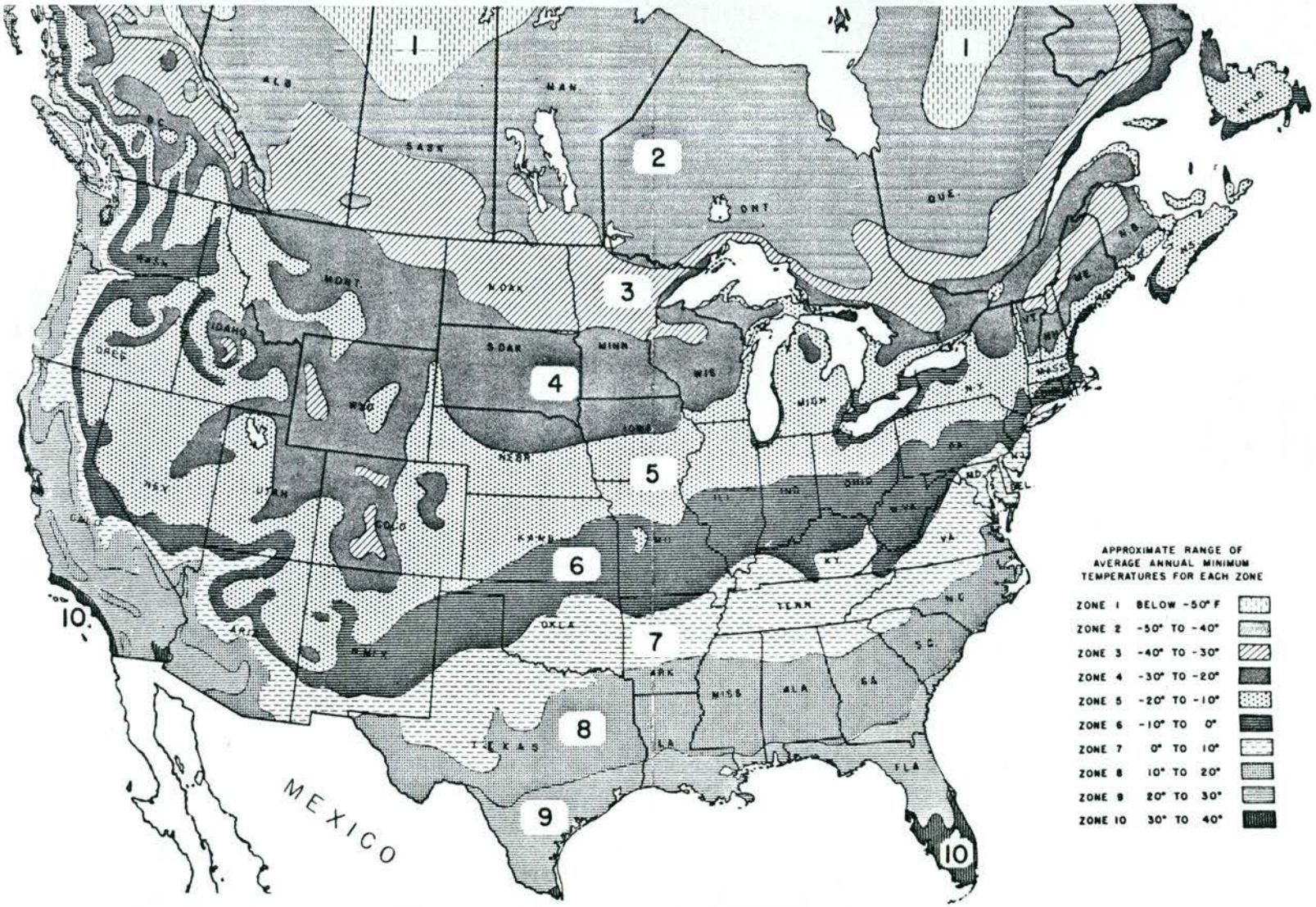


Figure 4-1. U.S.D.A. Plant Hardiness Zone Map

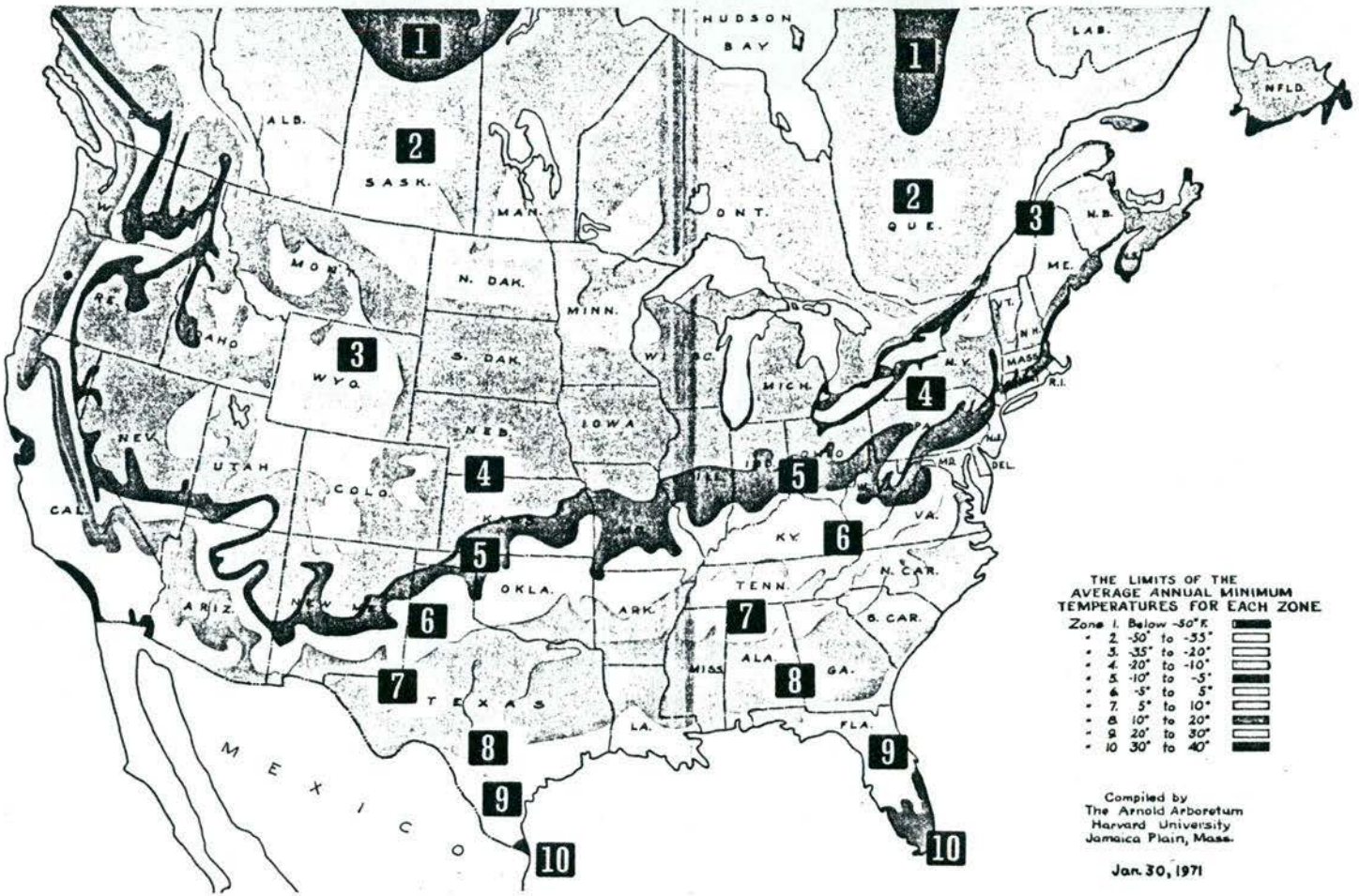
Figure 4-2. U.S.D.A. Hardiness Zones and Sub-zones

4-3. Some of these cover 5° and some cover 10°. They are based on experience at the arboretum with the hardiness of individual species, some of which have a more critical threshold than others, and on the areal extent of various zones in the northeastern states. Table 4-1 compares the two systems.

Unfortunately both systems do not match in several of their zones but both are widely used to designate hardiness of plants and local hardiness climates. The U.S.D.A. system is most widely used by nursery growers across the country and by agricultural experiment stations. The Arnold Arboretum system is used in many of the most important popular books and magazines used by the public. In this dissertation I will refer to the U.S.D.A. system when I use zone numbers unless specifically indicated otherwise.

A third system, devised by the University of California Agricultural Extension Service and used most popularly by Sunset magazine for use in the western states takes several other factors into account, such as maximum temperatures, humidity, etc., and results in 24 climate zones for the western U.S.[5] All but three of the 24 zones are found in California alone, for which both the other systems assign only 6 of their 10 zones. The Sunset system has some obvious advantages which could profitably be used by the two others.

The tenderness of certain species of plants, their susceptibility to injury or death below a given temperature, limits their use to those areas where they can survive. The U.S.D.A. lists several commonly used species of ornamentals by the coldest zone in which they will normally survive, Table 4-2.



Source: Wyman, Wyman's Gardening Encyclopedia

Figure 4-3. Arnold Arboretum Plant Hardiness Zone Map

Table 4-1. Hardiness Zone Systems Compared

U.S.D.A. Zone	Temperature Range	Arnold Arboretum Zone
1	below -50°	1
2	-50 to -45	
	-45 to -40	2
3	-40 to -35	
	-35 to -30	
4	-30 to -25	3
	-25 to -20	
5	-20 to -15	4
	-15 to -10	
6	-10 to -5	5
	-5 to 0	6
7	0 to 5	
	5 to 10	7
8	10 to 15	8
	15 to 20	
9	20 to 25	9
	25 to 30	
10	30 to 35	10
	35 to 40	

Source: Wyman and Flint, "Plant Hardiness Zone Maps."

Table 4-2. Selected Hardiness Zone Indicator Plants

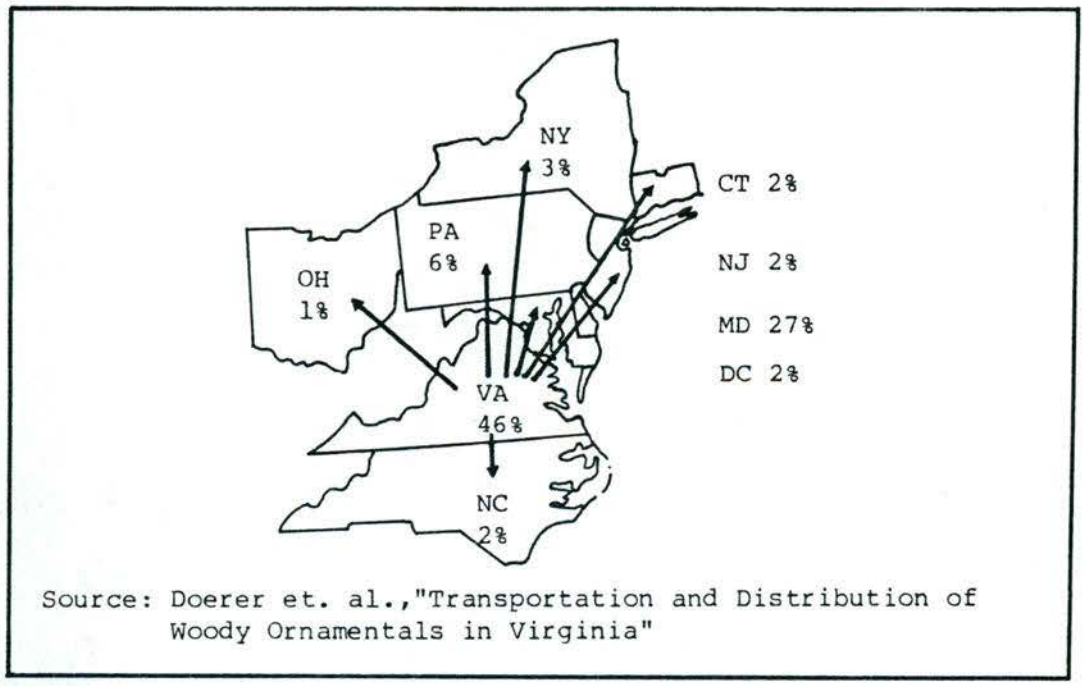
Coldest Zone of Normal Survival	Botanical Name	Common Name*
Zone 1 (below -50°F)	Populus tremuloides	Quaking aspen
	Salix reticulata	Netleaf willow
Zone 2 (-50° to -40°F)	Betula papyrifera	Paper birch
	Larix laricina	Eastern larch
Zone 3 (-40° to -30°F)	Berberis thunbergi	Japanese barberry
	Thuja occidentalis	American arbor-vitae
Zone 4 (-30° to -20°F)	Acer saccharum	Sugar maple
	Juniperus chinensis	Chinese juniper
Zone 5 (-20° to -10°F)	Cornus florida	Flowering dog-wood
	Ligustrum vulgare	Common privet
Zone 6 (-10° to 0°F)	Acer palmatum	Japanese maple
	Hedera helix	English ivy
Zone 7 (0° to 10°F)	Rhodendron 'kurume'	Kurume azaleas
	Ilex aquifolium	English holly
Zone 8 (10° to 20°F)	Prunus laurocerasus	English cherry-laurel
	Pittosporum tobira	Japanese pitto-sporum
Zone 9 (20° tp 30°F)	Schinus molle	Calif. pepper tree
	Eucalyptus globulus	Blue gum
Zone 10 (30° to 40°F)	Bougainvillea spectabilis	Bougainvillea
	Eucalyptus citriodora	Lemon gum

Source: U.S.D.A., "Plant Zone Hardiness Map."

*Some common names are from other sources.

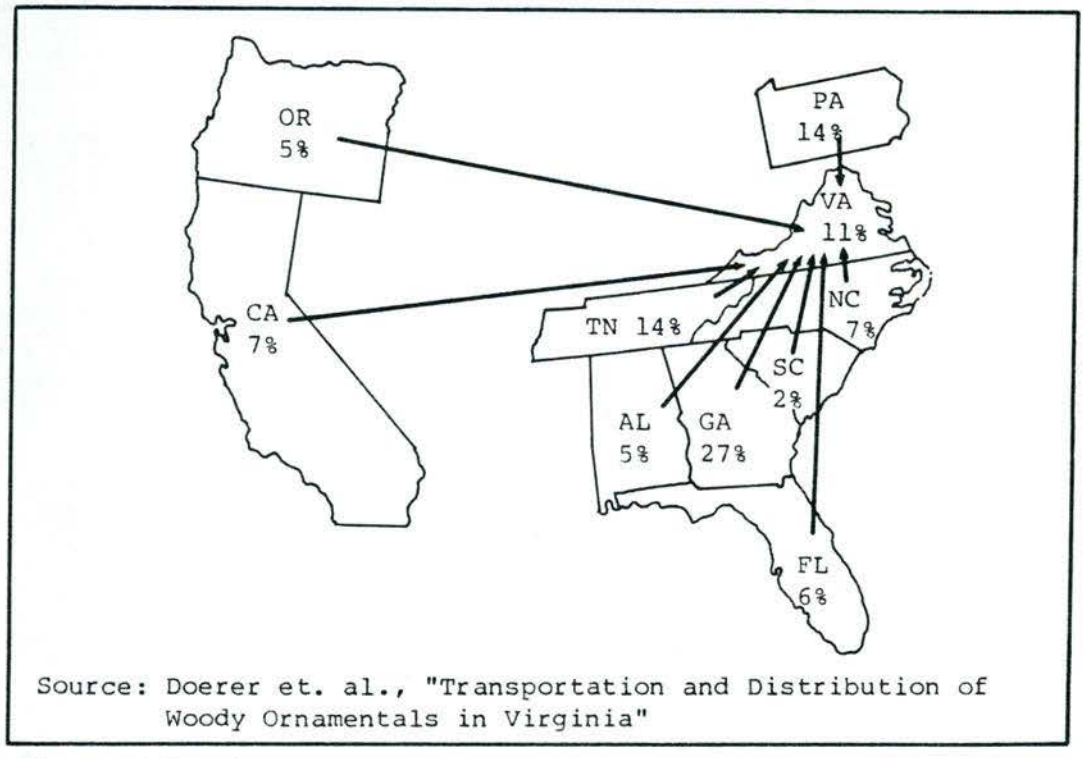
These show the coldest areas in which these plants can live, but not the coldest areas in which they are raised in nurseries. By and large nursery plants are raised in areas which are warmer, in winter, than those in which they are finally sold and planted in the landscape. There are two reasons for this. First, young nursery plants are often more tender than mature plants. They have shallower root systems, thinner bark, and are more easily injured by cold; even if not killed they can be stunted or weakened by temperatures which have little effect on mature plants at the same location. Second, warmer areas usually have longer growing seasons and earlier spring thaws, thus enabling young plants to grow more quickly to sales size.

The result is that the plants grown in nurseries in one area may be sold to cooler areas, and the plants bought in the first area may have been grown in some other warmer areas. The situation is well illustrated by the case of nursery imports and exports in Virginia.[6] Figure 4-4 shows the destinations of plants produced by nurseries in Virginia in 1978. 43% out of the 54% sent out of state went north and only 2% went south. (The other 9% went to states receiving less than 1% each and were not reported.) The sources of plants bought by Virginia retail nurseries shows the opposite picture, Figure 4-5. Of the 87% imported from states with over 1% of the total, 19% came from states in the same hardiness zones as Virginia (Oregon and Tennessee), 54% from states in noticeably warmer areas, and 14% from Pennsylvania. Much of the 14% from Pennsylvania, however, was attributd to brokers and rewholesalers who were simply passing on plants bought from growers elsewhere.[7]



Source: Doerer et. al.,"Transportation and Distribution of Woody Ornamentals in Virginia"

Figure 4-4. Destination of Plant Material Produced in Virginia, 1978



Source: Doerer et. al., "Transportation and Distribution of Woody Ornamentals in Virginia"

Figure 4-5. Origin of Plant Material Retailed in Virginia, 1978

A special situation exists for plants grown in containers rather than in the ground. Their roots are more exposed to the ambient air temperature which is almost always more extreme than soil temperatures. As a result container nurseries often need to be in even warmer areas than those growing the same plants in the field. This will be discussed in more detail in Chapter 11.

Other climatic factors are important as well, especially conditions during the growing season, and faster growth can give nurseries in one area a competitive advantage over growers in other areas. The length of the frost-free period and the dates of first and last frosts set the basic time limitations for growth of most plants. Different plants benefit in diverse ways. Flowering plants can be injured by unseasonal late spring frosts more than conifers, for instance, and the time at which plants enter dormancy in the fall can be critical for their success in areas with occasional early frosts at that time of year.

Summer heat can cause some plants to slow their growth while it is a stimulant to others. Humidity can act in much the same way. Of crucial importance to the length of the growth period within the growing season is the duration of daylight and darkness at various latitudes. Although little-studied for ornamentals, this appears to be important to the success of some northern nursery areas and can perhaps partially offset the limitations of short growing seasons or low winter temperatures. All of these climatic factors will be examined more closely for their locational implications in Chapter 11.

Soils and Water Supply

As with other forms of agriculture, nursery growing requires soils suited to the type of crop being raised. The constraints which the soil requirements of nursery operations place on their location depend directly on the plant type and the cultural practices of individual nurseries. Ornamental plants include many different types of plants, however, and they can be grown in a variety of ways. There are thus a variety of possibilities and requirements for nursery soils. The use of container-growing, especially with soilless media, has also made the characteristics of natural soils much less important as locational criteria. But container-growing is applicable for only certain plants and many nurseries still rely on natural soils for much or most of their growing operations.

The type of soil best suited for a plant depends on its growth requirements and on the cultural practices used with it. Plants which are dug bare root, for example, need a different soil from those dug with a root ball, and young seedlings need a different soil from older specimen-size plants. In general, it is advantageous for most nurseries to have some variety of soil types, to accommodate the variety of plants they raise.

Various soil properties are important: permeability, texture, acidity, fertility, depth, etc. But in the broadest terms the most important locational variables are permeability and texture. All nurseries growing their plants in the field require soils with at least fairly good drainage and aeration. One of the most important

characteristics of healthy nursery stock is a good root system, and roots of most plants require a soil which is not too compact or wet in order to develop a healthy root system. Soils can be artificially drained, and many nurseries rely on this, but the best nursery soils are those with natural drainage and permeability. Of course, soils must also be able to retain moisture as well, and for the small root systems of most nursery plants to avoid drought injury the soil must have a good water holding capacity. Some kind of loam is best for most nurseries.

Plants which are sold bare root generally require a light, sand or silt, loam. Bare root plants need a soil loose enough to permit free development of a branching root system and also loose enough to shake free of the roots at harvest time with a minimum of strain. Plants grown bare root include almost all rose plants, almost all deciduous trees three years old or younger, most deciduous shrubs of the same ages, and the seedling transplants and lining-out stock of all deciduous and most evergreen plants.

Harvest time for most bare root stock, except for plants transplanted within the nursery, is usually in the late fall or early winter after they have begun to enter dormancy for the winter. This is a rainy time of the year in most places, or at least a time of low evapotranspiration from the soil, and it is often wet for long periods with only short periods of relative dryness. Soils must therefore be able to drain quickly to permit tractors and other machinery onto the land. Heavy clays or poorly drained soils of any kind could cause equipment problems, excessive soil to adhere to the roots, and risk serious compaction which could damage the soil's ability to grow plants in the

future.

Nurseries growing bare root plants on a large scale, then, such as wholesale growers of deciduous trees, roses, and other shrubs, usually require a sandy or silty loam with good drainage. Typical locations are on river terraces, old lake shores, edges of alluvial basins, coastal plains, loess deposits, and a variety of sites in glaciated areas such as moraines and kame terraces. Needless to say, some of these can be found in most parts of the nation in one form or another.

Soils for container-grown plants are usually combined from ingredients imported to the site: sand, peat, bark, perlite, vermiculite, etc. Although some of these may come from local sources few of them come from the actual nursery site itself. Container nurseries are thus freed from many of the constraints imposed on field nurseries. They must still, however, be able to dispose of surface water, and this requires either a soil with some permeability or else a system of drainage ditches. Many nurseries combine container-growing with field-growing and thus tend to occupy soils suitable for field-growing even under their container yards. But many others are purely container operations and these are able to use sites unsuitable for normal growth of plants in the soil. This freedom allows them to take advantage of other site opportunities such as access to transportation, local microclimates, etc.

In addition, container nurseries are usually much smaller than field-grown nurseries. The plants can be spaced very closely and there is no longer a requirement for travel space between rows for large cultivating equipment. Container growers also do not need to fallow the

soil between crops of plants. For a given total number of plants, then, container nurseries are typically a tenth the size of comparable field-growing operations. This also gives them some locational advantages, especially in areas where land is in short supply and/or expensive, most typically in metropolitan areas.

Water supply needs for nurseries vary with the type of operation and to some degree with the type of plants raised. Rainfall is less important than one might expect since most nurseries use irrigation as a matter of course for at least some part of their operations. Container nurseries use irrigation almost exclusively, requiring as much as 3" of water per week in the summer,[8] far more than the normal rainfall in most parts of the nation. Nurseries growing plants in the soil do depend on rainfall for some older plants, three years or more in age, but even these need irrigation if there is a prolonged dry spell. Rainfall is thus a benefit to the extent that it reduces the need for irrigation, but it rarely provides a significant locational advantage in and of itself today.

Rainfall does, of course, strongly condition the availability of irrigation water supplies in most areas, and this can be an important limiting factor in nursery locations. Areas underlain by low yielding aquifers or far from sources of surface water are generally unsuitable for nurseries as for most types of agriculture. In addition, container nurseries are especially constrained by limitations on water supplies because they use much greater amounts of water than field nurseries, not just per acre but per plant as well. The porous soil media and the limited volume of soil in a container require more frequent watering

than for field-grown plants.

In the past, before diesel and electric pumps made deep groundwater accessible and large interbasin transfers of surface water possible, rainfall was much more important as a locational factor. Now ground water and interbasin transfers are more important for nursery water supplies. But growing competition for the use of such water supplies, especially in the West and in metropolitan areas throughout the nation, mean that in the future water supplies will be more restricted and the natural availability of water will assume more importance as a locational factor for nurseries.

The various aspects of soils and water supply will be discussed in more detail in Chapter 10. Special attention will be paid to the needs and locational constraints and opportunities of each of the major types of nursery growing, bare root, B&B, and container operations.

Labor Supply

Among agricultural commodities nursery products are one of the most labor intensive. As was noted in Chapter 3, hired labor accounts for some 36% of the production expenses for horticultural specialties in general. The availability of an agricultural labor force is one of the important locational criteria for nursery farming. The demand for labor can be satisfied in a number of ways and much depends on the particular seasonal requirements of different segments of the nursery industry.

One of the features of nursery labor is that it is distinctly less seasonal than that required for other commodities. The high degree of seasonality in most other commodities is tied to a need for hand labor

for harvesting while most other phases of production have been largely mechanized. Nursery production, however, requires relatively large amounts of hand labor at several periods throughout the year in addition to harvest times, Figure 4-6.

One measure of seasonality, or the lack of it, is the ratio between the number of workers employed less than 150 days per year and the number employed 150 days or more per year. Table 4-3 shows the numbers and ratios for various commodity groups of farms in 1978. Horticultural specialties have by far the lowest ratio of seasonality. It should also be noted that, although they account for only 3.7% of the seasonal workers, horticultural specialties employ 10.6% of the non-seasonal farm workers.

Among the various horticultural specialties nursery products is the leading specialty in number of workers hired, both seasonal and non-seasonal, with approximately one third of each. As Table 4-4 shows, however, nursery products is not characterized by an especially low seasonality ratio. Several other categories employ less seasonal labor, such as mushrooms and potted flowering plants and cut flower growers. These are the specialties least tied to seasonal market demand or to seasonal plant growth characteristics. Nursery products are tied to both of these.

Data from the Horticultural Research Institute, Table 4-5 and Figure 4-7, indicate that the largest firms employ the largest share of hired labor at nurseries, but are less seasonal than other size firms. When compared to Figure 2-9, though, which shows the distribution of nursery sales by size classes, it can be seen that the larger firms

Figure 4-6. Two-year Tree Roses Being Budded, Illustrative of the Heavy Labor Needs of Nurseries. These Plants Were Budded in September, 1983. They Were Topped in February, 1984, Harvested in November, 1984 for Sale and Planting in the Spring of 1985. Jackson & Perkins Nursery at Wasco, California

Table 4-3. Long-term and Short-term Labor Force, by S.I.C., 1978

S.I.C.	Workers hired <150 days/yr.	Workers hired >150 days/yr.	Ratio <150/>150
All farms	4,648,667	951,272	4.89
Cash grain	722,543	136,498	5.29
Vegetable	299,601	83,773	3.58
Fruit and nut	855,117	97,026	8.81
*Hort. Spec.	170,673	100,848	1.69
Dairy	288,422	132,527	2.18
Poultry	104,603	46,838	2.23

Source: 1978 Census of Agriculture Vol. I, Pt. 51, Table 35 (U.S. Data).

Table 4-4. Long-term and Short-term Labor, Horticultural Specialties, 1978

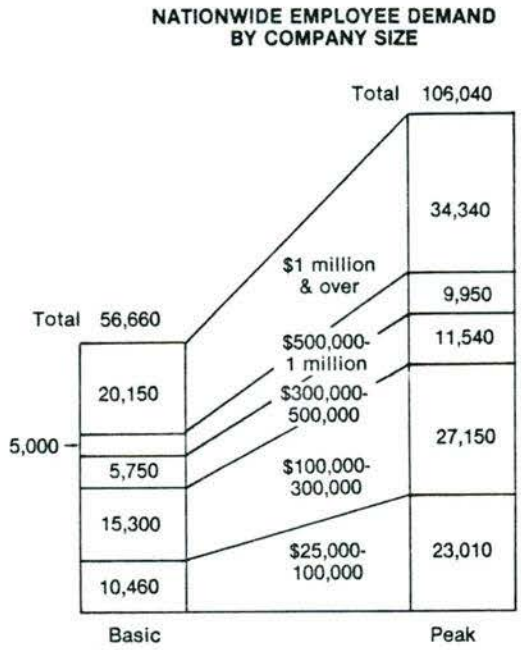
Specialty	Workers hired <150 day/yr.	Workers hired >150 days/yr.	Ratio <150/>150
All hort. spec.	128,826	95,066	1.35
Potted flowering plants and/or cut flowers	25,751	26,852	0.96
Bedding plants	15,505	5,780	2.68
Foliage plants	21,412	12,214	1.75
Sod	5,187	4,646	1.12
Bulbs, corms or rhizomes	1,918	386	4.97
Mushrooms	6,541	10,305	0.63
*Nursery products	45,623	30,885	1.48
Vegetable & flower seed	2,231	1,020	2.19
Vegetables grown under cover	1,634	650	2.51

Source: Census of Horticultural Specialties, 1979, Table 3.

Table 4-5. Nationwide Employee Demand by Company Size

Company Size	Average Number of Employees			Estimated Total Number Firms	Estimated Nationwide Employment	
	Basic	Peak	% Change		Basic	Peak
$25,000-100,000	4.0	8.8	120%	2,615	10,460	23,010
$100,000-300,000	10.2	18.1	77%	1,500	15,300	27,150
$300,000-500,000	12.1	24.4	102%	475	5,750	11,590
$500,000-1 million	20.0	39.8	99%	250	5,000	9,950
$1 million & over	108.9	185.6	70%	185	20,150	34,340
Total	32.0	56.7	77%	5,025	56,660	106,040

Source: Horticultural Research Intsitute, Scope IV, 11



Source: Horticultural Research Institute, Scope IV, 11

Figure 4-7. Nationwide Employee Demand by Company Size

employ fewer workers per sales dollar than the smaller firms. Much of this may be attributed to the greater degree of mechanization of large operations and to the greater degree of productive complexity, which is capable of employing workers during off-peak times in ways that are still productive and profitable.

Nevertheless, large nurseries can still be large employers. Monrovia Nursery, the 600 acre container grower in Azusa, California, employs roughly 700 workers year round and adds others to the payroll for short periods at other times.[9] Jackson & Perkins, the large bare root rose grower, employs 250 people in the summer at Wasco, California, but as many as 1200 each winter during the harvest period.[10] J. Frank Schmidt & Son, the bare root deciduous tree grower in Boring, Oregon, has an average staff of 260 employees.[11] Such large nurseries require a dependable local work force from which to draw their employees.

At the local scale the labor needs of nurseries can be met in both rural and metropolitan areas. The basic requirement is a large year-round local labor force, with some advantage going to those areas with a relatively high rate of unemployment or underemployment. In metropolitan areas much of the work force is often drawn from workers displaced from farm operations shutting down in the face of urban sprawl as well as from underemployed suburban and rural-fringe residents, especially for the seasonal peaks of employment. In rural areas nurseries may benefit from local large scale underemployment, especially in southern states where longer growing seasons permit less seasonality for the general agricultural work force.

The unusual seasonality of labor needs of some types of nurseries, particularly of bare root growers, enables them to take advantage of complementary seasonality in other crops. The rose growers in Kern County, California, for example, have their heaviest labor needs in the winter harvest season. They have a large available labor supply in the local resident farm worker population who are mostly out of work at that time.[12] The availability of unemployment insurance, food stamps, etc. provided by public agencies helps maintain the year-round availability of a work force which sees only seasonal employment, and nursery growers benefit from this as much as do other farmers.

Along with other commodities, the use of hired labor in the nursery industry has some pronounced geographical ethnic distributions. As described by Holt:[13]

> There are racial differences related to the pattern of intensity of hired labor use. Analysis of 1970 population census data indicated that among persons identified as farm operators and farm workers by the census, non-Hispanic whites were in the great majority as farm operators in every state except Hawaii. In the areas where farm operators far out-numbered hired farm workers, the hired workers tended to be drawn from the same ethnic stock as the farmers. However, where farming employed more hired workers than operators it tended (with exceptions) to be accompanied by a shift in the background of the workers, with many more of them being drawn from the black, Mexican-American, or other ethnic minority populations. In the twelve states of the Midwest, 96% of the hired farm workers were non-Hispanic whites. However, in the 27 states where hired workers were in the majority, only about 58% were non-Hispanic whites; the remaining were blacks, Hispanics, or other ethnic minorities. Thus in most areas where the employment structure of farming has developed in a mode emphasizing intensive employment of hired labor and a limited number of entrepreneurs, the employees have come from ethnic minority groups to a substantial extent. An element of potential race and class conflict is present in these areas that is almost entirely absent among the operators and regular hired workers elsewhere.

The high labor requirements of nurseries have led to different attempts to minimize the expenditures for labor. The two main approaches at present are a growing use of piecework instead of hourly wages[14] and a continuing emphasis on mechanization.[15] Container nurseries have been the greatest beneficiaries of mechanization so far. The use of automatic soil mixers, potting machines, flat fillers, plug extractors, and a variety of conveyors has reduced labor needs. The fact that large container nurseries use less labor per sales dollar is a direct outgrowth of their greater degree of mechanization. Field growers now use transplanting machines and mechanical diggers, but have much greater labor needs per plant than most container growers. And nurseries of all types are increasingly relying on fertilizing via irrigation water and on the use of chemical herbicides rather than hand weeding in order to reduce labor costs. These have limited applicability, however, since most nurseries raise such a variety of plant species that it is difficult to find treatments which can be applied safely or effectively to all. Much spraying, fertilizing, and even watering is still done by hand at even the most mechanized container nurseries.

Overall, labor supply needs for most nursery operations have rarely proven to be a strongly limiting factor to nursery locations. Rather, the availability of a large labor pool in certain areas has been an advantage which has perhaps increased the competitiveness of nurseries there.

Transportation

The impact of transportation costs and accessibility on nursery locations is considerable. It is the standard against which all relative advantages to production provided by other factors are measured. By and large today's refrigerated trucks can deliver plants safely and quickly almost anywhere in the country. Speed is of the essence, and the irregular delays inherent in railroad shipping mean that the vast majority of all plants today are sent by truck.

Current Shipping Practices

The size of truck required varies with the distance the plants are to be shipped. For long hauls, 500 miles or more, most plants are generally sent by 5-axle semitractor trailers with 40,000 lb. load limits.[16] At shorter distances many are sent by smaller trucks. Some large nurseries maintain their own fleet of delivery trucks used within a general radius of 500 miles, relying on common carriers to supply larger semis for longer deliveries.[17]

A full load of plants can be anywhere from 1500 to 10,000 or more plants. Often this is more than the size of a single order sent from one grower to one customer. A common practice is for a grower to send several smaller orders in one truck for multiple drops along the route to different customers. Alternatively, growers at a distant location may group their orders in a single load going to one destination area, perhaps serving several customers.

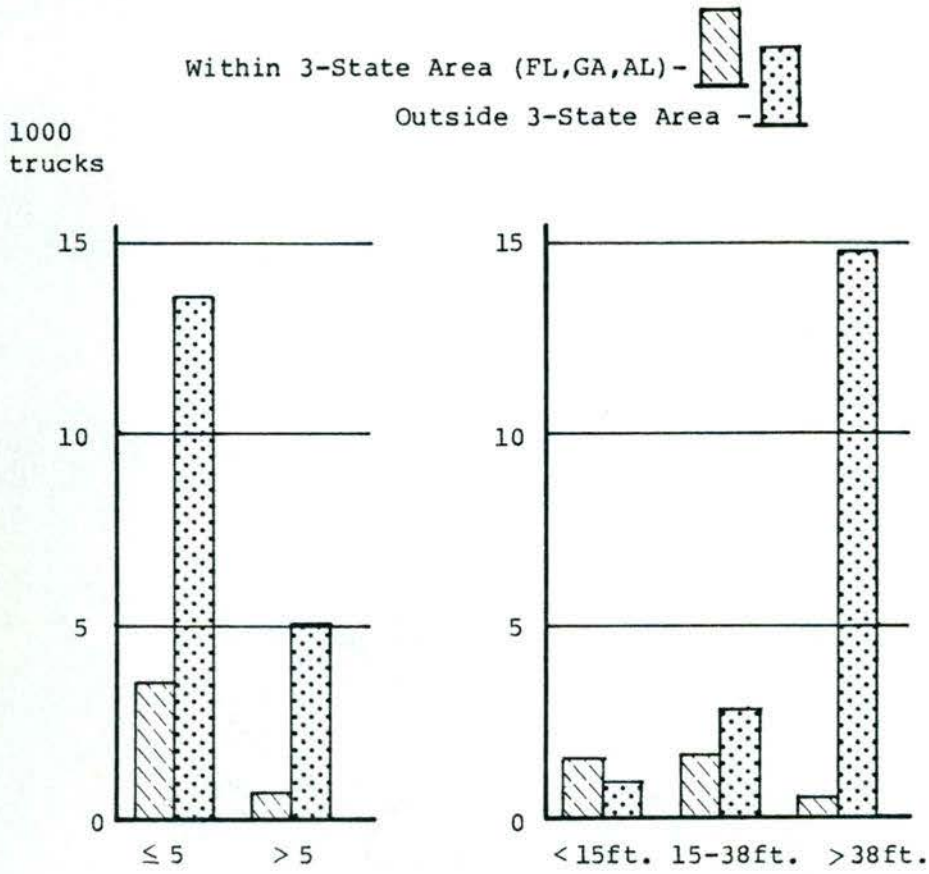
A study of truck shipments of nursery plants (including foliage and bedding plants and flowers in addition to woody ornamentals) which were

sent by truck north from central and south Florida[18] found that a greater percentage of trucks on long hauls made more than five stops, while a smaller percentage of those going only to northern Florida,, Georgia, or Alabama made that many stops, Figure 4-8(a). They also found that those sent within the 3-state area were smaller trucks than those sent outside the three states, which were overwhelmingly the larger 5-axle semis, Figure 4-8(b). The ability to group orders can be a locational advantage for nurseries near each other. This will be discussed later in this chapter as one of the agglomeration advantages.

Transportation Costs

For the standard 40 ft. 5-axle semi, shipping costs average approximately $1.00 per mile today.[19] This means that it costs roughly $900 to send a truck full of plants from Tennessee to New York, $3000 to send one from California or Oregon the same distance, etc. Growers who want to compete with Tennessee nurseries from a base on the Pacific coast for the New York market must be able to sell their plants, F.O.B. roughly $210 cheaper per truckload, to give but one almost random example. The relative cost, though, depends on the value of the cargo since it costs essentially the same amount to send a truckload of any kind of plant.

Bare root trees shipped from Boring, Oregon to New York, for example, will have transportation costs ranging from 6% to 15% of the wholesale price of the tree, F.O.B., Table 4-6. Costs to ship them to Kansas City would be lower, from 4% to 10% of the wholesale price. It



a) Number of Delivery Stops b) Length of Truck Bed

Source: Strain and Beilock,"Truck Shipments of Florida Ornamentals"

Figure 4-8. Florida Truck Shipments of Ornamental Plants by Number of Stops (a), Size of Truck (b), and Destination

Table 4-6. Transportation Costs for Bare Root Trees from Boring, Oregon

No. Trees	Size	Age	F.O.B. Wsle. Price	Cargo Value
10,000	5'-6'	1 yr	$5.00	$50,000
1,000	1 1/1"-2" cal.	3 yr.	17.50	17,500
1,000	1 1/2"-2" cal.*	3 yr	20.00	20,000

Shipping Rates	Cargo Value	Shipping Cost	Shipping Cost as % of Wsle. Price
To Kansas City	$50,000	$2,000	4%
(2,000 mi)	17,500	2,000	11
	20,000*	2.000	10
To New York	50,000	3,000	6
(3,000 mi)	17,500	3,000	17
	20,000*	3,000	15

Source: Interview with Norbert Kinen, Vice President, J. Frank Schmidt & Son Nursery, Boring, Oregon, October 1983; and 1983-84 Catalog, J. Frank Schmidt & Son Co.

*"Customized canopy" trees.

can be seen that the smaller trees, though lower priced individually, can bring a higher return per truckload because more of them fit into a truck thus reducing relative transport costs.

The ability to reduce relative transport costs influences the type of plant which can profitably be raised and sold at locations far from major markets. Since trucking costs are relatively inflexible, the advantages lie with plants which will maximize the value of the total cargo. There are two approaches to the situation: small plants, many thousands per load, or higher value plants that can boost the cargo value as well. Table 4-6 shows the relative advantage for small trees. It also shows that for higher value large trees compared to average value large trees. To send a regular 1 1/2"-2" caliper branched tree from Oregon to New York would result in transport costs at 17% of the wholesale price. With special pruning and branch-spacing, such as that practiced by J. Frank Schmidt & Son Nursery for their "customized canopy" trees,[20] it is possible to raise the value of a tree by $2.50, and this reduces the relative transport cost from 17% to 15% of the wholesale price.

Production of plants far from markets, then, tends to be in small plants or in plants with a larger value added. The concentration of rose plant nurseries in Kern County, California, which raise some 60% of U. S. rose plants,[21] is made possible in large part by their small size and light weight, making individual truckloads very valuable and reducing the relative transport costs. As shown in Chapter 2, lining-out stock tends to be produced farther from markets than does larger stock, a factor which allows for concentration in a few major production

locations.

The opposite result comes from production and shipment of plants which are either low value or occupy more space than normal. Balled-and-burlapped plants, for instance, take up more space and weigh more than container-grown plants and it takes fewer plants to fill a truck. A 40 ft. semi can carry roughly 6200 one gallon containerized azaleas (10"-12" across the top) but only 1500 B&B azaleas (14" across the top).[22] This makes transport costs four times greater per plant for the B&B azaleas. While B&B plants command higher prices in the market they cannot bring enough to justify long distance shipping at such rates. As a result B&B production generally occurs closer to markets than that of bare root or container plants.

Changes in Transportation

The cost of transportation varies with several factors, principally the cost of diesel fuel and the accessibility of nurseries to good highways. The cost of fuel has gone up dramatically in the 1970s but it has essentially held steady since 1980. Even so, during the '70s the increase in the price of fuel was more than matched by the rise in prices for nursery plants. This kept the relative cost of transortation the same for the most part and has had no apparent limiting effect on nursery locations. Future rises in fuel prices or shortages may, however, not be matched by higher market prices for plants. Nurseries far from markets must always be aware of their vulnerability to suddenly inflated transportation costs.

The accessibility of good highways to nurseries has changed over

the years, especially with the construction of the Interstate Highway System. Given the reliance of the nursery business on truck shipping, one would expect changes in nursery production as a result of the building of this highway system.

Winsberg studied this in the impact of interstate highways on agricultural production of various commodities in non-metropolitan counties in eleven southern states between 1954 and 1974.[23] He found that construction of the highways was accompanied by a significant increase in farm production from those rural counties crossed by north-south interstates. Production was not significantly greater in counties crossed by east-west interstates or in those without them. Among the various commodities, nursery products increased their share of the total value of agricultural production in all three types of counties. But in those crossed by north-south interstates nursery products doubled their relative share of the total, from 0.7% in 1954 to 1.5% in 1974. These north-south routes, of course, lead to markets in the Midwest and Northeast.

Winsberg's study did not look at production in metropolitan counties. As shown previously in Chapter 3, metropolitan counties are often major producers of nursery products. His findings would probably apply to metropolitan counties as well, though, for they are generally the major beneficiaries of interstate highway linkages.

Agglomeration Advantages

The location of many nurseries in one area creates benefits for all of them that each alone would not enjoy and encourages the

develoment of such nursery areas. Agglomeration of nurseries has been a feature of the business throughout its history, from early years on Long Island and near Charleston, down through the phenomenal concentration around Rochester in the nineteenth century, to the present day nursery clusters in Warren County, Tennessee, Dade County, Florida, Lake County, Ohio, and in the northern Willamette Valley of Oregon, among others.

Agglomeration economies exist in both rural and metropolitan areas. Berry, Conklin and Ray distinguish between localization economies, which accrue to a concentration of several operations in whatever type of location, and urbanization economies, which accrue to the mixture of operations in a metropolitan area.[24] The two can easily work together, and they appear to do so quite successfully for the nursery industry.

Localization economies consist of 1) the reputation acquired by goods produced in a given locality, 2) the expertise built up in an area among the several producers, leading to competition, innovation, and a shared knowledge of practices, 3) the creation of a pool of skilled labor, 4) the sophistication of local services, both physical and financial, to meet the particular needs of the industry, and 5) the ability to subdivide operations among various businesses, eliminating the need for total self-sufficiency, and permitting a broadening of the services and material resources available to any one establishment.[25]

Nurseries in agglomerated areas exhibit many of these localization economies. Of particular value to the development of the nursery industry in the U. S. has been the combination of factors 2 and 3 in a

process of "calving off" new nurseries from old ones by former employees striking out on their own. Factor 5 is also important as growers often will buy from each other to fill an order for which they do not have all the plants requested by a customer. They would rather spend part of their profit at a neighboring nursery in order to make a full order than lose a customer directly to another nursery by only filling part of an order.

Very important to agglomerations of wholesale nurseries is the attraction they provide to buyers for retail nurseries coming to the area from outside. Much as with automobile and furniture retailers, wholesale nurseries rely on the attraction of aggregation and comparison shopping, to boost business for all of them together. And, as seen earlier with transportation practices, nurseries often need to group their shipments to make up a full truck load. This alone can be a powerful disincentive to setting up small or medium sized wholesale nurseries in isolated locations. A wholesale grower in Lane County, Oregon, some 100 miles south of the nursery agglomeration around Portland, complained to me of his difficulty in shipping trees long distances. He enjoys essentially the same climatic advantages which help make the Portland area such a major nursery area, but to ship his trees to customers east of the Rockies he must first ship them to Portland where they can be added to the orders of growers there. The process involves extra handling, time, and expense. For the most part his market is one served by smaller trucks, within 500 miles of him. [26]

The advantages derived from urbanization economies also apply to

metropolitan nurseries as well as to other types of industries. The network of transportation lines which focus on urban areas give easier access for shipping; utilities and services are usually better developed than in rural areas, of particular benefit to the more industrialized forms of production such as container nurseries; the local labor pool is larger and more diverse and is able to supply seasonal labor as well as longer term workers; and metropolitan areas typically provide a reliable local market for the plants produced by nurseries there. It is not surprising then that many of the most notable agglomerations of wholesale nurseries are in metropolitan areas, or that the Megalopolis along the northern Atlantic seaboard is still a major nursery producing region.

Many nursery agglomerations, both urban and rural, got their start from an early locational advantage derived from climate, soils, or transportation, and became large centers of the industry in the past. As the years have gone by the market may have shifted away from them through population migration, their transportation advantage disappeared with changing technology or shifting markets, or their soils disappeared beneath asphalt and concrete as cities expanded. Yet such nurseries may continue to flourish in the same area, moving out away from the urban sprawl, perhaps on to poorer soils or over to new but less competitive transportation routes. The persistence of these agglomerations can be laid to a kind of historical momentum, benefitting now more from their localization and urbanization economies than from other locational advantages they may have enjoyed in the past.

The history of the nursery business is thus integral to an

understanding of its present day geography. The existence of the 600 acre Monrovia Nursery in the midst of a suburban commercial-industrial area and the continuing success of rural nurseries in such an apparently unlikely place as southwest Iowa derives in large part from the localization economies created in the past, to the historical momentum which has been maintained to the present. The next four chapters will examine this history in more detail, from its origins in the seventeenth century up to the beginning of the current era, around 1950.

Chapter Four - Notes

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[7]Ibid.

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[9]Monrovia Nursery Company, "Information Sheet; Answers to Most Frequently Asked Questions About the Nursery," Monrovia Nursery, Azusa, California; Mimeo, 1981.

[10]Interview with Joe Martinez, Jackson & Perkins Co., Wasco, California, Sept. 1983.

[11]Brent Marchant, "Efficiency Helps Schmidt's Compete in Today's Wholesale Market," American Nurseryman 157 (15 Apr. 1983), 57-60.

[12]Interview with David Stump, retired President, Jackson & Perkins Co., Medford, Oregon, Sept. 1983.

[13]James S. Holt, "Introduction to the Seasonal Farm Labor Problem," in Seasonal Agricultural Labor Markets in the United States, ed. Robert D. Emerson (Ames, Iowa: Iowa State University Press, 1984), 10.

[14]C. Ann Norris, "How Four Growers are Implementing the Piecework System," American Nurseryman 159 (1 Apr. 1984), 61-63.

[15]Roy Young, "Nursery Industry Mechanization Advances," Journal of Environmental Horticulture 1 (1983), 17-23.

[16]Technical Committee S-103, Factors Affecting Southern Regional Production Advantages for Kurume Azaleas, Southern Cooperative Series Bulletin 241 (Knoxville, Tennessee: University of Tennessee, Agricultural Experiment Station, 1979), 31.

[17]Hines Wholesale Nursery in Irvine, California, for example delivers in its own trucks to customers in California, Arizona, and Nevada; Interview with Judy Hefley, Customer Service Representative, Hines Wholesale Nursery, Irvine, California, Sept. 1983.

[18]J. Robert Strain and Richard Beilock, "Truck Shipments of Florida Ornamentals to the U. S. and Canada," Proceedings of the Florida State Horticultural Society 95 (1982), 181-184.

[19]This is an average of costs cited by various sources ranging from $.90 to $1.10.

[20]"New Culture Practices at J. Frank Schmidt & Son," Nursery Business 21 (Nov-Dec. 1976), 15-18.

[21]This figure is a very rough estimate. Exact data are unavailable. The Census of Horticultural Specialties 1979, Table 15 lists 30,022,000 rose plants sold at wholesale in 1978, nationwide. The Kern County Agricultural Commissioner's Agricultural Crop Report 1982 lists 24,380,000 rose plants produced in 1981 and 26,286,000 in 1982. The 1978 data, however, show only 19,638,000 rose plants grown in California that year.

[22]Technical Committee S-103, Factors Affecting Southern Regional Production Advantages for Kurume Azaleas, 61.

[23]Morton D. Winsberg, "Agriculture and the Interstate: A Note on Locational Impacts in the South," Growth and Change 12 (July, 1981), 41-46.

[24]Brian J. L. Berry, Edgar C. Conkling, and D. Michael Ray, The Geography of Economic Systems (Englewood Cliffs, New Jersey: Prentice-Hall, 1976), 150ff.

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[26]Interview with Clyde Beat, owner, Eugene Wholesale Nursery, Eugene, Oregon, Jan. 1984.

CHAPTER FIVE

A HISTORY OF THE U. S. NURSERY INDUSTRY: INTRODUCTION AND FIRST TWO CENTURIES

Introduction

The nursery industry in America developed slowly as the market and demand for its products grew over the years. Until the second half of the nineteenth century fruit plants far outnumbered ornamentals as nursery products. Even in the early years much of the planting stock for orchards and gardens was produced on a very small local scale. Once commercial nurseries were established for growing fruit stock, however, they developed the techniques and methods necessary for the production of ornamental plants as well. As the demand for ornamentals grew in the nineteenth century, many of these fruit plant producers added ornamentals to their inventory.

The demand for ornamental plants has changed markedly over the years. Up until 1900 or so it was strongly influenced by the steady stream of introductions of new species and varieties from abroad. Fads and rather strong shifts in popular taste marked the use of trees and shrubs. European nurseries were very important suppliers of certain plants to American nurseries up until 1919 when a federal quarantine prohibited most imports, to guard against the introduction of pests and diseases. Since then the American nursery industry has developed in relative isolation from that of other nations with the

exception of Canada which has continued to trade extensively with the U. S. in nursery products.

The changing location of nurseries has responded to many factors over the centuries. Climate has always been important, and the earliest nurseries were located along the Atlantic seaboard in areas which continue to be important nursery areas to this day. As markets developed inland with the spread of settlement new nurseries followed. Canals, railroads, and finally highways made possible a national market for nursery products from the mid-nineteenth century onward. As transport became easier, locational criteria came to depend more on those that gave production advantages: climate, soil, freedom from pests, etc.

As the business grew in the late nineteenth and early twentieth centuries, it diversified structurally. Whereas early nurseries propagated their own stock and bought and sold plants at both wholesale and retail, many later ones have specialized in one or a few of the areas involved. Production techniques changed also, although very slowly until the twentieth century. Overall, the nursery business has followed traditional ways more than many other forms of agriculture, and until very recently most nurserymen produced plants in much the same way as their predecessors centuries earlier. In this century innovations in propagation and production, particularly soil-less media in container growing, are transforming nursery operations and radically changing the criteria for locations.

The major periods in the history of the nursery business in the U.S. are tied to developments in the markets for nursery plants which

in turn follow broad social historical changes. The earliest period, the colonial years, were marked by the slow growth of fruit and some ornamental plant production along the eastern seaboard. The second period, from 1780 to 1830, saw the rise of commercial nurseries and the spread of production west of the Appalachians. The middle years of the century, 1830 to 1870, cover the years of the first widespread use of many newly introduced species and the development of new tastes and uses of ornamental plants that created a demand for them on a large scale in many parts of the country. In the fourth period, 1870 to 1920, an integrated national system of wholesale distribution developed, ornamentals passed fruit plants in importance, and large new markets arose with the building of suburbs around many cities. In the fifth period, 1920 to 1950, the national market became a mass market with new forms of merchandising, and production went through several violent swings as the depression and the second world war played havoc with both markets and supplies. In the aftermath of the quarantine on foreign imports, new American propagation facilities were established, and gradually a system of inspection and certification eased the restrictions of domestic quarantines. New forms of propagation, production, marketing and transportation began to change the business. But the depression and the war delayed their full impact until the years after 1950.

The Colonial Period

The development of horticulture in North American preceded the development of the nursery business itself. The earliest cultivators,

the native American Indians, planted various trees and shrubs along with their herbaceous crop plants. Captain John Smith reported that the Indians of Virginia, for instance, planted mulberry and locust trees, grape vines and roses.[1] But there are no reports of any nurseries among the Indians. As with many traditional cultivators the early Indians undoubtedly relied on personal exchanges of seeds or possibly vegetative stock to extend their plantings. But through these simple methods they were able to cultivate and transfer plants over a wide area. From early Spanish introductions into Florida and Mexico, the peach tree was spread by native cultivators all over eastern North America, from Mexico to the Ohio valley and along the Atlantic seaboard as far north as Massachusetts by the time the first English and French colonists arrived less than a century later.[2] The Indians are not known to have cultivated woody plants purely for ornamental purposes though they might well appreciate the beauty, shade, or visual screen provided by otherwise useful food, fiber, or medicinal plants.

The Seventeenth Century

The first European settlers in eastern North America also had relatively little use for purely ornamental plants. Early homesteads were planted with fruit trees and medicinal or kitchen herbs, and the early towns had few shade trees other than occasional remnants of the natural woodland. The first nurseries were for the production of economic plants. In New England, Gov. John Endicott of Salem started a nursery in 1628, which was followed in 1630 by the garden of Gov.

John Winthrop near Boston from which plants were sold to other settlers, including mulberries, plums, chestnuts, filberts, walnuts, and hawthorns.[3] Other early nurseries were begun by individuals needing stock to plant their own orchards growing more than their own needs and selling or trading the surplus to others. When their own planting was completed they usually discontinued their nursery operations. Thus there was a series of small nurseries in different areas as settlement spread. Henry Wolcott, Jr. of Connecticut, for example, sold apple, pear, and quince trees between 1648 and 1653, before he concentrated his energies on producing cider from his new orchards.[4]

Although there are a few records of grafted or budded varieties imported from Europe in the early decades of settlement, the difficulties of preserving live plants on the long Atlantic crossing in the early years made them both rare and expensive. The majority of orchard plantings were from seedling stock which gave rise to a great genetic diversity. Since the major use of the fruit was for cider, brandy, or butter, this presented few problems. And when vegetative propagation and varietal selection did become common in the eighteenth century they were able to draw on the great wealth of local variation in the seedling-grown stock. This led to the rapid development of many superior regional varieties in the eighteenth and nineteenth centuries.

In the South, primarily Tidewater Virginia and Maryland and coastal South Carolina, orchard plantings were more diverse though probably not as extensive as in the North. Ashe describes oranges,

lemons, pomegranates, figs, olives, peaches, apples, pears, cherries, quinces, walnuts, and chestnuts in South Carolina by 1682.[5] But few of these ever became commercially important, though continued experiments with them did give rise to a nursery trade in the next century. In the Tidewater, early settlers were alternately urged and required by the Crown to plant the native red mulberry (Morus rubra) for the raising of silkworms.[6] Though the silk industry failed to develop, primarily because other crops like tobacco made better profits using the scarce labor supply available, the mulberry was widely planted and was valued as an ornamental and a fruit tree in the early years before many other ornamentals were introduced.

In both the North and South ornamental plantings were limited and did not require nurseries for production. Seeds of herbaceous flowering plants were imported from Europe for cottage gardening. The few shade trees planted were almost invariably transplanted from the local forests, such as the American elms planted on the Boston Common in 1646 and 1670.[7] In general, the early settlers relied on fruit plants, whether trees, shrubs, or vines, to provide flowers, shade, fall color, and winter interest in addition to fruit around the house.

1700 to 1780

By the early eighteenth century, interest in woody ornamentals had increased in the American colonies. As settlement expanded inland and as society diversified, the demand for both orchard and ornamental plants grew apace. The first real commercial nurseries were

established in the middle of the century, primarily to supply fruit and nut stock. Even more important at the time and in their influence on the later ornamental plant trade, however, were the early botanic gardens and private estates of a few individual plant lovers. Interest in landscape gardening in Britain and the rest of Europe increased greatly in the eighteenth century. In England especially the new style of gardening in avowed imitation of nature came at a time when a great number of exotics were becoming fashionable, including many species from North America. As Jarvis has shown, the North American species were an important component of the changing horticultural attitudes of the time in England.[8]

The demand for American novelties gave rise to a small but vital business in plant exploration and botanical collecting in the colonies and to the formation of private botanic gardens. The first of these was that of Christopher Witt in Germantown, Pennsylvania.[9] Witt, an Englishman, came to Pennsylvania in 1704 and joined a colony of Rosicrucians. In 1708 he established his botanic garden, at first growing medicinal plants for local use, and later he became a correspondent of the London botanist, Peter Collinson, who was actively seeking North American plants for introduction into England.

Collinson's most important American collector, though, was John Bartram, a fellow Quaker, who began his botanic garden in 1728 in Philadelphia. Bartram was an indefatigable traveller, searching the colonies from New York to northern Florida, and a fine botanist with an eye for new species.[10] For many decades he was a vital link between England and America; not only did he send seeds and plants to

Collinson and other botanists across the Atlantic, he imported from them seed and grafted varieties of fruit, nut, and ornamental plants from Europe. Collinson sent Bartram, among others, the first seeds of horse chestnuts (Aesculus hippocastanum), cedar of Lebanon (Cedrus libani), and lilac (Syringa vulgaris), as well as bulbs, corms, and roots of many herbaceous perennials.[11]

John Bartram died in 1777 and was succeeded at his garden by his son William who followed ably in his father's footsteps, exploring, collecting, and exchanging plants over a wide area. Through the agency of Bartram's Botanic Garden a great number of vegetables, fruits, nuts, and ornamental species were introduced into the colonies in the eighteenth century. The Garden functioned to some extent like a modern agricultural experiment station, growing plants on trial until they had proven themselves, then propagating and distributing limited quantities to interested gardeners and nurserymen.

The most important contribution of the Bartram Gardens to the development of the nursery industry was in popularizing native species as ornamentals. While they had been available almost everywhere from local woodlands, Bartram made available a much wider variety from throughout the colonies. The catalogue from around 1780 listed for sale the seed, or live plants propagated from seed, of 17 oak species, 6 maples, 7 pines, 7 viburnums, 5 dogwoods, and literally dozens of other species and genera of native ornamentals.[12]

In addition to established botanic gardens, many wealthy individuals planted their own estates with a variety of specially imported plants and came through exchange or sales to be important

early sources of plants for other gardeners. Throughout the eighteenth century and to a lesser extent into the nineteenth century, large estates were important as minor arboreta and sources of new and rare varieties of ornamentals. In Massachusetts, the Hancock estate imported plants from England and then through sales made by its gardener was an important nursery source for the region. In 1770, George Spriggs, gardener to John Hancock, was selling peach, apricot, nectarine, quince, apple, mulberry, and linden trees through advertisements in Boston newspapers.[13]

In the southern colonies, private estates were the major means of horticultural introduction until after the Revolution. Plants were imported from Europe by individual planters rather than by wholesalers or nurserymen. By personal exchanges their plants spread to other estates. Colonel George Custis of Virginia was a great fancier of lilacs, and from his gardens came many of the plants later grown throughout Virginia, including some planted by Washington at Mt. Vernon.[14]

By the early eighteenth century street trees had become more common in American towns and were often a combination of European fruit trees and native shade trees. Some towns even required the planting of trees. In 1700, Philadelphia ordered that all residents must plant at least one tree in front of their house. Suggested species were "pines, unbearing mulberries, water poplars, lime or other shady and wholesome trees."[15]

In 1708, New York City required all residents along Broadway to plant a tree in front of their houses.[16] Between 1692 and 1701,

"stinking weeds" were removed from vacant lots in Charles Town, Massachusetts, and Broadway, the main road leading out of town, was planted for three or four miles with pine, cedar, and cypress trees.[17] This was one of the few instances of conifers being used to the exclusion of deciduous trees. Other towns, though not requiring planting, were often shady at least along the major streets. Germantown, Pennsylvania, for instance, had many streets lined with peach trees,[18] and New Haven, Connecticut had many elms and buttonwoods shading its Green in the heart of town.[19]

The first large commercial nursery in the colonies grew from a large private garden and orchard which offered surplus stock for sale. In 1737, Robert Prince of Flushing, New York, in what is now the Borough of Queens in New York City, began selling plants commercially. By 1767 he was advertising fruit trees for sale, with regular shipping schedules along the coast and the ability to ship to England if necessary.[20] By 1770 the Prince Nurseries were advertising ornamental trees and shrubs as well. In 1771, Prince printed an ad in the New York Gazette and Weekly Mercury offering a large variety of cherries, plums, apricots, nectarines, peaches, pears, apples, and other fruit plants including figs, plus a relatively long list of "timber trees and flowering shrubs." Among the latter were eight species of native oaks, three maples, three ashes, two dogwoods, two birches, and one species each of magnolia, buttonwood, locust, catalpa, sassafras, and lilac. For evergreen trees and shrubs Prince sold red cedar, three pines, spruce, fir, and hemlock, all natives, and imported laurel and silver-leaved holly.[21]

The Prince Nurseries were later divided between his sons, and the larger successor, renamed the Linnaean Botanic Gardens, became the leading nursery in the country and remained so until the middle of the nineteenth century. After the Revolution both George Washington and Thomas Jefferson, among many others, bought plants from the nursery.[22]

The location of the nursery probably had much to do with its success (see Figure 6-4). It occupied sandy loams adjacent to Flushing Creek on the northwestern edge of Long Island. The creek allowed ships to pull up close to the nursery both for importing European stock and for shipping orders up and down the coast of America. It also had good local markets on Long Island and in New York City for both orchard and ornamental plants. There were a few other nurseries on Long Island before the Revolution but none was as large or marketed as widely as Prince's. Thomas Young at Oyster Bay, a few miles to the east, for example, won an award from the Society for Promotion of Agricultural Arts in 1768 for the 27,000 apple trees in his nursery.[23]

In addition to the early nurseries there were also several seed merchants in major port cities of the colonies who occasionally imported woody plants as well. The two largest were, curiously, both in Charleston, South Carolina. Henry Laurens began business in 1755 and was followed by John Watson in 1763. Both dealt mainly in vegetable and flower seeds, herbaceous perennials, and fruit and nut plants. But Watson had become by the time of the Revolution a large importer of woody ornamentals and offered for sale in 1776 an

unspecified "great variety of English and American flowering trees, shrubs, evergreens, etc."[24]

The decades before the Revolution were times of growing demand for orchard and ornamental plants and saw the beginnings of a commercial trade to meet that demand. As life in the colonies became more secure and as the moneyed classes of merchants and large farmers grew in numbers the demand for ornamentals to adorn their residential grounds began to grow rapidly. Botanical gardens, seed merchants, and fruit nurseries all filled part of the need. It remained for the post-war years to sort out the new forms of business and see the development of a new system of commercial nurseries.

The Origin of Nurseries in the Early Republic, 1780 to 1830

The growing wealth of towns in the North and large plantations in the South after the Revolution came at a time when new landscape gardening styles and a fascination with exotic species were reaching widespread popularity in Europe. Those new tastes for novelty and fashion in ornamental plants reached the U. S. in the last decades of the eighteenth century and led to much greater use of ornamental plants. It was also a time of expanding agricultural settlement west of the Appalachians and of intensified agriculture east of the mountains, both of which increased the demand for orchard stock. Together, these created a market for new commercial nurseries in the years after the Revolution which provided the facilities and marketing channels for the slowly developing market for ornamental plants.

The new nurseries which grew up were almost all in old established

agricultural areas of the eastern seaboard and near major towns. European nursery stock was very important throughout the period and most of the succession of fashionable plants were exotic species, popular first in Europe. As this period progressed more fruit nurseries were established in western areas, primarily along major transportation arteries leading to the newly opened farm lands. Since most freight was shipped by water before the railroads took over from them in the 1840s and '50s, this gave a locational advantage to nurseries on rivers, coasts, and canals.

As Daryl Watson has interpreted the origins of the modern nursery in America, in the years immediately following the Revolution there were three traditions that contributed to the growth of large commercial nurseries: the nurseryman/farmer raising fruit trees for orchards on the frontier, the botanic garden, and the seed houses run by merchants in coastal cities. All three contributed something different to the modern nursery.

Seed Houses, Botanic Gardens, and Estates

It was a logical step to go from importing seed and bulbs to whole woody plants, especially for the larger seed houses. Given that the growing demand for ornamentals was usually in imitation of European styles, the importers of European plants had easiest access to the new, primarily urban, market for the new plants. In Charleston, South Carolina, the early seed merchants Laurens and Watson were wiped out by the disruptions of the Revolution, but Watson's business was bought by Robert Squibb in 1787 and soon became an extensive

importer of European and Asian ornamental plants to the Southeast.[25]

In Philadelphia, David Landreth, an English immigrant, expanded his vegetable truck farm into a seed house in 1734.[26] Beginning with vegetable seed, both imported from Europe and grown on his farm, he branched out into flower seed, bulbs, gardening tools, and ornamental plants. By 1828, his son David Landreth, Jr. was selling roses, camellias, rhododendrons, azaleas, magnolias, and the new Osage orange, seed of which had been brought back from the Lewis and Clark expedition twenty years earlier.[27] The Landreths had an extensive international trade as well, and maintained a branch in Charleston, South Carolina until the Civil War.

In 1796, Bernard M'Mahon emigrated to Pennsylvania from Ireland and started a seed and nursery business in Philadelphia. By 1806 he had become a very large dealer and published one of the first American horticultural encyclopedias, including within it a catalogue of his nursery offerings, as The American Gardener's Catalogue. In it he lists for sale 442 species and varieties of hardy deciduous trees and shrubs and 99 species and varieties of hardy evergreen trees and shrubs, plus an additional 1500 trees, shrubs, and herbaceous plants suitable for greenhouse cultivation, though one must assume that many of these were available only by special order to European nurseries.[28]

Out of the botanic garden tradition grew several nurseries in addition to Bartram's that were important in the early years of the Republic. Humphrey Marshall, a Quaker in Chester County, Pennsylvania,

west of Philadelphia, started another botanic garden in 1773 in what was to become Marshalltown. He collected for the European market and grew at his garden for the American market promising native species. In 1785 he published the first comprehensive discussion of American forest trees, Arbustum Americanum. A cousin of John Bartram and friend of other prominent Philadelphians, Marshall was influential more in introducing native species to ornamental use than in selling large numbers of plants in the way that Prince's nursery did. By helping to stimulate and diversify the tastes of a growing urban market, however, he had a large influence on later demand.[29]

Among Marshall's clients were the twin brothers Samual and Joshua Peirce who in 1800 began planting their newly inherited family estate in Chester County with many ornamental trees and shrubs. This estate was bought later in the century by Pierre S. du Pont and was transformed by him into the famous Longwood Gardens.[30]

Another of Marshall's clients was William Hamilton whose large estate in Philadelphia, "Woodlands," was a showcase of European and American ornamentals. Hamilton travelled in England after the Revolution, studied many of the newly laid out landscape gardens, and kept in close touch with British and European gardening styles on his return to America. He was very important in introducing fahsionable plants from abroad and was an early arbiter of landscape taste in the Republic. The lombardy popular (Populus nigra var. italica) is first reported in America at Woodlands in 1784, and its early use in Philadelphia started a fad which swept the nation for several decades.[3] Other important Hamilton introductions were the Norway maple (Acer

platanoides), ginkgo (Ginkgo biloba), and tree of heaven (Ailanthus altissima).[32] Hamilton exchanged plants with many other gardeners, including Thomas Jefferson who received some silk trees (Albizia julibrissin) from him.[33]

Other estates were also important introducers of plants from Europe in these years, such as the Delaware home of E. I. du Pont de Nemours who helped popularize the horse chestnut around the turn of the century.[34] "Belmont," the estate of Judge Richard Peters and "Lemon Hill," the seat of Henry Pratt, both in Philadelphia were also noted for their gardens and much visited after the turn of the century.[35]

In the South the leading botanic garden was that of Andre Michaux, a Frenchman who settled first in Bergen, New Jersey in 1785 but by 1787 had opened in Charleston a nursery for both American natives and European imports. Though he returned to France in 1796, his son carried on the nursery until 1802. Michaux was a great plant explorer who travelled from Quebec to Tennessee and from Virginia to the Bahamas in search of new species. He died in Madagascar in 1802 on his way to the Netherlands East Indies. Among his important introductions to the South, if not the nation, were crape myrtle (Lagerstroemia indica), ginkgo, chinaberry (Melia azedarach), paper mulberry (Broussonetia papyrifera), and the silk tree.[36]

Southern plantation estates were important local sources of new introductions also, but were usually not as closely tied to European fashions as northern ones. Jefferson's Monticello and Washington's Mount Vernon were important locally as arboreta from which an occasional

seedling or cutting made its way to other gardens, but they were rarely direct importers from Europe. Jefferson, in fact, bought sixty sugar maples plus balsam poplars, hemlocks, and balsam firs from Prince's nursery in 1791.[37]

Commercial Nurseries in the East

Of the three antecedent forms which contributed to the rise of commercial nurseries, the most important was the farm nursery raising orchard stock. Prince Nurseries on Long Island began this way and gradually added more ornamentals to their inventory. The same techniques and equipment could be used for both deciduous fruit trees and deciduous ornamental trees or shrubs, and it was usually a relatively easy step to add those ornamentals to the inventory. Evergreens, especially conifers, required different handling, however, particularly in digging and transplanting, and the delayed popularity of conifers in America many decades after they had become commonplace in European gardens may be attributed to the reluctance of early nurserymen to adopt special procedures for their cultivation in large quantities.

Much of the development of ornamental nursery stock in the early years was the result of a series of fads which promoted, and occasionally later denounced, the use of newly introduced species. For example, the Kenrick Nurseries of Brighton, Massachusetts, which began raising seedling fruit trees in 1790, made some large profits from riding the crests of waves of popularity for certain ornamental trees in succeeding years. The Lombardy poplar fad swept through New England from 1800 to the 1820s, and Kenrick's sold large numbers of them. When the

speculative bubble of silk production was inflating in the '20s and '30s, they switched over and sold large numbers of mulberries. The bulk of the nursery's sales, though, were of grafted and budded varieties of fruit trees, at which William Kenrick, son of the founder, was an acknowledged expert.[38]

The Prince Nurseries were the nation's largest throughout the early decades of the Republic, however. Even more of their success was due to fads for horticultural novelties, many of which they actively promoted. Besides the Lombardy poplar and the mulberry, Prince's promoted and benefitted from sales of weeping willows (Salix babylonica) in the 1820s and '30s. Though introduced via Europe from Asia in colonial times and popular in New York and Pennsylvania by 1800, the weeping willow became the most demanded ornamental in the 1820s when cuttings reputed to be from the same tree under which Napolean rested on St. Helena were propagated in America by William Prince.[39]

Another tree made popular by Prince was the black locust (Robinia pseudoacacia). A native forest tree from the Appalachians, the black locust had been planted by colonial farmers through much of the northern colonies outside its natural range before the Revolution. Useful for firewood, long-lasting fence posts, and emergency cattle forage, it was easily grown from seed. As an ornamental, valued for its lacy foliage and sweet white flower clusters, it gained popularity in the 1830s as a replacement for the lombardy poplar which was beginning to suffer from insect damage in many places. The black locust had long been popular on Long Island, and was widely publicized

by the English agricultural writer William Cobbett when he lived on the island for several years beginning in 1817.[40] It took Prince Nurseries, though, to make it available in large quantities and to advertise all its virtues at a time when another tree was needed to replace the failing Lombardy poplar.[41]

The biggest fad of them all was that for the Chinese mulberry (Morus alba) which grew up in the 1830s. The mulberry was the host for the valued silk worm whose propagation was expected to bring immense riches. Prince's sold mulberries by the tens of thousands, and many other nurseries followed, from Massachusetts to Missouri and Georgia. The speculative bubble burst in the late '30s when it was found that the labor and skill for processing silk was totally unavailable, and in 1839 a strong freeze killed mulberry trees all across the northern states. By 1844 when a second freeze hit, few farmers bothered to replant. The bust left many speculators broke including Prince Nurseries which had to be mortgaged to stay in business.[42] The nursery lost its leading position after this, though it still operated until just after the Civil War. In 1868 the property was sold and the Prince Nurseries went out of business.

Other smaller but locally important ornamental nurseries of the early years of the Republic existed up and down the eastern seaboard. Philip Walten of Baltimore was a fruit plant grower in the 1780s and by 1790 was selling ornamentals also.[43] James Bloodgood started a nursery in Flushing, Long Island not far from Prince's in 1798 that lasted into the twentieth century.[44] The Winship Nursery in Brighton, Massachusetts was founded in 1816 and supplied ornamentals

to the estates of Boston's wealthy elite for many decades.[45] And Thomas Hogg & Sons of New York City, begun in 1822, was a major source of ornamentals in that area.[46]

The Downing family of Newburgh, New York maintained a small nursery from 1801. When Samuel Downing died in 1822 his son Charles took over and expanded the nursery, becoming a leading expert on pomology. His younger brother, Andrew Jackson Downing, joined him as a partner in 1834 as the nursery was growing more ornamental plants and became sole owner in 1839.[4] His influence on the nation's taste in ornamental plants through his writings in the 1840s and '50s was enormous and will be discussed in the next chapter.

Early Nurseries in the West

West of the old seaboard centers, nurseries were established only sparingly before 1830. Demand for orchard stock was greatest in western New York and in the Ohio valley, the oldest settled areas of the West. In the early years most nurseries were, as they had been two hundred years previously in the newly settled coastal frontier, those operated by farmers raising more than they needed and supplying their surplus to other farmers. Some went on to become professional nurserymen while others remained orchardists. But the presence of large commercial nurseries back east was felt even at an early date.

In 1794, Israel Putnam came from Connecticut to Belpre in southeastern Ohio with 1000 apple trees and varietal cuttings to graft onto them and was soon supplying farmers with stock all along the Ohio River.[48] By 1815 the Shakers at Union Village in southwest Ohio

had started a nursery selling apple, cherry, and pear trees, original stock of which came from nurseries in Pennsylvania and New Jersey.[49] The first nursesry west of the Mississippi was also established in 1815 when James Hart Stark moved to what is now Pike County, Missouri, from Kentucky with seeds and scions of fruit trees.[50] The Stark Nurseries have come down to the present still in family ownership, one of the largest in the nation.

In western New York the first large fruit nursery was begun in 1805 by David Thomas at Aurora. Continued by his son until 1895, this was an important supplier of fruit stock in the Finger Lakes area of the state.[51] In the Genesee Valley new orchardists also bought trees from agents representing the Prince Nurseries, active in the area in the 1820s.[52] The first local nurseries there were small and depended on stock from larger eastern firms until 1834 when Reynolds and Bateham founded their Rochester Seed Store and Horticultural Repository, and by 1840 Ellwanger and Barry had founded the Mount Hope Nurseries at Rochester which soon would become the most famous nursery in North America.[53]

The fifty years after the Revolution saw a great change in the nursery trade. Ornamental plants became articles of fashion, new wealthy classes created a demand for them, and the first large commercial nurseries were established to meet that growing demand. Nurseries still were producing far more orchard plants than ornamentals, and would continue to do so for the rest of the century, but ornamentals had become profitable items in the nursery trade.

Throughout this period European imports were important, both for

exotic ornamentals and for seedling rootstock and scions for varieties. For many years American nurserymen depended on Europeans for propagation of fruit and nut plants. As trans-Atlantic shipping improved, especially after the end of the Napoleanic wars, it became easier to ship plants safely from Europe. The nursery business in Europe was much more sophisticated and had capabilities to produce large quantities of varietal stock much more cheaply than most American nurseries.

In both urban and rural areas the demand for shade trees and flowering plants of all kinds had increased. In many towns and villages in the north, local "improvement societies" of civic-minded individuals were urging their neighbors, and in some places requiring them, to plant trees, paint their fences, and curb their livestock.[54] In most cases this resulted in a greater use of native species of shade trees, such as American elm, buttonwood, and black locust.

It was in the larger towns and cities that exotic species were most popular, often as fad plants available only from nearby commercial nurseries. The use of exotic species had begun to spark some debate from those who felt that native species should be used instead.[55] The debate reached a high level in the 1840s and '50s when A. J. Downing began publishing his books on gardening and architectural esthetics and when agricultural journalism grew to be an important factor in the dissemination of ideas about horticulture.

Chapter Five - Notes

[1]As reported in U. P. Hedrick, A History of Horticulture in America to 1860 (New York: Oxford University Press, 1950), 5.

[2]Ibid., 19.

[3]Ibid., 25.

[4]Ibid., 31.

[5]Ibid., 221.

[6]Daryl Gene Watson, Shade and Ornamental Trees in the Nineteenth Century Northeastern United States (Ann Arbor, Michigan: University Microfilms International, 1978), 41.

[7]Ibid., 25.

[8]P. J. Jarvis, "North American Plants and Horticultural Innovation in England, 1550-1700," The Geographical Review 63 (1973).

[9]Hedrick, History of Horticulture in America, 85.

[10]See Edmund Berkeley and Dorothy Smith Berkeley, The Life and Travels of John Bartram from Lake Ontario to the River St. John (Tallahassee, University Presses of Florida, 1982).

[11]Hedrick, History of Horticulture in America, 85.

[12]Historical Society of Pennsylvania, From Seed to Flower: Philadelphia, 1681-1876, A Horticultural Point of View (Philadelphia: Historical Society of Pennsylvania, 1976), 36.

[13]Watson, Shade and Ornamental Trees, 30.

[14]Hedrick, History of Horticulture in America, 47.

[15]Carl Bridenbaugh, Cities in the Wilderness; The First Century of Urban Life in America 1625-1742 (New York: Alfred A. Knopf, 1960), 169.

[16]Ibid., 170.

[17]Ibid.

[18]Watson, Shade and Ornamental Trees, 39.

[19]Ibid., 34.

[20]Ibid., 70.

[21]Hedrick, History of Horticulture in America, Plate iv, following p. 48.

[22]Watson, Shade and Ornamental Trees, 64.

[23]Hedrick, History of Horticulture in America, 71.

[24]Ibid., 141.

[25]Ibid., 141.

[26]Ibid., 203.

[27]Ibid., 204.

[28]Ibid., 199.

[29]John T. Faris, Old Gardens in and about Philadelphia and Those Who Made Them (Indianapolis: Bobbs Merrill, 1932), 130-149.

[30]Ibid., 221.

[31]Hedrick, History of Horticulture in America, 146. There is some doubt if Hamilton had lombardy poplars that year. Others claim Andre Michaux had them first in New Jersey in 1785. See Hedrick, p. 191.

[32]Faris, Old Gardens in and about Philadelphia, 150 ff.

[33]Ibid., 163.

[34]Hedrick, History of Horticulture in America, 147.

[35]Faris, Old Gardens in and about Philadelphia, 293, 297.

[36]Watson, Shade and Ornamental Trees, 65; and Hedrick, History of Horticulture in America, 193.

[37]Watson, Shade and Ornamental Trees, 64 and note 50, p. 83.

[38]Hedrick, History of Horticulture in America, 209-210.

[39]Watson, Shade and Ornamental Trees, has an extensive treatment of the fads for various trees. For his discussion of the weeping willow see pp. 115-118.

[40]Ibid., 132-133.

[41]Ibid., 131-136.

[42]Ibid., p. 94.

[43]Hedrick, History of Horticulture in America, 159.

[44]Frederick McGourty, Jr. "Long Island's Famous Nurseries," Plants and Gardens 23 (1967), 58-61, 82.

[45]Watson, Shade and Ornamental Trees, 97-98.

[46]Hedrick, History of Horticulture in America, 213-214.

[47]Ibid., 246.

[48]Robert Leslie Jones, History of Agriculture in Ohio to 1880, (Kent, Ohio: The Kent State University Press, 1983), 217.

[49]Ibid.

[50]Hedrick, History of Horticulture in America, 327.

[51]Ibid., 212.

[52]Watson, Shade and Ornamental Trees, 202.

[53]Blake McKelvey, "The Flower City: Center of Nurseries and Fruit Orchards," The Rochester Historical Society Publications 18 (1940), 128.

[54]Watson, Shade and Ornamental Trees, 143 ff.

[55]Ibid., 153 ff.

CHAPTER SIX

GROWTH AT MID-CENTURY, 1830 to 1870

The middle decades of the nineteenth century were years of rapid expansion for the nursery business. Fashion came to dominate the use of ornamental plants even more than before, and new arbiters of taste came to influence greatly the demands of a larger gardening public. Many new plants were introduced to use, both native and exotic, and evergreens became at least as popular, if not more so, than deciduous species.

The center of production shifted and western New York became the leading nursery area in the nation. Large commercial fruit nurseries were also set up in the Midwest and Pacific states and to a lesser extent in the South. Ornamental plants were also grown in the Midwest in large numbers by the end of this period, and the differences in regional uses of plants began to shape regional differences in nursery production.

In the older northeastern states the nursery business diversified, and the first nurseries devoted exclusively to ornamentals were started. European imports remained important for many types of plants, but a growing interest in this country led to increased experimentation in selection and breeding of ornamental plants. Agricultural journalism provided an important forum for new ideas, fashions, and the spread of new varieties. In many parts of the country farmers and gardeners formed horticultural societies which also helped in the spread of ideas and horticultural methods, and the federal government and many states

established bureaus or departments of agriculture which furthered the development of horticulture.

New Concepts of Taste

During the middle of the nineteenth century the ornamental nursery business really came of age. Before the 1830s, orchard stock had been the major focus of all nurseries and ornamentals were carried, however profitably, as a supplement to sales of fruit and nut plants. The fads for Lombardy poplars, weeping willows, and mulberries had benefitted many nurseries, but by the volatility of their popularity had demonstrated ornamentals to be high risk items. What was needed to sustain ornamental nursery production on a more consistent basis was a much larger consuming public and a greater demand for a larger number of species of plants to cushion the booms and busts of single species fads. What was needed was a public sense of taste, an educated market with a widespread desire to use a variety of ornamental plants.

Americans who travelled to England and the Continent were impressed by the new styles of gardening they saw, particularly the work of the later designers of the English School, such as Humphrey Repton and John Loudon.[1] Private estates in this country had their gardeners, often European, and these from time to time designed gardens for others. Most landowners, though, still lacked the services of professional designers or a literature guiding them in doing it themselves based on American conditions. J. C. Loudon had written prolifically in England on gardening and was widely read in this country, but he was dealing with a clientele, a climate, and a culture very different from that in

America.[2]

In 1824 a wealthy Belgian nurseryman and landscape designer, Andre Parmentier, came to America, settled in Brooklyn, New York, and opened a botanic garden, a nursery for both fruit and ornamental plants, and a landscape design practice. Parmentier imported plants fashionable in Europe at the time, including many of the recently introduced cut- and colored-leaf varieties such as the purple-leaf beech (Fagus sylvatica 'atropurpurea'), among some 400 other species and varieties of trees and shrubs and some 200 varieties of roses.[3] He used them in his designs for wealthy clients' estates in the "natural" English style then popular in Europe. Most of the plants were exotic to America, and his clients were dependent on nurseries, often his own, for their supply.[4]

Parmentier died in 1830, unfortunately, and no designers with a large practice followed him for several years. These were the years of several of the fads discussed earlier, and it was during this time that the need for a more comprehensive taste in landscape appreciation and gardening esthetics became apparent. Perceiving the need most strongly was the Newburgh, New York nurseryman Andrew Jackson Downing. In 1841, at the age of 26, he published his first book, A Treatise on the Theory and Practice of Landscape Gardening. It was instantly popular with a wide audience among the educated elites of the nation.[5]

Downing's book set forth a system of taste based on esthetic principles then recognized in England, basically similar to those of Repton and Loudon. He described the use of many species of plants and gave rather detailed suggestions on architectural as well as garden design, in which "a country gentleman of leisure finds a resource of the

most agreeable nature."[6] He sought, as stated in his preface, "by rendering familiar to the reader most of the beautiful sylvan materials of the art, and by describing their peculiar effects in Landscape Gardening, to encourage a taste among general readers."[7]

The esthetic taught by Downing was based on the two principles of the Beautiful and the Picturesque, which he illustrated as follows:[8]

> The Beautiful in Landscape Gardening is produced by outlines whose curves are flowing and gradual, surfaces of softness, and growth of richness and luxuriance . . . The Picturesque in Landscape Gardening aims at the production of outlines of a certain spirited irregularity, surfaces comparatively abrupt and broken, and growth of a somewhat wild and bold character. (Figures 6-1 and 6-2).

The use of different species of plants was to be determined by their character, both singly and in groups, and how they contributed to either a beautiful or a picturesque composition. The overriding goal was to create "an expressive, harmonious, and refined imitation" of nature.[9] Elms and maples were of all trees the most Beautiful, while the Picturesque was best expressed by larches, firs, and oaks.[10] In his chapters on deciduous and evergreen trees he characterized each species and recommended for or against its use in various situations. While not rejecting exotic species, he encouraged the use of neglected native plants, especially the conifers. Indeed, Downing

> regretted that the fine evergreen trees both of this country and Europe, which compose the Pine and Fir tribes, have not hitherto received more of the attention of planters. It is inexpressable how much they add to the beauty of a country residence in winter.[11]

Downing's influence was tremendous. Almost overnight he gave the gardening public a set of principles, however simplistic, and specific

Figure 6-1. Downing's Example of the Beautiful in Landscape Gardening

Figure 6-2. Downing's Example of the Picturesque in Landscape Gardening

instructions in the design of properties and the use of plants. He went on to publish in 1842 Cottage Residences, on architectural design of the small country place, a topic neglected in his Treatise which dealt mainly with properties of from five to several hundred acres in extent. Downing became the leading arbiter of taste in the nation, and his advice was sought by gardeners, architects, and even the federal government which commissioned him in 1851 to design the gardens surrounding the Capitol, the White House, and the Smithsonian Institution.

Unfortunately he died in 1852, at the age of 37, when the steamboat he was taking to New York City burned and sank in the Hudson River. His influence survived him, however. His Treatise went through several printings and editions into the 1870s, and in 1850 he had published his major architectural work, The Architecture of Country Houses, which was a tastemaker for several decades. Though he was active for only a decade, Downing's ideas inspired a generation of American gardeners and architects. As Russell Lynes states in The Tastemakers,[12]

> There is scarcely a monument left, scarcely a garden or a house or a terraced hillside, to which we can now point and say Downing did that. But there is scarcely a building still standing from the 1840's and 50's or a city park in which Downing's ideas, sometimes distorted almost beyond recognition, cannot be detected.

His influence on the nursery business came through the taste he made fashionable. Although a nurseryman himself, and the leading one in the Hudson Valley, Downing did more for other nurseries by helping to enlarge the demand for ornamentals, particularly for evergreens which had been little used throughout the 1830s. He encouraged the use of native shade trees in his Treatise in 1841, and by 1851 he went further, condemning

the use of exotics in general.[13] He was influential in creating a demand for the silver maple (Acer sacharinum), for example, as a replacement for the exotic tree of heaven and white poplar (Populus alba) which had gone through rapid fads of popularity in the 1830s and '40s.[14]

Downing also had a large impact on the nursery business by helping to stimulate the use of ornamentals of all types. Before him landscape gardening had been the domain of the wealthiest estate owners. City dwellers had been content with a few shrubs and a tree or two, if they had any space for woody plants at all. After Downing's work appeared, a great many of them sought places in the country in order to enjoy the "smiling lawns and tasteful cottages" he showed them. The development of rail and steamboat lines had made commuting easier, and the wealth derived from the burgeoning industry and trade of northern cities had created a class of people with the means and the desire to take up residence in the country.

John O. Simonds, the modern landscape architect, put it well in his "Appreciation" in the facsimile edition of the Treatise in 1967:[15]

> Downing was suited to his time, for the 1840s and '50s were years in which the public mind was disturbed by the growing industrialization of New England, with its attending smoke, fumes, noise, and pollution, and entranced with the notion of man's return to nature. Thoreau, who built his cabin at Walden Pond in 1845, was to accelerate the movement, but it was Downing who showed the way.

Besides the influence of Parmentier and Downing the wider use of ornamentals was stimulated by a new role for plants in the city, in large city parks. While certain cities and towns had attempted to plant street trees and preserve small open spaces before, it was not until the middle decades that municipal parks were developed on a large scale. Downing

had urged the creation of such a park in New York, but his early death prevented him from being actively involved in its development. A young English architect, Calvert Vaux, whom Downing had met on his European travels and had emigrated to America at his urging to collaborate with him in his design practice did, however, play a major role in the design of New York's first large park. Vaux, in partnership with Frederick Law Olmsted, a writer and gentleman farmer-turned-designer, won the competition to design the new Central Park in 1858.

840 acres in the center of Manhattan were set aside for a public recreation ground. What had been a rocky and marshy tract of vacant land, with the exception of several hundred squatters, was converted by Olmsted, and Vaux into a park of broad meadows, copses of trees, lakes, fountains and promenades. By 1865 when most of the park had been planted initially over 270,000 trees, shrubs, vines, and herbaceous plants had been put in the ground. Some one quarter of these had been raised in a nursery in the park run by the city, but the other 200,000 were purchased from a variety of local nurseries, fourteen different ones in 1864 alone.[16]

The emphasis was on native trees and shrubs, but many exotics were also planted. Central Park was very influential in the design of other large city parks in the last quarter of the century and in sparking municipal interest in civic improvements on a large scale.[17] Through these the civic market for nursery products became an important one in succeeding years.

New Plants, 1830 to 1870

The use of evergreens, especially conifers, had been limited before

the 1830s. The most popular were shrubs, such as English yew, boxwood, and holly. The limited use of conifers was due in large part to their difficulty of handling. Unlike deciduous plants which can be transplanted bare root and can be easily pruned to reduce transplant shock, conifers need a root ball with soil in moving and do not take well to pruning in most cases. The lack of available plants in most nurseries in turn discouraged their use by gardeners, and the lack of familiarity with them limited the demand. By the 1830s, though, the European gardening styles becoming popular in this country were beginning to create a demand for them at the same time that American nurserymen were becoming more skillful in handling a broader range of plants. Both the demand and the supply grew slowly in the 1830s and then increased markedly in the 1840s.

Already by 1828 the Norway spruce (Picea abies) was a popular tree, and William Prince listed in that year eight other conifers in regular demand from his nursery, including both native and European species.[18] Along with Norway spruce the only two other conifers in widespread use in most parts of the nation before 1840, though, were the Scotch pine (Pinus sylvestris) and the Austrian pine (Pinus nigra).[19]

Part of the European style in using conifers was the collecting together of many varieties and species then recently introduced from Asia, the Pacific coast of North America, and the southern hemisphere. Fads for collecting new plants quite apart from their use in landscape compositions became an important element in the growing popularity of conifers.[20] By 1859 when Henry Winthrop Sargent enlarged and edited the sixth edition of Downing's Treatise, he noted the increase in

the number of conifers in use over the past 18 years.[21]

> Mr. Downing mentions seven abies, and we now have in cultivation, more or less general, twenty-three more. We have growing in the different collections in this country, principally between Washington and Boston, twenty more pines, in addition to the fifteen he enumerates, twenty-five junipers, against one in the first edition; ten new (Thujae) arbor vitae, and seven yews.

It was at this time that gardeners confronted seriously the question of the hardiness of exotic plants. Having no system to measure the critical factors responsible for freeze damage, they relied on rather simplistic descriptions of the climatic conditions of a plant's native habitat, comparisons with the success or failure of other plants deemed similar to the new one, and more often then not on simple trial and error. Thus it was that the deodar cedar (Cedrus deodara), an untested novelty from the Himalayas in 1841, showed great promise until the winters of 1855-56 and 1856-57 killed most of them to the ground north of Washington, D.C.[22]

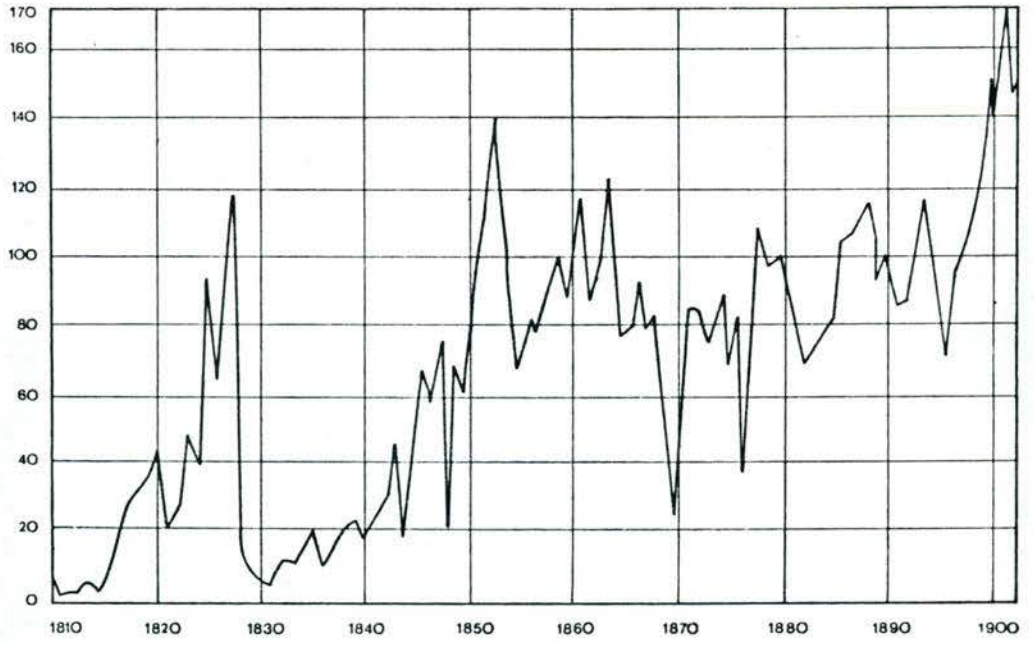
Site conditions such as soil texture and moisture, exposure to wind and sun became critical factors for plants at the margins of their hardiness. Throughout this period, though, there were many gardeners willing to gamble on the new species and others who demanded what was popular in Europe even if their climate was not as hospitable. Arboreta and private estates were important as test sites for the hardiness and requirements of new introductions. Two prominent ones whose successes and failures were reported in horticultural journals were those of H. H. Hunnewell at Wellesley, Massachusetts, and H. W. Sargent at Fishkill, New York.[23]

Among the new introductions to Europe at the end of the eighteenth century had been some new roses from China. These, when crossed with the

existing European garden roses, began to yield a rich array of new hybrids by the 1820s. By the middle of the century the new Tea roses came on the market and became garden favorites in America as well, Figure 6-3. Some nurseries carried extensive lines of both old and new varieties. Downing's Highlands Nursery at Newburgh had 160 varieties for sale, and the Crapo Nurseries in New Bedford, Massachusetts, chose to specialize in rose production, perhaps the first in the nation to do so.[24]

In addition many Asian flowering plants were making their way via Europe to American nurseries and became standards in American gardens by the end of the century. The first of the Asiatic magnolias and European hybrids of them such as the saucer magnolia (Magnolia x soulangeana), along with Japanese crab apple (Malus floribunda), empress tree (Paulownia tomentosa), and several species and varieties of spiraea, weigela, hydrangea, rhododendron and azalea were introduced between 1830 and 1870.[25]

One of the most popular of the Asian plants was the camellia (Camellia japonica and C. sasanqua). Though not reliably hardy outdoors in the East north of Delaware, they were grown there in greenhouses and outdoors in the South, valued for their evergreen foliage and winter flowers. Prince Nurseries offered in their 1822 catalogue seventeen varieties of C. japonica, all apparently British imports. In 1832 Michael Floy & Sons of Harlem, New York offered forty-one varieties including three of their own seedlings. By 1852 Hovey & Co. of Cambridge, Massachusetts, had one hundred and two varieties.[26] Hedrick attributes the camellia's rapid rise to its use as a cut flower, inspired by the popularity of Alexandre Dumas' La Dame aux Camelias in 1848 and its operatic adaptation, La Traviata, by Verdi in 1853.[27]



Source: Krussman, The Complete Book of Roses, 166, Figure 69

Figure 6-3. Number of New Rose Varieties Registered in France, 1810 to 1902

New Nurseries in the East

The increased demand for ornamentals and the need for extra care in handling some of them led some nurseries to specialize in ornamentals rather than fruit plants. Although the arrival of the railroad had spurred new fruit and market gardening in many areas of the Northeast and this in turn had led to increased nursery production of fruit and nut plants,[28] some nurserymen chose to abandon this market for the also expanding one in ornamental plants.

The first of the new purely ornamental nurseries were apparently on Long Island, Figure 6-4. Samuel Parsons' nursery in Flushing, just a stone's strow from Prince's, was established in 1838. Specializing at first in native trees and shrubs, Parsons soon added roses, becoming one of the leading rose nurseries, and later became one of the first to import Japanese plants.[29] In 1854 Isaac Hicks founded his nursery near Westbury, Long Island, and soon came to specialize in evergreens, particularly coniferous trees.[30] Hicks Nurseries have continued into the twentieth century, although now as a retail rather than a wholesale nursery.

Other nurseries in the East which still carried fruit and nut plants increased their ornamental offerings in this period. Bloodgood's on Long Island was one of these, as was Hogg's in New York City. In 1862 Thomas Hogg was sent by President Lincoln to Japan, where he lived for eight years collecting seeds and plants that he shipped to his brother James at the family nursery. Through the Hogg's Nursery many Asiatic plants were introduced directly to the U. S. rather than via European nurseries.[31] In the Philadelphia area, Figure 6-5, the Moon

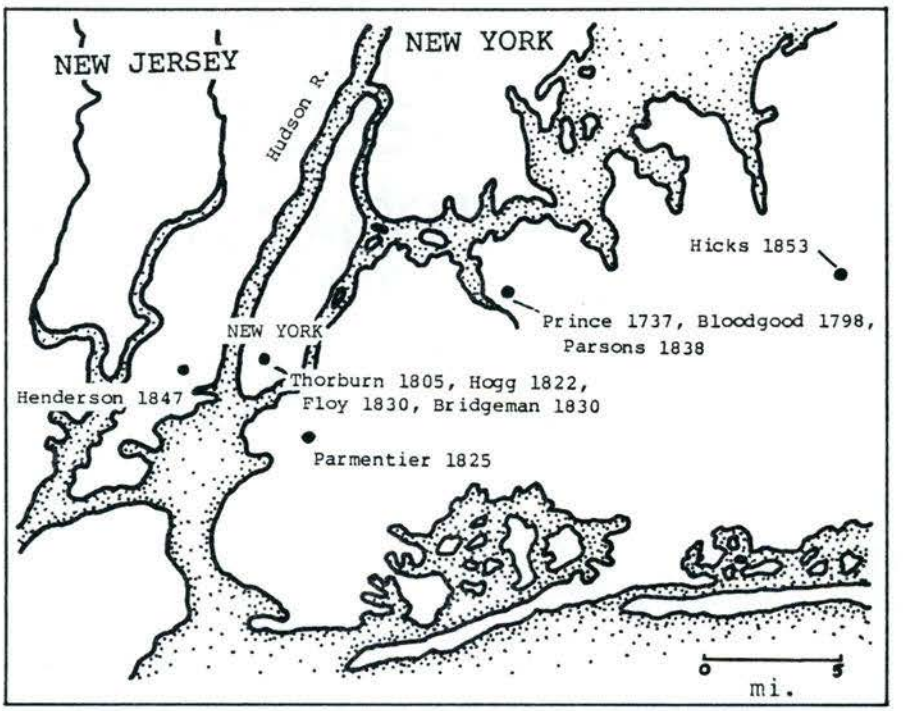


Figure 6-4. Early Nurseries in the New York Area

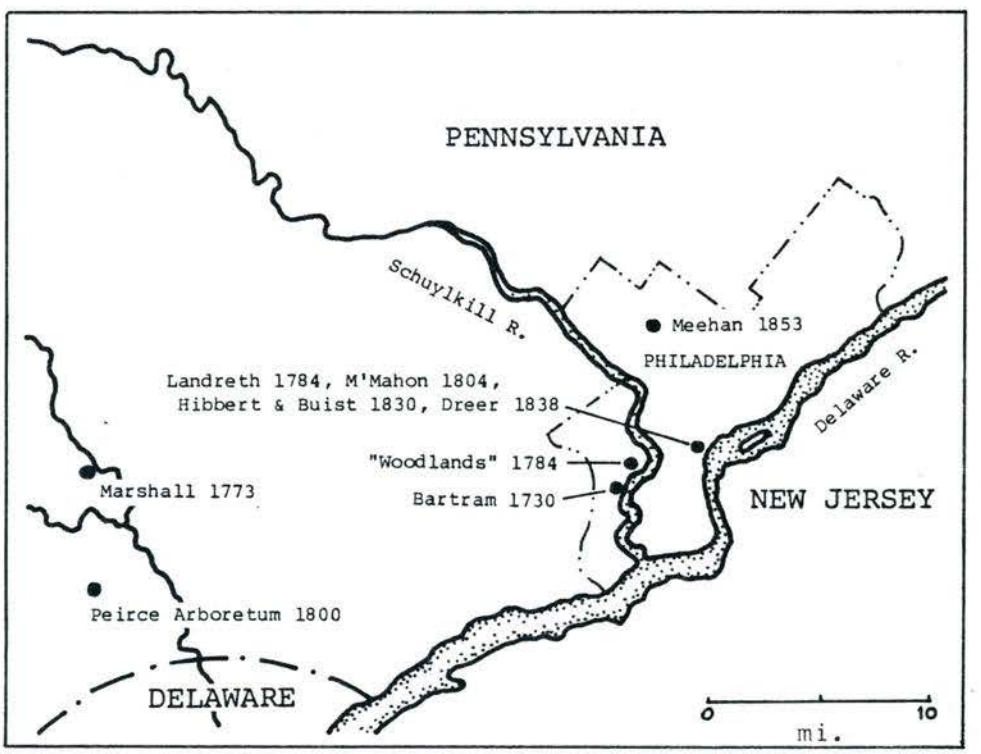


Figure 6-5. Early Nurseries in the Philadelphia Area

Nurseries in Morrisville, and Landreth's in Philadelphia also increased their lines of ornamentals. One of the largest nurseries in the second half of the century was founded near Philadelphia in 1853 by Thomas Meehan who had come from England, originally working as a gardener, at Bartram's and elsewhere. Meehan's Germantown Nurseries came to be one of the most noted in the country, and for thirty years, from 1859 to 1889, he was also the editor of The Gardener's Monthly, a leading horticultural journal.[32]

Other important eastern nursrymen of this period were C. M. Hovey of Boston, also publisher of The Magazine of Horticulture from 1835 to 1868, Robert Buist a Philadelphia florist and seedsman, and Robert Halliday of Baltimore.[33]

Nurseries in the West and South

The rapid growth of the western states in this period led to the development of nurseries there for fruit, nut, and ornamental plants. The first ones were mainly for orchard stock in the Ohio valley and western New York, but by 1840 new nurseries were producing along the shores of the Great Lakes. As well as orchard stock they often sold ornamentals.

The growth of towns was rapid on the western frontier, and their citizens, though physically removed from Europe and the east coast, were not insensible to the demands of good taste.[34] 1000 copies of Downing's Treatise were purchased by the state of Ohio in 1859 for its school libraries.[35] Agricultural journals published in the East also circulated in the West, including Downing's own The Horticulturist, and in Cincinnati was published the Western Horticultural Review edited by John A. Warder.

Transportation access was the key to success for most early western nurseries. The Ohio River gave Cincinnati nurseries an early boost supplying the rest of the Ohio valley. After 1825 the Erie Canal allowed for continuous passage from the Atlantic into the Great Lakes, from New York to Buffalo, and allowed New York nurseries to market in the Lakes states. The introduction of steam navigation reduced travel times and made schedules more reliable, a very important factor in shipping live nursery stock. The reduction was especially noticed on the Atlantic crossing, and it allowed for even more European plants to be imported directly. Downing's nursery in Newburgh on the Hudson, for instance, received stock directly from Europe via steamer and shipped its sales west via the Erie Canal to the western states.[36] Even more important by the 1850s was the railroad, which could move plants inland as well as along the waterways, though at considerably higher cost through most of this period.

The Erie Canal came to be the most important artery for the movement of plants during these middle decades. Connecting the markets of the Midwest with the suppliers on the East Coast, it reversed the direction of the bulk trade in other agricultural commodities. By opening the expanding markets of the West it contributed to the growth of the Long Island nurseries, but it also allowed for the growth of newer nurseries in upstate New York. Downing's Highlands Nursery supplied plants to 23 states by 1840.[37]

It was in western New York, though, that the greatest number of new nurseries were established during this period. The center of production was in Rochester which had 18 nurseries in 1858. The rest of Monroe County had another 12, for a total of 30 nurseries, out of 104 in all of

New York state that year.[38] With a relatively mild winter climate tempered by Lake Ontario (in U.S.D.A. Hardiness Zone 6, comparable to northern New Jersey, Figure 4-1)[39] and with access via the Erie Canal in both directions, Rochester held a unique position between East and West. Originally supplying the local market for orchard stock, the nurseries in and around Rochester by 1860 had over 2000 acres in cultivation and are reputed to have supplied over half of the nursery sales of the entire nation in that year.[40]

The single most important one was the Mount Hope Nurseries of Ellwanger and Barry. George Ellwanger came from Germany in 1836 and took a job as foreman in the new nursery of Reynolds and Bateham. In 1839 he set up his own firm, and in 1840 was joined by Patrick Barry, an Irish gardener who had worked for four years at the Prince Nurseries. They sold mainly fruit stock in the early years but added ornamentals quickly and by 1845 were reported to be the largest supplier of ornamentals in western New York.[41] The greatest part of their business was in fruit trees, however, and Patrick Barry was a nationally recognied expert on their care. In 1863 he published The Fruit Garden, perhaps the most comprehensive manual then written, including in it a 50-page chapter on the operations of a nursery covering everything from soils and grafting methods to the design of labels.[42]

In 1855 the Mt. Hope Nurseries had 52 acres of ornamental plants,[43] and by 1859 they had increased this to 90 acres, with over 24 acres in evergreens, plus 400 acres of fruit and nut stock.[44] Ellwanger and Barry grew rapidly to become the largest nursery in the nation. Hedrick reports they sold more than twice as many trees and shrubs as the next

two largest nurseries combined during the 1850s and '60s.[45] They were especially important as suppliers to other nurseries in the West, and nurseries throughout the Midwest and as far away as California and Oregon got their start with plants from Ellwanger and Barry. Many of their employees went on to start their own nurseries and they were thus important as trainers of a large part of the next generation of nurserymen.

Mt. Hope Nurseries sold plants to the eastern states and Canada as well, primarily fruit trees. In 1855 over half their sales of ornamental trees were to the West. Some 30% of the total went to Illinois, and over half of that was of one species, the Norway spruce. Evergreens dominated sales of ornamentals to the West while deciduous trees made up the majority of eastern sales.[46]

In the Midwest the first ornamental nurseries were usually dependent on eastern nurseries for their stock though they did much of their own propagation in later years. Among the earliest were those at Cincinnati. At first private estates were important sources of introductions to the area, but by 1844 there were three nurseries which sold ornamentals as well as orchard plants. One was owned by A. H. Ernst, who was also a garden designer and laid out Spring Grove Cemetery, modelled on the style of Mt. Auburn in Cambridge, Massachusetts.[47]

Ernst was influential in introducing evergreens to the Ohio valley at a time when they were first becoming popular in the East as well. Also involved in the planning of Spring Grove Cemetery was John Ashton Warder, medical doctor and horticultural journalist. Warder, through his Western Horticultural Review did a great deal to help spread the new

garden tastes and to help midwesterners learn the hardiness in their climate of the many newly introduced species. In a June, 1853 editorial piece he urged the planting of several new "vernal flowering shrubs" including Forsythia viridissima, Wiegela rosea, Spiraea prunifoilia, Magnolia x soulangeana, and Wisteria sinensis, and chided western gardeners for their conservatism in plant choices.[48] Warder was also enthusiastic about the "hardy" catalpa (Catalpa speciosa) which had recently been recognized to be a separate species from the southern catalpa (C. bignonioides) and was hardy much farther north. It became an important midwestern shade tree by the time of the Civil War.[49]

Nurseries in the Midwest were confronted with very different climatic conditions than those in the East or the South. They were forced to experiment to find species that did well there, especially on the prairies where summer drought and winter freezes were much worse than elsewhere. The black locust was brought west in the 1830s and '40s and did well until the '50s when the locust borer wreaked havoc on mature trees. Within ten years most of them in Illinois were removed and replaced by silver maples and American elms which had proven themselves during the preceding decades in several areas.[50]

Silver maple was apparently a favorite of nurserymen who began propagating them in large numbers. M. L. Dunlap in central Illinois was growing over ten thousand of them in 1859. Other species were also encouraged by nurserymen: Osage orange, northern catalpa, white poplar which had a minor fad in the early '60s, and finally the Lombardy poplar which was reintroduced in the late '60s and remained popular as a shelterbelt tree despite its insect problems.[51]

Evergreens were especially popular by the 1850s for shelterbelt plantings and as ornamental specimens of "taste and refinement." In 1859, Illinois nurseries carried four times as many evergreen trees (665,000) as deciduous ones. Arborvitae (Thuja occidentalis), Austrian pine, balsam fir, Norway spruce, red cedar (Juniperus virginiana), Scotch pine, white pine (Pinus strobus), and white spruce (Picea glauca) were the species in greatest demand.[52]

Several areas in the Midwest became early nuresry centers and later became important centers of ornamental nurseries. The Miami valley of Ohio, north of Cincinnati, developed in this period. John Haines was an early propagator of the northern catalpa. His two original trees near Dayton provided the source of much of the nursery stock used throughout the Midwest.[53] Near Cleveland Dr. Jared P. Kirkland grew fruit plants and ornamentals in the 1840s and became the first nurseryman to graft and bud magnolias.[54] In Mentor, east of Cleveland, Jesse Storrs and J. J. Harrison started separate nureries in the 1850s but formed a partnership in 1860 which went on to become one of the largest in the nation.[55]

Monroe, Michigan was the western terminus of Lake Erie steamers and became an important nursery center in the 1840s. Nathaniel Hoag began a fruit nursery just west, in Lenawee County, in 1833 with plants from the Prince Nurseries.[56] In 1840, "Variety" White started a nursery in Monroe with a large selection of fruit varieties from the East,[57] and in 1843 I. E. Ilgenfritz came from Pennsylvania and established a family nursery which survives to this day.[58]

Ornamentals were carried by many nurseries in northern Illinois in

this time. John A. Kennicott founded his Grove Nursery northwest of Chicago in 1836. He was editor of The Prairie Farmer for a number of years and sold plants throughout Illinois and as far west as Kansas and Nebraska. Kenicott obtained ornamentals propagated by other nurseries to the east, from Indiana to New York and even occasionally from Europe, and he had a standing account with Ellwanger and Barry.[59] Located off the water transport routes, Kennicott relied largely on railway shipping for his plants.

In Waukegan, on the shores of Lake Michigan north of Chicago, Robert Douglas from Scotland established a nursery in 1848. Douglas became the leading forestry nursery in the country after the Civil War and was a leading authority on conifers of all types, including ornamentals, as well as an innovator in growing seedling rootstocks for fruit trees.[60]

Iowa had several early nurseries, James Smith in Des Moines by 1847 and Suel Foster in Muscadine by 1855. Smith eventually had nurseries in seven different counties in Iowa, though not all at the same time, and in 1879 at the age of 79 he moved to South Dakota to founded yet one more nursery.[61]

The most peripatetic traveller among American nurserymen, however, outdistancing Johnny Appleseed by far, was Henderson Lewelling (1809-1878). Born in Salem, North Carolina, he moved in 1825 with his family to Indiana where his father Meshack founded the town of Salem and a nursery of fruit trees which supplied several counties.[62] In 1836 Henderson and his brothers John and Seth moved to Iowa, started a nursery there and in 1838 founded the town of Salem.[63] In 1847

Henderson set out again, overland to Oregon with a wagon packed with some 700 grafted fruit plants. He managed to keep them alive across the plains in the summer, and when he arrived in the Willamette valley in the fall of 1847 he was the first nurseryman in the area with varietal fruit stock. In 1848 he teamed up with Joe Meek who had brought bushels of fruit seed along in his wagon, and they began a nursery with Meek's seedlings as rootstock and Lewelling's varietals as scions. Their nursery was immediately successful in the rapidly developing valley farmlands. In 1850 Henderson travelled back across the prairies to New York, bought more stock from both Ellwanger and Barry and from Downing and sailed back with it via the Isthmus of Panama.[64]

Henderson's brother Seth joined him in Oregon, but in 1851 he moved to California with a load of grafted stock and started one of the first nurseries there. Joe Meek followed him, and in 1854 Henderson too moved to California, founding yet another nursery, in Alameda County. A few years later, though, he moved on again, this time to Honduras, then the scene of much yanqui filibustering and agricultural speculation. There his string of successes ended, and he lost all his money. Returning to California he lived out his years as a small farmer until his death in 1878.[65]

California was the scene of great nursery activity in the 1850s. Supplying the gold miners of the Sierra and the rapidly developing city of San Francisco had been Oregon's major market in the first years of the decade. The opportunities for local production were soon realized, however. In addition to the Lewellings and Meek other early nurserymen also grew fruit and nut stock. General John Bidwell of Chico had the

largest fruit nursery in the state by 1860 and also raised ornamentals.[66] B. S. Fox who came from Ireland via New York and Massachusetts nurseries started a nursery in San Jose in 1853 which rivalled Bidwell by 1860, with over a million fruit trees plus large numbers of ornamentals.[67]

Very early in the development of the nursery business in California ornamentals became an important component. Most were imported from Europe or the eastern states, but also from Australia and, relatively early, from Japan. The Golden Gate Nursery in San Francisco was selling camellias, fuschias, acacias, roses, poinsettias, callistemons, pittosporums, escallonias, and melaleucas in 1858.[68] In the Los Angeles area, still a sleepy hamlet through most of this period, William Osborne imported ornamentals from nurseries on the east coast, including lilacs, viburnums, and Philadelphus species. By 1858 he also had over 20,000 rose plants in his nursery.[69]

The biggest growth in California nurseries, however, was in fruit and nut stock. Vast acreages were planted with orchards in northern California, and many nurseries supplied them. By the middle of the decade planting slowed down and this led to a glut of nursery stock on the market. Prices for fruit trees reportedly dropped to six cents a tree by 1856, and by 1858 some nurseries were selling them for a penny a tree.[70] Few new nurseries were started in the '60s. One important exception was that of John Rock, a German who came to San Jose in 1865 and established what later would become the California Nursery Company, one of the largest in the nation.[71]

In the southern states horticulture lagged behind developments in

the rest of the country. Field crops provided most of the agricultural wealth, and ornamentals were still traded between estates and their gardeners. Two large nurseries did grow up in the South before the Civil War, though. The Richmond Nuseries in Virginia raised fruit trees to supply that state's orchards and sold as far away as Tennessee and Kentucky.[72] Near Augusta, Georgia, Prosper Julius Alphonse Berckmans founded a large nursery in 1856 for fruit trees and ornamentals, including many varieties of camellias and azaleas. Berckmans became a leading fruit breeder, developing new varieties of apple, pear, and grape for the South. He also imported many ornamentals from Europe and Japan. After the war Berckmans' became the leading nursery in the South with a national trade in many types of ornamentals including greenhouse plants.[73]

By the end of the 1860s the ornamental nursery business in the U.S. was well established in several different areas. Railroads, canals, and steamships allowed for rapid movement of plants and led to the beginnings of a nationwide market. The largest firms, such as Ellwanger and Barry's Mt. Hope Nurseries, sold plants from New England to California. In different regions, though, special lines of plants were developing that later would become important to the business. California's first imports from Australia, the southern states' first subtropicals from east Asia, and the worldwide group of conifers used in the Midwest marked the beginnings of distinctly regional patterns in ornamental plant production. The great influx of Asian species, often via Europe, had begun and was on its way to completely changing the look of American gardens.

As new concepts of taste came to dominate the use of ornamentals, instructed by Downing and the horticultural journalists, the demand for ornamental species grew rapidly. By 1870 nurseries were in very active competition with each other to introduce new species from Asia and new hybrids and varieties from Europe. By that time there were already regional gluts in the market for orchard stock, and price wars which drove some nurserymen out of business. The competitive advantages of increased production efficiency, quality control, transportation access, and name recognition became important. The old era of botanic gardens and estate garadeners had come to a close and nurseries had firmly entered the age of mass production and national merchandising.

Chapter Six - Notes

[1]Derek Clifford, A History of Garden Design (London: Faber and Faber, 1962), covers the era well.

[2]J. C. Loudon, The Suburban Gardener and Villa Companion (London: Longman, Orme, Brown, Green, and Longmans, 1838) and The Landscape Gardening and Landscape Architecture of the Late Humphrey Repton, Esq. (London: Longman & Co., 1840). Loudon emphasized specimen planting, making full use of the many new species being introduced to England from the far corners of her Empire, and called his approach the "gardenesque" to distinguish it from Uvedale Price's "picturesque."

[3]Hedrick, History of Horticulutre in America, 228.

[4]Watson, Shade and Ornamental Trees gives a list of "forest trees offered for sale by Andre Parmentier, 1826," taken from an advertisement in the American Farmer IX (March 14, 1826), 416. All 12 species listed are exotics.

[5]Ibid., 105.

[6]Andrew Jackson Downing, A Treatise on the Theory and Practice of Landscape Gardening, sixth ed. revised and enlarged by Henry Winthrop Sargent (New York: A. O. Moore & Co., 1859), facsimile edition with a Special Appreciation by John O. Simonds, Jr., (New York: Funk & Wagnalls, 1967), ix.

[7]Ibid., x.

[8]Ibid., 8-9.

[9]Ibid., 51.

[10]Ibid., 80-82.

[11]Ibid., 260. Downing did note the use of conifers on some large estates in a 'special mixed grove' called a pinetum.

[12]Russell Lynes, The Tastemakers (New York: Grosset & Dunlap, 1954), 22.

[13]Watson, Shade and Ornmental Trees, 155.

[14]Ibid. Watson cites a piece Downing wrote in his Horticulturist I (November, 1851), 481-491.

[15]Downing, Treatise on Landscape Garadening, ivA.

[16]Board of Commissioners of the Central Park (New York) Annual Report, Nos. 2 through 9 (New York, 1859-1866).

[17]Albert Fein, Frederick Law Olmsted and the American Environmental Traditon (New York: George Braziller, 1972).

[18]Watson, Shade and Ornamental Trees, 157 reproduces the list from William Prince, A Short Treatise on Horticulture (New York: T. & J. Swords, 1828), p. 83.

[19]Downing, Treatise on Landscape Gardening, 473.

[20]Watson, Shade and Ornamental Trees, 156 ff.

[21]Downing, Treatise on Landscape Gardening, 474.

[22]Ibid., 492.

[23]Watson, Shade and Ornamental Trees, 159. Both Hunnewell's "Wellesley" and Sargent's "Wodenethe" are described in Sargent's Supplement in the 6th edition of Downing's Treatise, pp. 437-445.

[24]Hedrick, History of Horticulture in America, 246, 270.

[25]See for example the list "Introductory Dates of Familiar Trees, Shrubs, and Vines," Plants & Gardens 23 (1967). 87-89. The list is based on dates mentioned for each species or variety in 2 books by Donald Wyman; Trees for American Gardens, 2d. ed., rev. and enl. (New York: Macmillan, 1965) and Shrubs and Vines for American Gardens (New York: Macmillan, 1949).

[26]These early nurseries and others are discussed in H. Harold Hume, Camellias in America, Chapter 3, "Camellias Come to America" (Harrisburg, Pennsylvania; J. Horace McFarland Co., 1946), 23-52.

[27]Hedrick, History of Horticulture in America, 222.

[28]Ibid., 241.

[29]Ibid., 245.

[30]Ibid., 247.

[31]Ibid., 215.

[32]Ibid., 248.

[33]Hume, Camellias in America, 23-52.

[34]See for example the discussion of cultural amenities in Richard C. Wade, The Urban Frontier, Pioneer Life in Early Pittsburgh, Cincinnati, Lexington, Louisville, and St. Louis Chapter 8, "The Better Life" (Chicago: The University of Chicago Press, 1959), 231-269.

[35]Watson, Shade and Ornamental Trees, 106.

[36]Ibid., 201.

[37]Ibid.

[38]Hedrick, History of Horticulture in America, 245.

[38]U. S. Department of Agriculture, Agricultural Research Service, Miscellaneous Publication No. 814, Plant Hardiness Zone Map, rev. (Washington, D.C.: U. S. Government Printing Office, 1965).

[40]Watson, Shade and Ornamental Trees, 207. The best single history of the Rochester nurseries is McKelvey, "The Flower City."

[41]The history of the Mt. Hope Nurseries is well told in McKelvey "The Flower City."

[42]P. Barry, The Fruit Garden: A Treatise (Rochester, New York: P. Barry, 1863).

[43]Watson, Shade and Ornamental Trees, 205.

[44]McKelvey, "The Flower City," 145.

[45]Hedrick, History of Horticulture in America, 243.

[46]Watson, Shade and Ornamental Trees, 207.

[47]Ibid., 184.

[48]J. A. Warder, "Vernal Flowering Shrubs," Western Horticultural Review 3 (June, 1853), 426-428.

[49]Hedrick, History of Horticulture in America, 314 and Watson, Shade and Ornamental Trees, 220 ff.

[50]Watson, Shade and Ornamental Trees, 194.

[51]Ibid., 215 ff.

[52]Ibid., 214.

[53]Ibid., 221.

[54]Hedrick, History of Horticulture in America, 315.

[55]Marie Brandstaetter Shamarello "The Nursery Industry in Lake County," rev. Lake County Nurserymen's Association Executive Committee, 1978, on Lake County Nurseryman's Association Location Map (Mentor, Ohio, 1981). See also the short biography of J. J. Harrison in Richard P. White, A Century of Service, A History of the Nursery Industry Associations of the United States (Washington, D. C. : American Association of Nurserymen, 1975), 360-361. Harrison was the third president of the A.A.N. in 1878-1879.

[56]Hedrick, History of Horticulture in America, 320.

[57]Ibid.

[58]Ibid., and see also the short biography of Charles A. Ilgenfritz, son of I. E. Ilgenfritz, in White, A Century of Service, 380-381.

[59]Watson, Shade and Ornamental Trees, 209 ff.

[60]Ibid., 224, and Hedrick, History of Horticulture in America, 325.

[61]Hedrick, History of Horticulture in America, 331.

[62]Ibid., 315.

[63]Ibid., 330.

[64]The full story of Lewelling's Oregon adventures is told in W. P. Duruz, "Notes on the Early History of Horticulture in Oregon, with Special Reference to Fruit-Tree Nurseries," Agricultural History 15 (1941), 84-97.

[65]Hedrick, History of Horticulture in America, 377.

[66]Gordon J. VanLaan, A Penny a Tree, The History of the Nursery Industry in California from 1850-1976 (Sacramento, California: California Association of Nurserymen, 1982), 7.

[67]Ibid., 10.

[68]Ibid., 8-9.

[69]Ibid., 13.

[70]Ibid., 17.

[71]Ibid., 20.

[72]Hedrick, History of Horticulture in America, 283.

[73]White, A Century of Service, 379, and Hume, Camellias in America, 48-50.

THE GEOGRAPHY OF THE U.S. NURSERY INDUSTRY: LOCATIONAL CHANGE AND REGIONAL SPECIALIZATION IN THE PRODUCTION OF WOODY ORNAMENTAL PLANTS

VOLUME II

by

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CHAPTER SEVEN

RISE OF A NATIONAL INDUSTRY, 1870 TO 1920

In the half century from 1870 to 1920 the nursery business expanded to many new areas, diversified internally, and became a national industry on a large scale. As a business it suffered through several depressions, though, in the 1870s, 1890s, and in the years after the first world war. New markets opened for ornamental plants in the rapidly growing cities and suburbs, and by the turn of the century ornamentals surpassed fruit and nut plants in the business.

In the older nursery areas of the Great Lakes and Atlantic seaboard, ornamentals became the mainstay of the business. In many newly developing nursery areas in the West and South, however, plants for farm use predominated until the end of this period. Throughout the nation production became so diversified that no one region dominated the business as the Rochester area or Long Island and Philadelphia had done before.

New markets for these nurseries were sometimes regional, sometimes national. New farmlands in California, Oregon, and Washington needed fruit and nut trees, and these were produced by local or regional nurseries. The Great Plains and the Red River Valley of the North needed shelterbelt plants, mostly deciduous, and these came from regional nurseries but also from more distant nurseries to the east as well. In the South and Southwest a variety of farm plants were raised and sold locally and regionally, though some large nurseries marketed outside the

region.

Old Midwest and East Coast nurseries met a growing demand for ornamentals in the suburbs of the larger cities and towns on the new private estates, which flourished in this heyday of pre-tax capitalism. Some also served part of the market for fruit and ornamentals in the rest of the nation through mailorder and sales by agents.

New species and varieties were introduced, from Asia mainly, though often via Europe, and tastes became much more diverse. By the end of this period almost all the species of plants now commonly used had been introduced, though hybridization and selection continued to provide new varieties. The dependence on European propagators for certain kinds of plants, mainly rose and fruit understocks and hybrid flowering shrubs, continued. But the end of this period was marked by the imposition of a federal quarantine which closed off all foreign imports.

As the railroad and parcel post made shipment of plants easier and as the foreign introduction of many kinds of agricultural products brought new pests and diseases into the country, nurserymen and other farmers sought protection through quarantine and inspection regulations. The U. S. Department of Agriculture was set up at the beginning of this period but lacked authority to regulate inspections and certifications within the states. But it did have power to quarantine interstate and international shipments, and by the end of the period was using this power to try to halt the spread of pests and diseases. In 1919 it imposed a total ban on imports of foreign nursery products that caused substantial changes in the American nursery business in following years.

Many nurserymen began to form trade associations during this period, on state, regional, and national levels. The American Association of Nurserymen became the major voice for the national concerns, dealing with Congress, the U.S.D.A., and the railroads, for example. And trade journalism developed as new publications devoted to the interests of commercial nurserymen began to supplant part of the general horticultural press.

The Bureau opf the Census began to provide coverage of horticultural specialties in 1889, and the data collected reveal some of the broad distributional patterns of the nursery business in that year. Figure 7-1 shows the acreage in nursery crops in the various states and territories. New York was the leader, followed closely by Illinois and Ohio. Nine of the ten leading states were in a broad belt from New York and Pennsylvania in the east to Nebraska and Kansas in the west. Together these nine states accounted for just over 75% of the total national nursery acreage.

The proportion of the acreage in each state devoted to ornamental plants is shown on the map by shading. In the nation as a whole ornamentals took up only 25.5% of the nursery acreage in 1889, and in only ten states did they account for as much as a third of the acreage. The leading states were in the Midwest: Illinois, Iowa, Nebraska, and Ohio, where trees were used as much functionally as windbreaks around farms as they were for ornament. The urban markets of the eastern cities are perhaps reflected in the higher than average proportion of ornamentals in Massachusetts and Pennsylvania (though Connecticut and New Jersey show lower than average proportions. In the South and on the

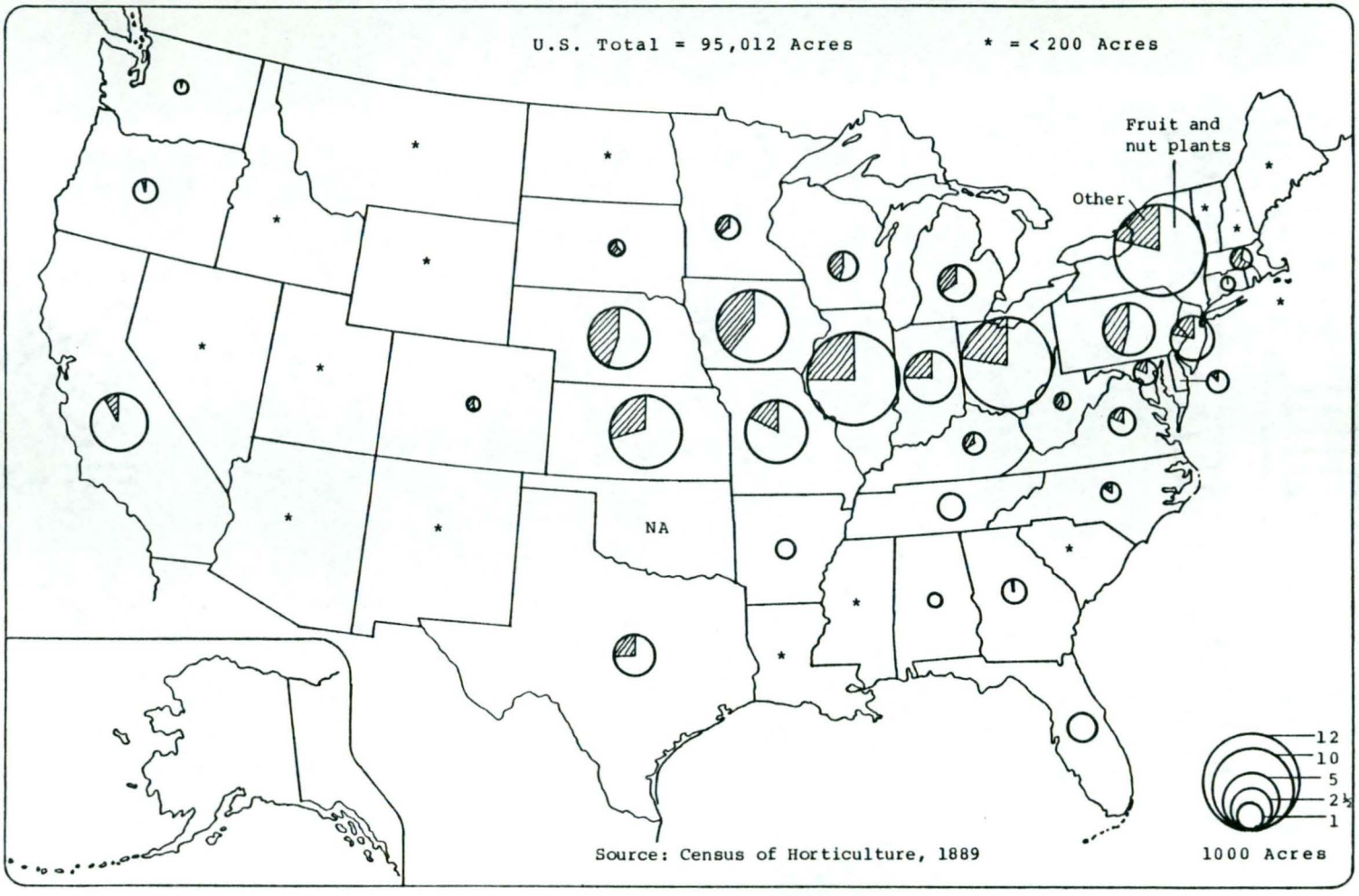


Figure 7-1. Nursery Acreage, 1889

Pacific coast ornamentals made up a much smaller proportion of the nursery acreage. Most of the nurseries in these regions were supplying orchard plantings of fruit and nut stock.

Among ornamental plants the acreage of deciduous trees exceeded that of evergreen trees in all but eleven states. Most of these were in the Midwest with Illinois leading the nation and continuing the pattern set in the previous decades in that state. In the plains states deciduous trees had greater acreage than evergreens.

Expansion to New Areas in the West and South

The expansion of nursery production to new areas generally accompanied the development of new farm areas or intensification of horticulture in old areas. In the Prairie states from the Dakotas to Kansas and Missouri there were new orchards planted, more in the southern part than in the north, primarily of apple, plums, and cherry. In addition many farmsteads on the plains needed trees and shrubs for windbreaks and woodlots.[1] While the invention of barbed wire helped solve the fencing problem it could not provide fuelwood or shelter from the wind. In 1873 Congress passed the Timber Culture Act which allowed for homesteads to be taken of up to 160 acres if the claimant planted and maintained for at least eight years 40 acres of trees no more than twelve feet apart, or at least 7500 in all. In 1878 this requirement was lowered to only ten acres of timber.[2] Although many homesteaders failed to keep their trees alive, many were planted and the Timber Culture groves were a stimulus to the nursery business in the Midwest for a decade or more.

Nurseries already established in Iowa and Missouri were joined by new ones, primarily in Iowa, Nebraska, and Kansas. There were a few nurseries in the Dakotas and Minnesota, but most nurseries growing plants for the plains states market were in the slightly warmer more southerly parts of the region. Among the largest in this period were, in Missouri: Stark's at Louisiana; in Iowa: Sherman's and May's at Charles City, Hill's and Watrous' at Des Moines, Wilson's at Atlantic, and Lake's Shenandoah and Mt. Arbor in Shenandoah; in Nebraska: Marshall's at Arlington; in Kansas: Pearsall's at Ft. Scott, Stannard's and Crawford's at Ottawa, and Taylor's and Skinner's at Topeka; in Minnesota: Jewell's at Lake City, Cashman's Clinton Falls Nursery at Owatonna, and Bailey's in St. Paul.[3]

The new developing farmlands of the prairie states were also served by agents of the larger eastern and midwestern nurseries. The Chase Nurseries of Rochester, New York, one of the largest agency firms, had some 1500 sales agents in 1887.[4] These agency sales cut into the market of local nurseries, and there was considerable animosity at times between Eastern and Western Nurserymen. Since many of the western nurseries were simply retailing or rewholesaling trees which they had bought from the same eastern nurseries, they viewed agency sales by them as unfair competition.

Agents were often not employees of the nurseries whose plants they sold but independent agents, and the itinerant ones among them developed a rather unsavory reputation as "tree peddlers."[5] Minnesota nurserymen convinced their legislature to pass a law in 1884 banning sales by agents of out of state nurseries. The U. S. Circuit Court ruled it an

unconstitutional infringement on interstate commerce, however, ten years later in a case involving an agent of the Bryant Nurseries of Princeton, Illinois, who had been jailed in Minnesota for his tree peddling.[6]

The Census of Horticulture in 1889 collected data on the number of agents employed by nurseries in each state, and they show the extent to which New York and Ohio nurseries dominated this segment of the nursery business (Figure 7-2). The same nine states from New York to Nebraska which led in nursery acreage are also the leaders in sales agents, however. It is interesting to note that the states with greater than average acreage in ornamentals have proportionately fewer sales agents than states with above average fruit and nut acreage. Apparently agents were selling more fruit and nut plants than ornamentals in 1889.

In the South and Southwest recovery from the Civil War was limited by a local lack of capital. Many northern agricultural promoters and nurserymen saw opportunities there, and by the 1880s had planted large acreages of fruit and nut orchards and/or established nurseries.

Noah Albaugh, fruit tree nurseryman from near Dayton, Ohio, and J. Howard Hale, small fruits nurseryman of Glastonbury, Connecticut, both had extensive orchards near Ft. Valley, Georgia in the 1890s. Hale also established a nursery there, raising peach, pear, and plum trees.[7] The Huntsville Wholesale Nurseries in Alabama were established in 1873 by another Dayton nurseryman, W. F. Heikes, who hired an English horticulturist, John Fraser, as manager.[8] And the Alabama Nursery Company, later Chase Nurseries, was set up in Huntsville in 1889 by several members of the same family which operated the large Rochester nursery.[9] All of these new southern nurseries raised mainly fruit and

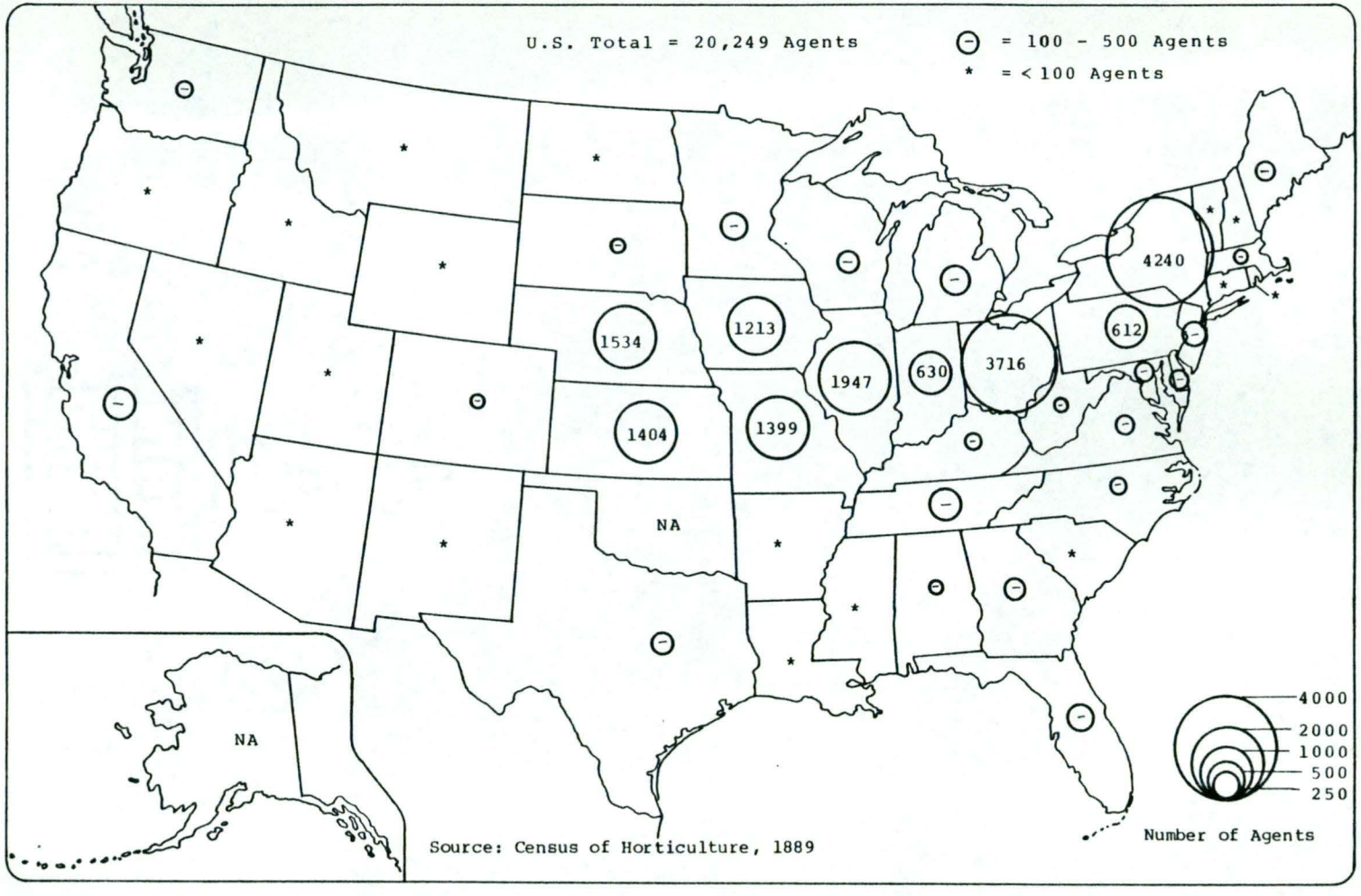


Figure 7-2. Sales Agents Employed by Nurseries, 1889

nut stock in their early years, but they added ornamentals to their inventory by the turn of the century.

The largest southern nursery from before the war was Berckmans' Fruitlands Nursery in Augusta, Georgia. In the 1880s and '90s they expanded into a wide variety of ornamentals including tropicals for the florist trade, grown under 60,000 sq. ft. of glass.[10]

In Tennessee, early nurseries were the Southern Nursery Co. and Shadow's Nursery, both at Winchester, Bird and Dew, Camp's, and Newsom's in Knoxville, and Boyd's in McMinnville.[11] Some of these were agency firms, selling to the southern Mississippi valley and southern plains area. In North Carolina were Lindley's at Greensboro since just after the war, which raised cut flowers and had extensive orchards in addition to their nursery stock,[12] and Kelsey's at Linville since 1895 which specialized in native plants and had a large branch in Massachusetts.[13] In Lexington, Kentucky, the Hillenmeyer Nurseries, founded in 1841, grew to be one of the largest regional fruit tree producers, but with the decline of that market around the turn of the century, switched to ornamentals by 1910.[14] On the Gulf Coast at Mobile was the Langdon Nurseries, an important local importer of European plants, including camellias, of which they offered thirty-nine varieties in 1891.[15]

In Texas, throughout this period, nurseries were growing mainly fruit and nut plants. Baker Brothers in Ft. Worth was started in 1884 and sold fruit trees in Texas and New Mexico.[16] The Texas Nursery Co. was organized in 1898 in Sherman, and the Mayhew Nursery Co. in 1902 at Waxahachie.[17]

Nurseries in the Pacific states were supplying fruit and nut stock throughout this period, with increasing amounts of ornamentals after the turn of the century. In Washington and Oregon they raised mainly apple, pear, plum, cherry and berry plants. In California it was all of these and many more including citrus fruits and subtropicals like date, avocado, and fig. Some of the California nurseries also grew large numbers of ornamental plants for the rather specialized market within the state.

Completion of transcontinental rail lines to northern California in 1869, to southern California in 1879, and to the Pacific Northwest states in 1883 opened eastern markets to western crops and stimulated large fruit and nut plantings and the growth of nurseries to supply them. It also allowed eastern nurseries to sell in the West, however, and West Coast nurserymen began to face some of the same competition from eastern agents as did midwesterners, although on a much reduced scale.

The milder climate on the West Coast allowed for more rapid growth of nursery stock of many species, and western nurserymen were able to compete in the Midwest with local and eastern nurseries with some types of plants. Several large firms grew up in the West in this period. In Washington: the May Nursery Co. in the Yakima valley; in Oregon: the Oregon Nursery Co. with sites near Salem and Beaverton as well as in the Yakima valley of Washington, Pilkington's at Durham, south of Portland, which was also a large importer of ornamentals from Europe, Portland Wholesale Nursery at Portland, and McGill's at Fairview, east of Portland, and Milton Nursery in Milton. Except for Milton, which was in

northeastern Oregon north of Pendleton, all the other large Oregon nurseries were in the northen Willamette valley, and most were near Portland.[18]

In California the largest nurseries in this period were fruit and nut growers. Ornamentals became increasingly important, though, especially at the end of the century as orchard planting slowed in most areas and as the rapid growth of cities stimulated the production of ornamentals for the residential market.

John Rock and R. D. Fox, two of the larget nurseries in northern California, joined together in 1884 to form the California Nursery Co. at San Jose, which moved to Niles on the east side of San Francisco Bay in 1886. They were the largest grower on the West Coast until after the turn of the century, with over 750 acres in production of not only fruit and nut stock but a large variety of ornamentals. They also imported many plants from India, Japan, and Australia, serving the rapidly diversifying Californian tastes in ornamentals.[19]

Two other giants of this period in the orchard nursery business were the Leonard Coates Nursery, first in Napa County in 1878 but after 1904 in Santa Clara County,[20] and Roeding's Nursery at various sites, especially in the newly irrigated orchard lands near Fresno. George Roeding built up a huge nursery and orchard empire between 1885 and his retirement in 1927. He had hundreds of acres in nursery stock at several sites, and in 1917 he bought the California Nursery Co. of Rock and Fox.[21]

In addition to the California Nursery Co. at Niles, other important growers of ornamentals in northern California were Pacific Nurseries of

San Francisco, later at Colma just down the peninsula to the south, raising herbaceous perennials, rose plants, and fruit trees since 1869,[22] R. J. Trumbull of San Francisco, importer of Australian and Japanese plants since 1870,[23] Edward Gill of Oakland, specializing in roses since the 1880s,[24] the Domoto Brothers of Oakland, the first major Japanese-American nurserymen, since the 1880s importers primarily of Japanese, Australian, and European flowering plants,[25] and the Oki Nursery in Sacramento since 1907, originally in fruit tree production.[26]

In southern California the boom growth decades after 1880 led to a large market for ornamentals, but few large nuresries developed until the very end of this period. Many which did carry ornamentals imported heavily from abroad, from Australia, Japan, and Europe especially. The largest in this period were Joseph Sexton in Santa Barbara since the 1870s, Germain's in Los Angeles since 1871, which went on to become a large chain of garden centers in this century, Howard & Smith in Los Angeles since 1890, and Armstrong's in Ontario since 1889. The last two became large growers of rose plants by the end of the period.[27]

Ornamental Plant Nurseries in the East

The nurseries of the Great Lakes and northern Atlantic seaboard states had begun to lose their national dominance of the fruit and nut plant business by the turn of the century. Except for those specializing in agency sales or, later, in mail order sales, most were gradually shifting their emphasis to ornamental plants. The depression of 1873-78 slowed down sales of orchard and berry plants, and when the recovery

came in the 1880s many local and regional nurseries in the plains, southern, and Pacific states were ready to meet the local demand. The depression of the 1890s only repeated the process.

More profitable were the rapidly increasing markets for ornamentals in their own regions. In the Midwest this also included the windbreaks of rural areas and, in the early part of this period, the very large plantations for railroad fuel and ties out on the prairies. Robert Douglas of Waukegan, for instance, became a major grower, seller, and even contrct planter of larches for the Illinois Central and of northern catalpas for the Kansas City, Ft. Scott, and Gulf Railway in the 1870s and '80s.[28]

In the older states of the Eastern Midwest several major nursery areas rose to national prominence. Foremost among these was the Miami valley near Dayton, Ohio. This area had by 1879 over sixty nurseries, more than half of them wholesalers.[29] Prominent there were George Peters & Co. raising fruit trees from 1869 to 1904 with a partnership in a Kansas nursery, Albaugh Nursery Co. at Tadmore, and the Siebenthaler Nursery founded in 1870, originally selling fruit trees, but increasingly selling shade trees in the twentieth century.[30] In northern Ohio Storrs & Harrison of Lake county grew to be a giant fruit stock grower with 300 acres in 1881, increasing to 1200 acres by 1914.[31] They helped give rise to many other nurseries in the immediate area by bringing in or training men who later set up their own operations. Also in Lake County was one of the largest early ornamental growers, Cole Nurseries of Painesville, founded in 1881.[32]

In Illinois besides Robert Douglas, large nurseries in this period

first grew fruit trees, then switched gradually to shade and shelterbelt trees. Several, such as Bryant's Nursery in Princeton, were large agency firms. Augustine Nurseries in Normal, like others, shifted gradually from fruit to shade trees from 1876 into the end of this period. The D. Hill Nursery at Dundee west of Chicago was founded in 1875 and was one of the nation's largest growers of conifers by the end of the period.[33]

In Indiana there were relatively few large growers, but the largest and one of the oldest there, C. M. Hobbs in Bridgeport near Indianapolis, was a national grower, originally of fruit trees but increasingly of ornamentals. They are still in business as a retail nursery.[34]

In western New York the center of activity broadened beyond Rochester, and the area around Geneva and Newark to the east became important. Many older Rochester firms like the Mt. Hope Nurseries continued on in this period, but others went out of business, and several new ones arose in Monroe County which surpassed them.[35] Newer Rochester firms like the Chase Nurseries, established in 1868, and Brown Brothers, begun in 1885, grew bigger than Mt. Hope and carried on the Rochester tradition into the twentieth century.[36]

Other large new nurseries were in Geneva, some 30 miles east of Rochester. A few had started there as early as the 1840s, like Maxwell Brothers' and Smith's, and by the end of the century they were national wholesalers of fruit trees.[37] In Newark, just north of Geneva, was Jackson & Perkins founded in the 1870s and one of the nation's largest rose growers by the end of this period.[38] Other large nurseries in western New York were in Dansville, south of Rochester, and in Lockport,

west of Rochester.[39]

On the Atlantic seaboard some older nurseries continued and enlarged their ornamental offerings. Other new ones joined them, often specializing for a time in a particular line of stock, but the largest were those which diversified their inventory. On Long Island Prince Nurseries had gone out of business, but Bloodgood's, Parsons and Hicks continued and prospered. Parsons was a heavy importer of rhododendrons and azaleas from Europe and Japan and also sold many varieties of Japanese maples. Hicks continued to specialize in conifers and was also involved in retail sales and landscape contracting, widely known for their skill at moving very large trees. These firms prospered from the many estate gardens which were planted on Long Island before 1919.[40]

Around Philadelphia, Meehan's at Germantown continued as one of the best known in the nation into the 1920s. Moon Nurseries of Morrisville became one of the leading propagators of new ornamentals, introducing pearl bush (Exochorda racemosa) and the amoenum azalea (Rhododendron obtusum var amoenum), among others.[41]

In New Jersey were Eugene Bauman, at Newark, one of the suppliers of New York's Central Park and of many large estates and other city parks in northern New Jersey before the turn of the century; Flemer's (later Princeton) Nursery, in the business since 1882 and since 1913 at Princeton, a large grower of shade trees; and Lovett's of Little Silver, near the shore, growing shade trees and fruit plants.[42]

In New England many new nurseries were established as suburban and estate planting spread out from the rapidly industrializing cities and towns. Burr's in Manchester, Connecticut, the New England Nurseries in

Bedford, Massachusetts, and the Rhode Island Nursery Co. in Newport are noted among others.[43]

The 1900 Census gives figures for total acreage and sales by counties for 1899, for those farms with more than 40% of their income derived from nursery products. Unfortunately, this was not reported again until 1949, so this one census must be relied upon to represent this entire period at the finer scale of the county. The leading 50 counties are shown in Figure 7-3. Four of the top 50 and three of the top four were in western New York. Together these four counties accounted for just over 11% of the nation's sales. The national leader, Monroe County had more than twice the sales of the next county and some 6% of the national total.

The other prominent cluster was the area between and around New York City and Philadelphia, where 8 of the top 50 counties produced over 6% of the total also. Many others of the leading 50 are scattered across the Midwest and South with no real groupings. This reflects the role of most of these nurseries in supplying a local market, whether urban or rural, and it also reflects the absence of any clearly defined climatic production advantages at this time.

This was a time of rapid change for the nursery business, however, with declines in fruit and nut production and increases in ornamental production that did not quite make up for them.

New Taste and New Markets

New markets opened up for ornamentals in the last quarter of the nineteenth century and the early decades of the twentieth.

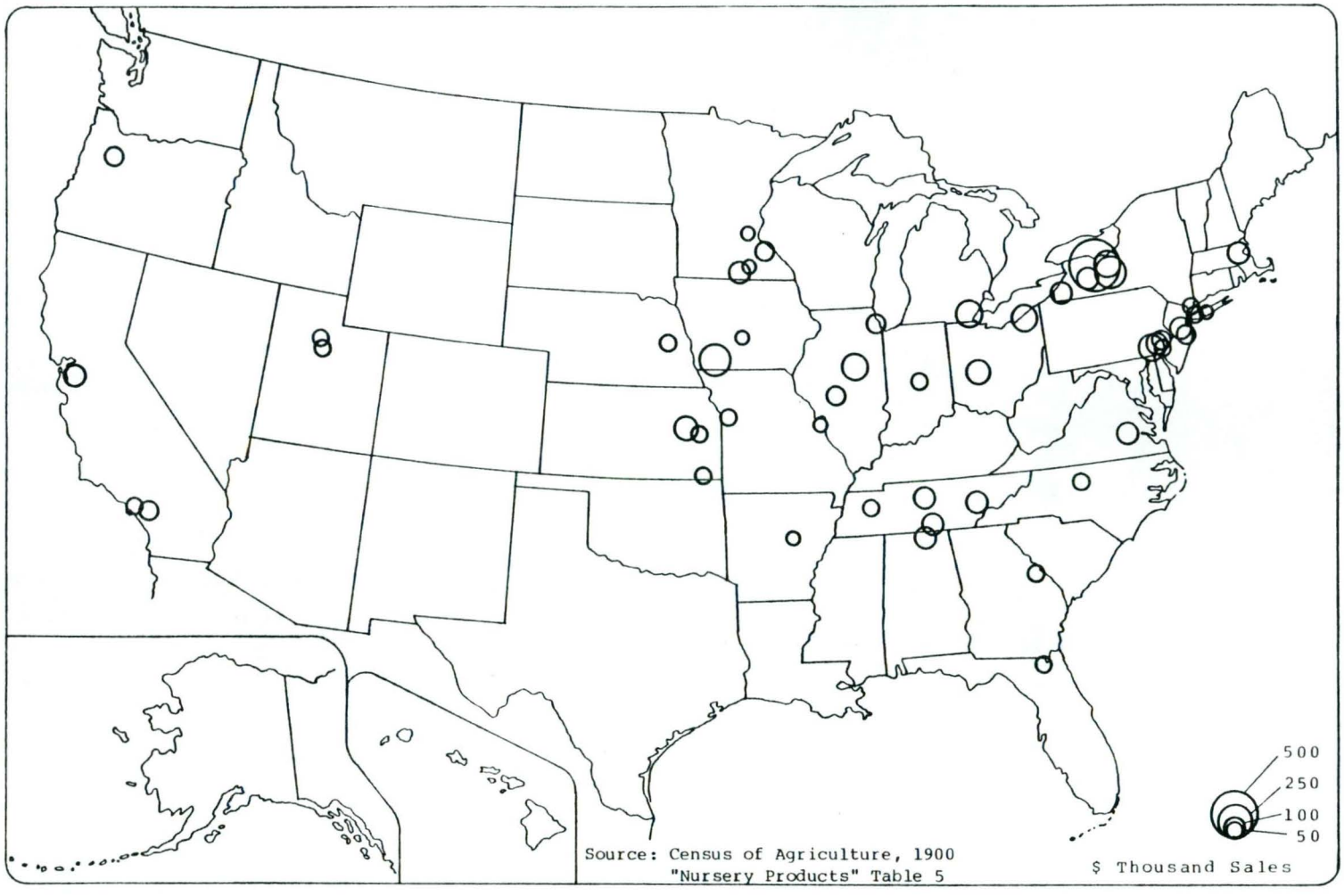


Figure 7-3. Fifty Leading Counties in the Sale of Nursery Products, 1899

Industrialization after the Civil War spurred the growth of cities especially in the Atlantic Northeast and Lakes states, and new forms of transportation allowed those cities to spread out much beyond their earlier boundaries.

As Warner has shown in detail for Boston, the growth of new suburbs of middle class houses was directly tied to construction of new street railways, water, and sewer lines.[44] Mayer and Wade illustrate a similar growth for Chicago's suburbs at the turn of the century.[45] The expansion of suburban areas beyond the old "walking city" was encouraged by the new rural esthetic ideals which had swept the nation at mid-century. As Warner says, "the rural ideal, by its emphasis on the pleasures of private family life, on the security of a small community setting, and on the enjoyment of natural surroundings, encouraged the middle class to build a wholly new residential environment: the modern suburb."[46]

Elemental to the new suburban ideal was a single family house, if possible, with a lawn and trees. The taste which Downing had helped popularize before the Civil War had now filtered down to the growing middle classes, who by the 1870s and '80s had the means to buy at least a small piece of land on which to construct a place in that image.[47] What Downing had scaled down to 5-200 acres and Americanized from English landscape parks of from 50 to 1000 acres had now to be transformed again, into suburban lots of from 1/4 to 2 acres. Just as the country gentlemen of leisure needed Downing to guide them in planting their new estates, the middle class businessmen of this later generation needed a guide to their new residential environment.

In 1886 Frank J. Scott published The Art of Beautifying Suburban Home Grounds of Small Extent. In it he set out to fill what he saw as the "need of practical works to epitomize and Americanize the principles of decorative gardening, to illustrate their application to small grounds, and to effect in miniature, and round ordinary homes, some of their loveliest results."[48] Aiming at "the business man of moderate means," Scott urged him to forego Downing's rural villas for close-in street car suburbs, "to go no further into the country than where good roads have already been made, and where good sidewalks have either been made, or, from the character of the growth of the neighborhood, are pretty sure to be made within a short time."[49]

Given the rapid growth of streetcar suburbs, over 250 square miles around Boston between 1870 and 1900, for example, this area of roads and sidewalks overtook many of the older country villas outside cities. New villas, in turn, were built even farther out than before.[50]

In contrast to Downing, his friend and mentor, who sought to inculcate the public with his set of tastes, Scott recognized that there were by then already "a great variety of wants and tastes."[51] He sought instead to instruct in the use of a few general principles, which he illustrated by a set of six rules, and to help people take advantage of their limited lot sizes to produce the best effect.

Scott favored the conscious framing of views, both to and from the house, and especially recommended that adjoining property owners consider each others' lines of sight. He wanted to make of a city block a landscape whole rather than a collection of unrelated parts. He particularly disliked tall hedges and fences around the front yard. "It

is unchristian to hedge from the sight of others the beauties of nature which it has been our good fortune to create or secure."[52]

Miniaturizing an esthetic based on large estates required selecting only the most important elements which conveyed the image of the ideal. Scott felt that "these two things, then, are the most essential to the businessman's home - a fine lawn and large trees."[53] He urged suburbanites not to try to squeeze all the plants of an estate onto a small lot. Small lots need proportionately smaller plants than large estates to keep them from looking cluttered. For this reason he did not favor the use of coniferous trees, finding them attractive only when young, and "rigid and monotonous" at maturity.[54] He did find the newer semi-dwarf varieties of conifers useful, however, in certain cases.

Scott recommended the use of shrubs in place of trees to form spaces within a yard. He felt that the then most commonly used shrubs were the most successful for this, not the new varieties and species popular simply for the sake of novelty. "Lilacs, bush-honeysuckles, syringas, snowballs, deutzias, and weigelas are the ones which approximate most nearly to perfection in shrubs."[55] In the planting of deciduous trees he encouraged native species but did not condemn exotics. In fact he found the horse chestnut to be "one of the most perfect of single lawn trees," and felt that "for an avenue of trees it has no superior."[56]

Scott was important in helping to create the new suburban landscape of America as a unique environmental form. At a time when many small lot owners were seeking to stuff their half-acre yards with everything

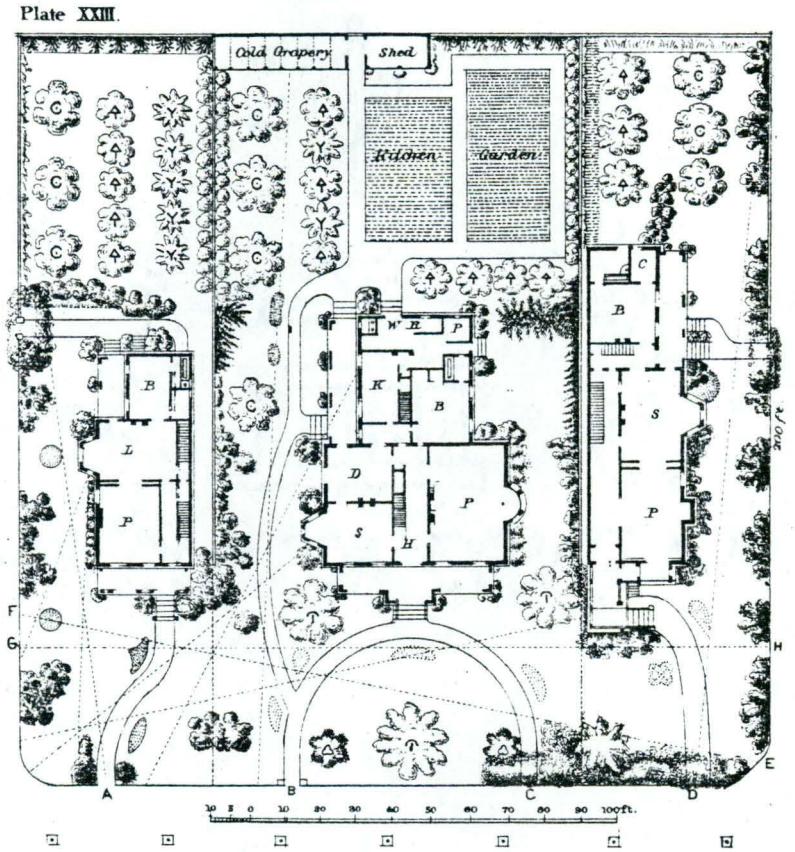


Figure 7-4. Residential Planting Plan from Scott's Suburban Home Grounds, 1866

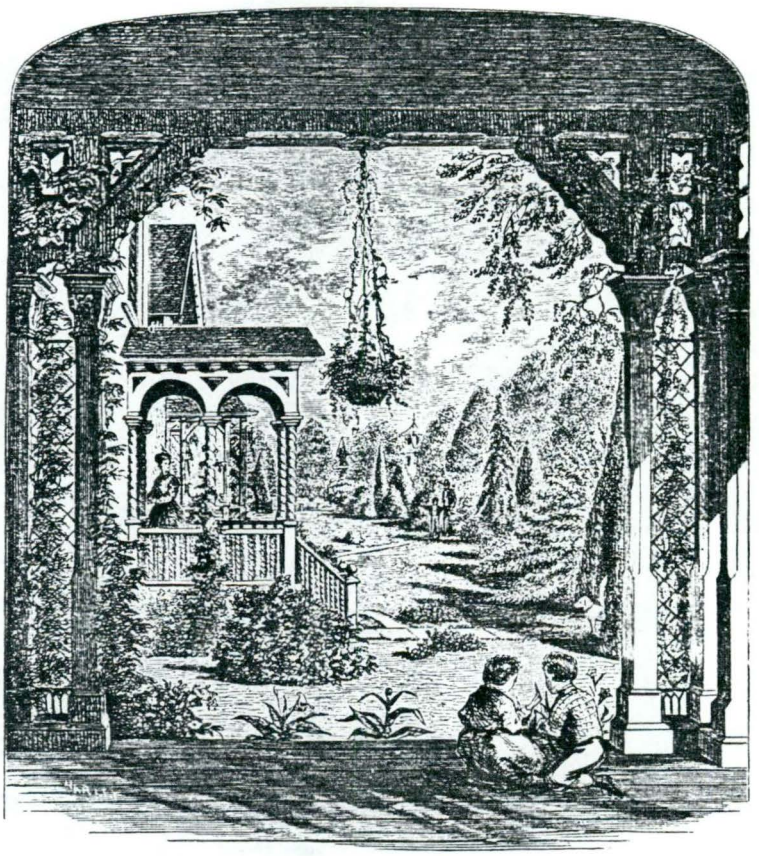


Figure 7-5. View of Scott's Suggested Suburban Landscape

fashionably used on a twenty acre estate he counseled restraint and careful planning. By clarifying the basic planting elements compatible with the new suburban lots and blocks he helped shape the market for ornamental plants for many years.

Farther out from the cities were the estates of the wealthy, and in this period there were many new ones built. With the rise of a small class of very wealthy industrialists and financiers came a new style of architecture and gardening which aimed at ostentatious opulence in imitation of the European baroque. The gardens of these merchant princes gradually adopted more and more formal elements and left Downing, Loudon, and the English school behind. By the turn of the century and up to the first world war the neo-Italian styles held sway,[57] emphasizing architectonic use of plants, including many evergreens, especially those like boxwood, yew, and laurel which could be pruned or sheared into geometric shapes.

The planting of newly built country places often called for an instantly lavish effect, and the moving of large trees and shrubs became a specialized part of the trade. Some nurseries, like Hicks on Long Island, were noted for their skill in moving large trees.

Many large cities in this period built large parks and park systems following the example of New York's Central Park. Olmsted himself designed many of them, such as Boston's Franklin Park and Chicago's Washington and Jackson Parks, and other landscape architects such as H.W.S. Cleveland and Charles Eliot designed others.[58] Most large urban parks aimed at a naturalistic effect and called for large numbers of native trees. The construction of wide tree-lined boulevards linking

individual parks with a series of parkways into a system also became common,[59] and these often used exotic as well as native species. Many cities, however, had realized the savings to be had from growing their own, and had set up municipal nurseries that eliminated some of this market from private nurseries.[60]

New Plants, 1870 - 1920

The introduction of plants to Europe and North America from other continents continued throughout this period, aided greatly by organized expeditions of "plant hunters," botanists sent out by large arboreta such as London's Kew Gardens and Boston's Arnold Arboretum, and occasionally by large nuseries.[61] Asian plants far outnumbered all others, especially among the temperate flora. From subtropical areas Australia and South Africa made important contributions also. Many of the species introduced in the middle of the century only became popular in this later period, including many of the conifers from the west coast of North America and the flowering cherries from Japan.

The most important new introductions between 1870 and 1920 were primarily flowering trees, such as Japanese dogwood (*Cornus kousa*), Pissard plum (*Prunus cerasifera*), Bradford pear (*Pyrus calleryana*), and evergreen shrubs, such as Japanese pieris (*Pieris japonica*), various cotoneasters, and the Pfitzer juniper (*Juniperus chinensis* var. '*Pfitzeriana*').[62]

Many of these were first introduced to European nurseries, but throughout this period many American nurseries were able to import them from Europe as soon as they were commercially available. The nurseries

of England, France, Germany, Belgium, and the Netherlands were able to propagate plants more cheaply in many cases than most American nurseries, and many had active programs of varietal selection and hybridization. Pfitzer juniper, for example, was first discovered as a single variant plant in the Spaeth Nurseries in Berlin in 1899.[63] Such genera as Rhododendron (including azaleas), Rosa, Magnolia, Syringa (lilacs), Clematis, and Viburnum were the subjects of active breeding efforts by European nurserymen. By the end of this period Americans were making important contributions as well, especially to roses, rhododendrons, and lilacs.[64] The Arnold Arboretum of Harvrad University was an important agent in the importing and testing of many new varieties after its establishment in 1872, but was only the foremost of a growing number of arboreta across the country which came to life in this period and carried on much of the work of the older botanic gardens.

As the varieties of plants available multiplied, tastes and personal preferences diversified also. Whereas in 1850 a gentleman of leisure with twenty acres of land might, with some planning, manage to grow everything then available, by 1890 or 1910 even such a large estate could not accommodate the wealth of possibilities, let alone a quarteracre suburban lot. Gardeners became more heterogeneous in their choices, and nurseries began to differ widely in their offerings. Large general nurseries tried to carry almost everything in common use, but some chose to specialize in one or a few genera with as many varieties as had been developed.

Roses were perhaps the most developed, and by 1919 were being sold

by several large nurseries who specialied in little else. The development of Hybrid Tea roses around the turn of the century with their extended blooming season and wider range of colors greatly increased the appeal of roses, and separate rose gardens became popular features in many residential yards.

In different regions of the country different plants were used, and as the range of possibilities increased, regional markets diverged more sharply from each other. In the South many new species and varieties of Asian genera became popular, particularly broadleaf evergreens. Some, like camellias, azaleas, cherries, laurels, viburnums, hollies, and privets had their northern counterparts in other, usually deciduous, species. But others were genera unique to the South, such as Pittosporum, Lagerstroemia, and Nerium (oleander). Berckmans' Nursery near Augusta was an important regional source for many of the new European hybrids of camellia and azalea.[65]

Most of the Southeast is only slightly warmer in winter low temperatures than coastal areas of the Northeast, however, and plants used in each area have many broad similarities. The Gulf coast and Florida, though, are much milder and able to support many subtropical and, in some locales or with extra protection in winter, tropical plants. By the end of this period many new species and genera had been introduced to Florida and the Gulf coast but most gardening still relied on more northerly plants such as azaleas and camellias.[66]

In California, the warmer winters allowed, and the drier summers demanded, a different ornamental flora. While some northerly plants, especially conifers, could be grown, much of the temperate ornamental

flora such as maples, lindens, and horsechestnuts, did not do well in the dry summer heat, especially in southern California. The rapid growth of cities and towns in the southern part of the state after 1880 led to a great demand for ornamental plants there. Nurseries in the south were busy producing fruit and nut stock, though, for the many new orchards in the area and were slow to adopt a very wide selection of ornamentals. A writer for the Los Angeles Times in 1904 complained that "Los Angeles nurseries are sadly in need of ornamental shrubs, there being scarcely a score of desirable shrubs of any size to be found in the entire city."[67]

Many of the early introductions in the southland were made by individual gardeners. The deodar cedar, for instance, was first planted in 1885 in Pasadena by John Woodbury who obtained seed by mail from the U. S. Deprtment of Agriculture in Washington.[68] By the end of the century more nurseries were carrying ornamentals, and by the time of the first world war there was a thriving local business in southern California for nurseries producing ornamentals.

Rowan has documented the development of the ornamental flora in southern California, primarily the Los Angeles basin, in an admirable way.[69] He found that there was a great diversity of species in use there by the turn of the century, much of it imported and propagated by private gardeners. Many early gardeners, lured to the area by its climate,[70] sought lush tropical effects and planted their yards heavily with large-leaved subtropicals. Palms such as Washingtonia, Erythrea, and Howea, and dracaenas, and even bananas were common around many homes. Street and lawn trees included the Brazilian pepper tree

(Schinus molle), Australian silk-oak (Grevillea robusta), and several species each of Eucalyptus, Acacia, and Araucaria.

A special place was occupied by roses, which bloomed more freely in California than in the East, and the new Hybrid Teas were especially popular. Indeed, roses were something of a fixation of California newcomers, and one nurseryman estimated that 90% of the sales in ornamentals in the Los Angeles area in 1900 were made up of rose plants.[71]

After the turn of the century temperate species gained popularity as gardens began to mimic the national styles. Adaptable species of maples, oaks, locusts, and hawthorns became popular, along with many conifers such as arborvitaes, yews, and cedars. There was a trend away from large trees on small residential lots, a practice of early suburban settlement of the area. As builders put up smaller and lower houses, in the bungalow style commonly, people sought to frame them with shorter trees in their front yards. One garden critic was even urging in 1913 that small houses have no trees at all in front. "They only mar the sidewalk, obstruct the view, and shade the plants too much."[72] The "plants" referred to were roses and other flowering shrubs and beds of herbaceous perennials and annuals.

The distinctiveness of regional plantings in different parts of the nation was always challenged by the national style popularized in books and magazines and made available almost anywhere by railroad shipments from large nureries. The suburban landscape ideals promulgated by Scott and popularized by others, such as Alexander Oakley's Home Grounds in Appleton's Home Books series,[73] spread throughout the nation. The

railroad made the realization of this ideal possible as many nursery products could be shipped anywhere the rails went, increasingly so after the use of refrigerated freight cars began around the turn of the century. The fact that national styles were being created in the Northeast, one of the colder regions of the nation, meant that plants called for in standard lists could also grow in most of the warmer areas of the country also.

One measure of the penetration of this national influence into regional markets is given by Walter Rogers in his history of gardening styles in Tucson, Arizona.[74] He found that many native plants and a limited number of spanish colonial introductions dominated the ornamental flora of Tucson until 1880, when the Southern Pacific rail line was completed. After that there was a rapid influx of architectural and gardening styles from the East, and to a lesser extent from California. New plants used after 1880 were, among others, oleanders, chinaberry, glossy privet (Ligustrum lucidum), pepper tree, Pittosporum tobira, and some twenty-two varieties of roses hardy in the area. He did note, however, an increased interest in native plants after 1900, largely due to the efforts of the University of Arizona experiment station.

Development of a National Industry

The completion of the major transcontinental rail lines and the addition of new lines linking the southeast, plains, and southwestern states with the Lakes states and the Northeast between 1870 and 1900 effectively created a national transportation system which allowed for a national market. And while the bulk of the freight was at a wholesale

level, much of it was at retail. The rise of large mailorder general retail firms like Montgomery Wards in 1872 and Sears Roebuck in 1886 set an example which many nurserymen also followed. Whereas a nursery had previously needed an agent or a broker to sell its stock outside its immediate area, often requiring holding nurseries and extensive lines of credit, with the advent of mail order sales using railroad express deliveries, printed catalogues and advertisements in national magazines became an easier substitute.

A great boost came in 1888 when western railroads changed their classification of nursery stock from first class to third class, lowering the rates considerably.[75] The initiation of rural free delivery in the 1890s allowed for increased use of the U. S. postal system, and the introduction of parcel post in 1913 made possible increased postal sales of nursery plants.

Mailorder sales gradually replaced agency sales, and as the market for ornamentals surpassed that for fruit plants around the turn of the century, buyers turned increasingly to mailorder firms for many plants, mainly deciduous ones shipped bare root in refrigerated cars. These sales effectively bypassed retail nurseries, and there was some friction between them and the major mailorder nurseries.[76]

Another sign of the growing national market was the development of multi-state nurseries. Some growers in one region with major markets in another either bought or established nurseries there to grow plants for the special regional market, or to supply their main nursery with plants grown more easily elsewhere. Augustine's Nursery in Normal, Illinois, had a branch in Topeka, Kansas in the 1890s; Brown's Nursery in

Rochester, New York, had a branch in Welland, Ontario, Canada; and the Texas Nursery Co. in Sherman had a branch in Durant, Oklahoma.[77]

Related to this was the practice of contrct growing, in which one grower would raise plants that would be sold to another nurseryman to be sold with his other plants, whether at wholesale or retail. Brewer and Stannard's Ottawa Star Nurseries in Ottawa, Kansas, for example, grew their own fruit trees but also contracted to have them grown by other nurseries in Oklahoma and New York in the 1880s and '90s.[78] Many of the mailorder firms in particular relied on contract growing to fill their needs and maintain a complete line of stock.

The national nursery industry had already diversified greatly by 1870, and when the depression of 1873-78 cut sales around the nation many nurserymen saw a need to form a national association to help deal with their pressing concerns in common action. Meeting in June, 1876 in Chicago, a group of sixty two midwestern nurserymen formed the American Association of Nurserymen, Florists, and Seedsmen.[79] Later shortened to the American Association of Nurserymen (A.A.N), the organization quickly took in members from all the nursery growing states of the U.S. and several Canadian provinces.[80] Early work dealt with the concerns of large wholesale fruit tree growers, primarily, and over the years the florists, seedsmen, and many retail nurserymen dropped out to form their own more specialized organizations.

Mediating conflicts between large agency sales firms and local wholesalers and retailers, seeking railroad rate adjustments, and lobbying Congress and the U.S.D.A. on agricultural regulations was the early focus of the organization.

When sales of ornamentals began to exceed those of fruit plants around the turn of the century, the concerns of the AAN became even more diverse, including improved relations with the American Society of Landscape Architects, increased involvement with state and federal quarantine regulations, and early consumer sales promotion and publicity campaigns. The diversification of the nursery business put strains on relations between different segments of the industry, particularly between retailers and the large mailorder firms, and between smaller local wholesalers and large agency firms. The AAN was helpful in setting trade practice policies to obviate some of the most difficult areas, but conflict continued and plagued the organization for many years.[81]

In addition regional associations were set up by nurserymen in several parts of the country. The oldest was the Western Association of Nurserymen, set up in 1890 and drawing members from the Mississippi River to the Rocky Mountains, followed in 1899 by the Southern Association of Nurserymen, in 1903 the Pacific Coast Association of Nurserymen, 1911 the New England Nurserymen's Association, 1912 the Northern Retail Nurserymen's Association, and in 1908 the Southwestern Nurserymen's Association.[82] When regional interest diverged it was often the regional associations which led the fight, as when the Western Association sought local state bans on California fruits in retaliation for California agricultural quarantines which excluded potentially diseased Midwest fruit stock in 1892.[83] Regional associations also played a more positive role, developing new trade policies, nursery stock standards, etc. and proving their worth before the national

association later adopted them.

Pests and Quarantines

The growing interstate movement of plants and the large number of introductions from abroad inevitably led to the dispersal of insects and diseases. Some, such as the codling moth, had come to America with the first colonists, but the most rapid influx of new pests came in the late nineteenth and early twentieth centuries: cottony-cushion scale to California from Australia in 1868, the gypsy moth to Massachusetts from Europe in 1869, pear leaf blister mite from Europe in 1870; all began to spread slowly, or rapidly, after their introduction. The most spectacular spread, though, was that of the San Jose scale which was brought from Asia to California in 1880 and spread across the nation in the next few decades, devastating orchards from coast to coast.

Farmers in different states began to fear plants imported from elsewhere and began to demand quarantines, inspections, and outright embargoes on certain plants. In 1892 California banned imports of stone fruit plants from east of the Rockies in order to keep out peach yellows disease. Many states began to implement quarantines on plants and produce from other states and on some shipments within a state.[85] In states where the nursery business either contributed significantly to the state's economy, such as New York, or where its introductions had the potential for harm to the rest of the state's agriculture, such as in California, strict inspection and internal quarantines were set up.

Efforts to secure national inspection and certification programs run by the U.S.D.A. failed, however, in several attempts over the next

decades. Nurserymen were divided over the issue, and some large eastern nurseries in particular opposed interference with their ability to market nationwide.[86]

The spread of the boll weevil in the 1890s from Mexico into Texas and then throughout the South, and the introduction of chestnut blight from Europe to New York in 1903, which began destroying one of the most important eastern forest trees, called for stronger measures to deal with foreign introductions. The U. S. Department of Agriculture was especially concerned with the large imports of nursery stock from Europe, and in 1912 announced its intention to ban all nursery imports in the near future.

The business as a whole was seriously dependent on European propagators for rose and fruit understocks and for many varieties of flowering shrubs. George Perkins of Jackson & Perkins of Newark, New York, a large importer of rose rootstocks, feared "being legislated to death" by the U.S.D.A.[87] Irving Rouse, president of Jones & Rouse near Rochester, the largest importer of fruit trees and understock at one time, complained, "One thing is absolutely certain and that is that if such a law is passed it practically kills the nursery business in the United States."[88] Other nurserymen not so dependent on European imports, however, supported the idea of a quarantine as a way to prevent further losses from pests and diseases.[89]

In 1916 a new pest appeared which seriously threatened the nursery business for many years. The first find of the Japanese beetle was in a nursery near Riverton, New Jersey across from Philadelphia. In the next few years it spread throughout New Jersey and into Pennsylvania, New

York, Connecticut and Delaware. Because of the beetle's voracious and almost omnivorous appetite, the U.S.D.A. imposed a federal quarantine on shipment of nursery stock out of the infested area in 1919. Several large nurseries had their sales territory drastically reduced, and in the following decade the quarantine severely restricted the sales of nurseries within the quarantine area.[90]

The Japanese beetle episode simply underscored the need for control on foreign imports, and in November of 1918, the U.S.D.A. promulgated Quarantine No. 37 which went into effect June 1, 1919. This quarantine prohibited importation of almost all classes of nursery plants from abroad.[91] While it did permit importation of inspected and certified soil-free bulbs and rootstocks, it drastically reduced the total number of plants brought into this country. As but one example, Belgium exported 32,000 cases of plants to the U.S. in 1913, but only 3 cases in 1920.[92]

The nursery business went through several years of uneasy adjustment to the quarantine. A large new market was immediately opened for rose and fruit stocks and for varieties of flowering shrubs. By the middle of the next decade the foreign imports had been replaced by American-grown plants, and Rouse's dire predictions had been shown to be groundless fears. If anything, the quarantine proved a boost to the American nursery business, allowing domestic growers to produce all phases of growth of their plants and requiring them to develop propagation skills which they had lacked until then.

By 1920 the nursery business was in another depression, this one the national business slump following the first world war. But it soon

recovered with the building boom of the twenties. Nurseries had found a major new market for ornamentals in the rapidly expanding suburbs of the nation's cities, and in the next period, 1920 to 1950, this market broadened, even through a greater depression and a greater war.

Ornamentals had replaced fruit plants as the leading category of nursery production and were the mainstay of the business in many regions of the country by 1920. Many fruit and nut nurseries of earlier years had switched to production of ornamentals, and a large number of new species and varieties were in production overall. Introduction of new pests and diseases had led to state and federal quarantines, including Quarantine No. 377. New methods of inspection and certification were developed in the next period, but in this period the quarantines proved troublesome to some nurseries and a boon to others.

Construction of rail lines and the use of refrigerated cars allowed for long distance shipping of plants. The nursery business became a national industry in this half century, and mailorder sales, contract growing and multistate nurseries marked a growing inter-regional interdependence. Like many other American industries of the time, the nursery business had formed its own trade associations working to enhance common interests of its members.

Several new states had become major producers by 1920. Figure 7-6 shows the distribution of nursery sales by state for 1919 and the percentage change from that of 1899. The data reflect both the nationwide depression and the effects of Quarantine No. 37 for part of the year, but give a good sense of the growth of production as well. California had become the largest nurery producer in the country during this

period, surpassing New York, and several other states in the Northeast, Midwest and South were showing large increases over the 20 years. The consistent growth along the Atlantic seaboard from Maryland to Massachusetts, excepting New York and Pennsylvania, marked the growth of ornamental nurseries there serving the expanding suburban markets. Elsewhere the picture was mixed, and in the Midwest and the South some states increased while others decreased, with no strong regional patterns.

By 1920 the nursery industry was on the threshold of a strong period of growth. Most of the species of ornamentals in use today had been introduced, although many varieties remained to be developed. The industry had shifted fundamentally, from a collection of regional fruit and nut producing nurseries to the beginnings of an integrated national system producing mainly ornamental plants. And the imposition of Quarantine No. 37 had cut it off from its dependence on European propagators. The next period saw the further integration of a national production and distribution system, but it also saw some rough times as well.

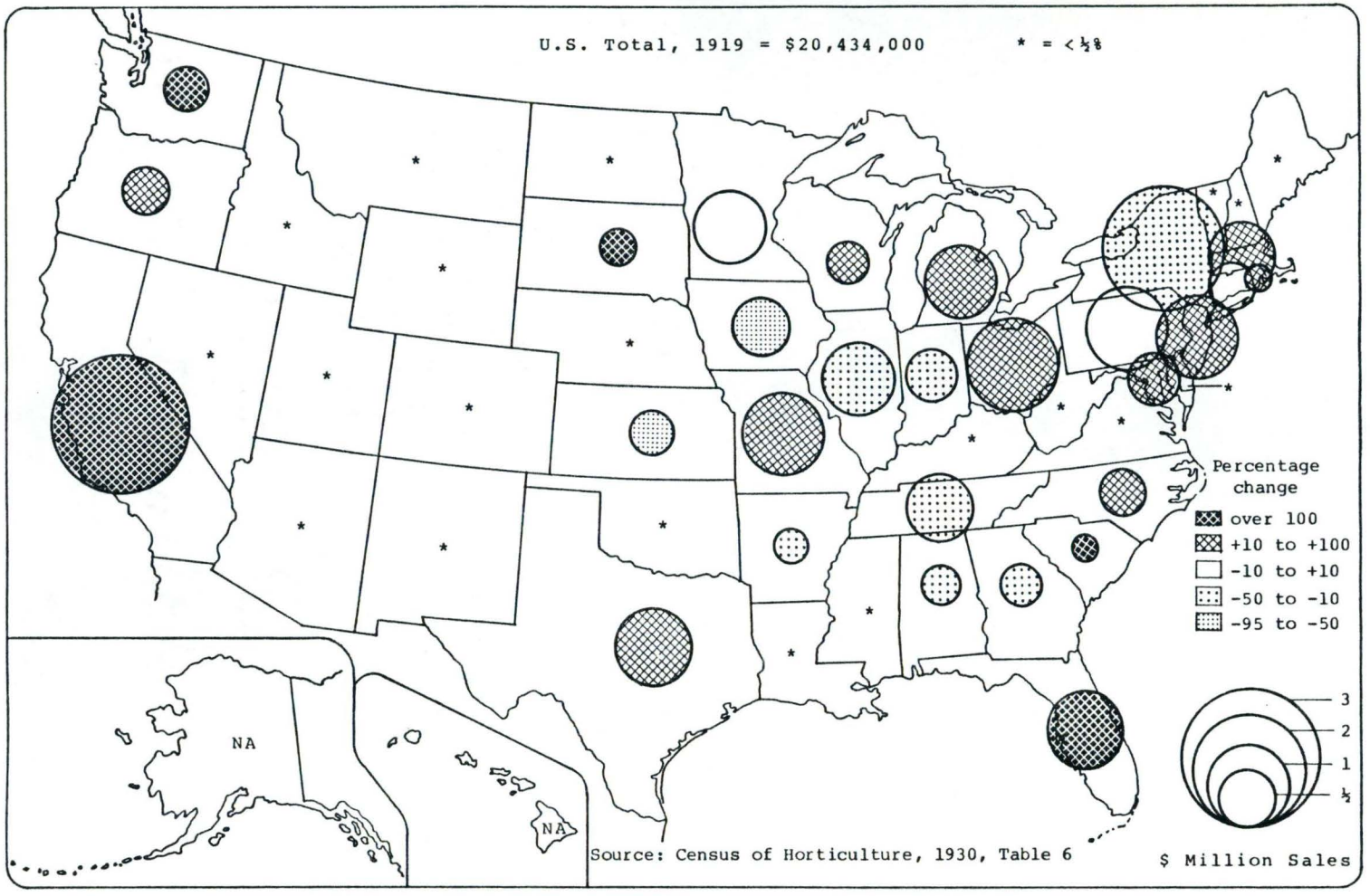


Figure 7-6. Nursery Sales, 1919, and Percentage Change from 1899

Chapter Seven - Notes

[1]The story of early afforestation and shelterbelt plantings is well told by William H. Droze, Trees, Prairies, and People: A History of Tree Planting in the Plains States (Denton, Texas: Texas Woman's University, 1977).

[2]Ibid., 18-29, for the story of the Timber Culture Act. The Act was repealed in 1891 when it had become clear that it was failing to meet its objectives of widespread afforestation on the plains.

[3]The story can be pieced together in broad outline from the capsule biographies of past presidents of the American Association of Nurserymen in White's A Century of Service, 355-458.

[4]Watson, Shade and Ornamental Trees, 227.

[5]Ibid., 226.

[6]White, A Century of Service, 165.

[7]Ibid., 362 and 374.

[8]Ibid., 411.

[9]Ibid., 391.

[10]Ibid., 379.

[11]Ibid., 328-331, in the discussion of the history of the Southern Nurserymen's Association.

[12]Ibid., 371 and 401.

[13]Ibid., 402.

[14]Ibid., 406.

[15]Hume, Camellias in America, 50.

[16]White, A Century of Service, 418.

[17]Ibid., 397.

[18]The early history of nurseries in the Pacific Northwest can be pieced together from the presidential biographies, and the history of the Pacific Coast Association of Nurserymen in White's A Century of Serivce, 318-325. Also good is Charles H. Potter, "Background and History of the O.A.N. (Oregon Association of Nurserymen), O.A.N. Digger 2 (August, 1957), 3; and 3 (July, 1958), 2.

[19]Van Laan, A Penny a Tree, 20.

[20]Ibid., 27.

[21]Ibid., 33.

[23]Ibid., 9.

[24]Ibid., 24.

[25]Ibid., 34.

[26]"A Bit of History" in the 1984 Price List of Oki Nursery Co., Sacramento, California.

[27]Van Laan, A Penny a Tree, discusses Sexton's on p. 21, Germain's on p. 24, Howard & Smith on p. 108, and Armstrong's on p. 108. For the early history of Armstrong Nursery Co. see also White, A Century of Service, 428.

[28]Watson, Shade and Ornamental Trees, 222-224.

[29]Ibid., 227.

[30]White, A Century of Service, 417 and 436.

[31]Shamarello, "The Nursery Industry in Lake County."

[32]Ibid.

[33]White, A Century of Service 372 and 409 on Augustine's, and 426 on Hill's. For Hill's see also L. L. Kumlien, "A Half Century of Evergreen Propagation," American Landscape Architect 1 (November, 1929), 29, 32-35.

[34]White, A Century of Service, 383 and 440.

[35]Ibid., 363.

[36]The decline of the Rochester nurseries is covered well in McKelvey, "The Flower City." Ellwanger and Barry's Mt. Hope Nurseries closed in 1918.

[37]Hedrick, History of Horticulture in America, 245; and White, A Century of Service, 378.

[38]A brief history of Jackson & Perkins before World War II is found in "Open Diamond Jubilee Rose Garden," American Nurseryman 86 (July 15, 1947), 16-17.

[39]White, A Century of Service, 369 and 359.

[40]Frederick McGourty, Jr., "Long Island's Famous Nurseries," Plants and Gardens 23 (1967), 58-61, 82.

[41]Hedrick, History of Horticulture in America, 247.

[42]White, A Century of Service, 407 and 415.

[43]Brief histories of major New England nurseries of the 1940s are contained in "A.A.N. members in New England," American Nurseryman 86 (15 July, 1947).

[44]San Bass Warner, Jr., Streetcar Suburbs; the Process of Growth in Boston, 1870-1900 (Cambridge, Massachusetts: Harvard University Press, 1962).

[45]Harold M. Mayer and Richard C. Wade, Chicago: Growth of a Metropolis (Chicago: University of Chicago Press, 1969).

[46]Warner, Streetcar Suburbs, 14.

[47]Of the 22,5000 houses built in the southern part of the Boston Metropolitan area between 1870 and 1900, slightly over half were single-family units (Warner, Streetcar Suburbs, 35). These were occupied mainly by the upper and central middle classes. The trend-setters of the era were, as now, people of the upper middle class, whose "tastes advertised the fashions of the day," and whose "habits presented models for the rest of the middle class," (Warner, Streetcar Suburbs, 53).

[48]Frank J. Scott, The Art of Beautifying Suburban Home Grounds of Small Extent (New York: John Alden, 1886), 14.

[49]Ibid., 29.

[50]Warner, Streetcar Suburbs, 179.

[51]Scott, Suburban Home Grounds, 299.

[52]Ibid., 61.

[53]Ibid., 22.

[54]Ibid., 294.

[55]Ibid., 456.

[56]Ibid., 338.

[57]The era is covered well in Newton, Design on the Land, particularly in Chapter 25, "The Influence of Charles A. Platt," 372-384, and Chapter 30, "The Country Place Era," 427-446.

[58]Fein, Frederick Law Olmsted.

[59]Ibid., for a case study see Martha Rogers, "The Bronx Park System, A Faded Design," Landscape 27 No. 2 (1983), 13-21.

[60]New York City set up a nursery to supply plants for Central Park as early as 1860. By 1865 the park was largely self-sufficient; Board of Commissioners of the Central Park (New York), Annual Reports 2-9 (1859-1866).

[61]See Alice M. Coats, The Plant Hunters, (New York: McGraw-Hill, 1969). The social and political underpinnings of nineteenth century colonial economic botany are explored in Lucile H. Brockway, Science and Colonial Expansion: The Role of the British Royal Botanic Gardens (New York: Academic Press, 1979). For a thoroughly enjoyable personal account by the greatest turn-of-the century plant hunter read Ernest Henry Wilson, A Naturalist in Western China (London: Methuen, 1913).

[62]Based on the list "Introductory Dates of Familiar Trees, Shrubs and Vines," Plants & Gardens 23 (1967), 87-89.

[63]Donald Wyman, Wyman's Gardening Encyclopedia (New York: Macmillan, 1971), 598.

[64]Gerd Krussman, The Complete Book of Roses, trans. by Gerd Krussman and Nigel Raban (Portland, Oregon: Timber Press, 1981), 166-167; Philip A. Livingston and Franklin H. West, eds., Hybrids and Hybridizers: Rhododendrons and Azaleas for Eastern North America (Newton Square, Pennsylvania: Harrowood Books, 1978). The leading American lilac growers were in Rochester, NY, among them John Dunbar and William Barry.

[65]Hedrick, History of Horticulture in America, 283.

[66]The types of plants available in the deep south in the period can be seen best in gardens of the period. See, for instance, Hattie C. Rainwater and Loraine M. Cooney, eds., Garden History of Georgia 1733-1933 (Atlanta: Peachtree Garden Club, 1933) and Loutrel W. Briggs, Charleston Gardens (Columbia, South Carolina: University of South Carolina Press, 1951).

[67]Reported in "Gardening News," Los Angeles Times, 6 August, 1904, p. 12; cited by Charles Henry Rowan, "Ornamental Plants as a Factor in the Cultural Development of Southern California," Master's Thesis, University of California, Los Angeles, 1957, 138.

[68]Rowan, "Ornamental Plants," 92.

[69]Ibid.

[70]Ibid., 66-72.

[71]Ibid., 139.

[72]Van Laan, A Penny a Tree, 52. Rowan also documents this change in taste in the early years of the century, p. 142-3.

[73]Alexander Oakey, Home Grounds (New York: D. Appleton, 1881).

[74]Walter Rogers, "Looking Backward to Cope with Water Shortages; A History of Native Plants in Southern Arizona," Landscape Architecture 69 (1979), 304-314.

[75]White, A Century of Service, 370.

[76]Ibid., 32.

[77]Ibid., 372-3 and 409-10 for Augustine's; 386 for Brown's; and 382 for the Texas Nursery Co.

[78]Ibid., 387.

[79]Ibid., 7-15.

[80]Canadians can still be members of the A.A.N., but they are required to also be members of the Canadian Nursery Trades Association (White, A Century of Service, 71).

[81]Ibid., 271.

[82]The regional nursery associations are well documented in A Century of Service, 292-346.

[83]Van Laan, A Penny a Tree, 95, note 15.

[84]Dates taken from Ralph H. Davidson and William F. Lyon, Insect Pests of Farm, Garden and Orchard, 7th ed. (New York: John Wiley & Sons, 1979).

[85]Van Laan, A Penny a Tree, 95.

[86]White, A Century of Service, 165-168.

[87]Ibid., 173.

[88]Proceedings of the 63rd Annual Meeting of the Western New York Horticultural Society, January-February, 1918, 115.

[89]Among them was John A. Armstrong, California rose grower, who spoke in favor of a quarantine in 1911 at the annual meeting of the Pacific Coast Nurserymen's Association (White, A Century of Service, 321). The extent of the dependence on nursery imports is seen by figures for 1896-1900. Imports averaged $884,562 per year, while exports were only $120,243. Total U.S. nursery production in 1899 was only $10,123,873.

[90]Ibid., 169.

[91]U. S. Dept. of Agriculture, Federal Horticultural Board, "Notice of Quarantine No. 37, Nursery Stock, Plant, and Seed Quarantine," Service and Regulatory Announcements (October-November, 1918), 101-110.

[92]White, A Century of Service, 175.

CHAPTER EIGHT

BOOM, BUST, AND BOOM AGAIN, 1920 TO 1950

The three decades following the first world war saw the nursery industry go through rapid and, in some cases, wrenching change. The implementation of Quarantine No. 37 required the establishing of American propagation nurseries and encouraged the development of more intensive breeding and varietal selection programs. Markets in this period changed abruptly several times. The business went through its worst boom and bust cycles as the rapidly expanding residential markets of the mid-twenties collapsed in the early thirties, then rose again sharply after the second world war.

Improved transportation, especially the use of trucks on federally built highways, made the national interchange of plants easier. This led to an increased emphasis on national marketing and regional specialization. Climate became a more important locational factor as transportation difficulties became less important. At the same time the first use of container-growing and soilless media began to make soils less important as a locational factor also.

The major market, residential planting, expanded tremendously in the '20s, only to shrink drastically in the early '30s, rebound in the late '30s, fall in the early '40s with the war, and finally boom to new highs in the late '40s. The turmoil made planting a gamble and long range planning very difficult. Government programs in the '30s opened new markets for reforestation, erosion control and slope stabilization

plantings, but new government-run nurseries gave private nurserymen competiton for these markets.

Though few new species were introduced in this period compared to previous years, many new varieties came on the market. Roses became very popular as breeding and selection produced new varieties with superior characteristics. Evergreen shrubs began to replace deciduous ones in popularity as styles changed throughout the period. As plants became consumer items in a mass market, marketing took new forms. Aggressive promotional campaigns, specialized retail garden centers and retail nurseries became important outlets, and the first chain-stores began to carry plants on a seasonal basis.

The industry became more economically specialized as some wholesale nurseries switched over to retail sales and landscape contracting while others gave up retailing to specialize in wholesale growing, and still others chose to concentrate on selected activities such as propagation, contract-growing, or mailorder sales.

This period set many of the basic patterns that have endured in the business through the following decades. By the end of the '40s, when sales began to rise again, it followed many of the trends established twenty years before.

The Aftermath of Quarantine No. 37

When promulgated in 1919, Quarantine No. 37 cut off most of the supply of European root stocks to American rose and fruit tree growers. It also eliminated most imports of "finished" flowering shrubs which had undergone extensive breeding in Europe and Japan: rhododendrons,

azaleas, camellias, and roses, among others. The quarantine permitted importation of plants and bulbs if free of all soil and individually inspected and certified to be free of pests and visible signs of disease. Nurseries were thus able to import small shipments of budwood and grafting stock, but quantities were much smaller than in the years before the quarantine and nurserymen were quick to realize the need for American propagators and breeders.

The federal government became involved further through the work at U.S.D.A. experiment stations and at land-grant colleges,[1] but the most immediate results were achieved by nurserymen trying to fill a large new market demand. Nurseries in the Kaw valley of Kansas, which had produced as much as 90% of the nation's apple rootstock at the turn of the century, mostly on native species, only to lose their market to imported French rootstocks in the early decades of this century, began to do the same again and produced rootstock from French cider apples in large quantities once more.[2]

In California, rose growers experimented with several rootstocks including those previously imported from Europe like Manetti and Rosa canina plus local American choices such as R. odorata and Ragged Robin.[3] They entered the new market in a big way, realizing that the nation's appetite for roses was rapidly increasing. George Roeding's newly acquired California Nursery Co. at Niles planted two million cuttings in 1920, mostly Manetti, for their own use and several thousand more for sale at wholesale to other growers.[4] Jackson & Perkins Co., which had been growing rose plants in New York, New Jersey, and California before the quarantine, largely on imported rootstock, began

to grow more in Pleasanton, California, just east of Niles. By 1923, George Perkins could state that "California is already turning out more rose bushes than were imported in pre-war days."[5]

Rose production also increased dramatically in east Texas, particularly in the area around Tyler in Smith County. By 1936 two hundred growers there were selling eight million plants a year,[6] though they lacked the care of the California growers in selecting rootstocks.[7] Greenhouse production of roses on their own roots from cuttings was also important in Ohio in the '20s.[8] Older rose nurseries in the Northeast continued to raise them also, now mostly on California-grown rootstock.

Nurserymen raised other plants for themselves that had been imported previously, and they began more actively to select and hybridize them. The Domoto Brothers of Oakland, California, for instance, imported some of the first Kurume azaleas to this country from Japan in the years immediately before the quarantine. They continued to select from among these in the following years and sold promising varieties to eastern nurserymen, some of whom continued to improve them as well.[9] In Mobile, Alabama, the Overlook Nurseries imported camellia seeds from Japan in the '20s and selected from the seedlings several varieties which became popular by the '40s.[10]

The search for new varieties, whether in roses, camellias or any of the other popular flowering shrubs, was motivaated in large part by a desire for novelty among the consuming public.[11] But it also sought to find plants more resistant to pests or better able to survive harsh climatic conditions which had previously limited a plant's range.

It was in this period that nurserymen finally solved one of the problems that had plagued them for years, the protection of proprietary rights to new plants. Nurserymen had debated for many years the idea of using the nation's patent laws to register and protect the ownership of new varieties. Opposition had been strongest from the large agency firms who sold plants developed by others, often in Europe. When the quarantine required Americans to develop new plants and when the agency sales method lost ground to mailorder and retail nursery sales, more nurserymen saw merit in the idea. The A.A.N. lobbied Congress and the U.S.D.A., and in 1930 the patent act was amended to include plants reproduced asexually.[12] The first plants patented were mainly roses and fruit varieties; by 1934 there were 84 patents, and by 1943 there were 610.[13] Many of the early patents were, unfortunatley, used to ballyhoo the novelty of plants much in the way that patent medicines had been marketed a generation earlier. But the protection of proprietary rights seems to have encouraged more research into breeding and hybridization, especially among the rose growers,[13] but also among other growers as well.

The Importance of Climate

The rise of a large rose propagating industry in California and of smaller ones for rhododendrons, azaleas, and camellias on the Atlantic and Gulf coasts,[14] underscores the importance of climate to the changing locations of nurseries in this period. The reason most often cited for the success of California and Texas as growing areas for rose plants was the faster and more vigorous growth possible in these

areas with longer growing seasons than in the Midwest or Northeast.[15] This growth was especially important in rootstocks. What took one year to reach a saleable size in California might take two years in Ohio or New York. The plants could still be shipped to the East for budding and growing on, but increasingly even this was done in California or Texas.

The same was happening with other plants as well. Owen Wood, for example, was a nurseryman with 200 acres in Bristol, Virginia, planted to a wide range of ornamentals. He also had a smaller nursery in Poplar, North Carolina, raising native plants, and another one near St. Petersburg, Florida, where he raised azaleas and camellias.[16] Mt. Arbor Nursery in Shenandoah, Iowa, had land in eastern Washington where they raised fruit trees and land in the San Joaquin valley of California where they raised rose plants.[17]

Contract growing also increased, based on climatic production advantages, and many of the southern and West Coast nurseries grew plants on contract for wholesalers in other, colder, areas of the country. Whereas before, contract growing and multi-state nurseries had been seeking to supply specialized plant types to firms marketing nationally and to supply regional markets, now they were increasingly used to supply a wide array of plants to firms with established markets in the Northeast and Midwest.

This was also a time when horticulturists began to establish the first sets of criteria for defining hardiness in ornamental plants. Alfred Rehder published his map of climatic zones in North America in 1927 in his Manual of Cultivated Trees and Shrubs, based on annual minimum temperatures.[18] In 1940 he revised the book and refined the

map of climate zones further.[19] Rehder was curator of the Herbarium at the Arnold Arboretum, and using temperature data assembled by U.S. Weather Bureau, Arnold Arboretum continued to refine and update its map of hardiness zones in following years. In 1928 the U.S. Department of Agriculture published one of the advance sheets from its Atlas of American Agriculture, with a map showing average annual minimum temperatures.[20] The U.S.D.A. used different intervals from those chosen by Arnold Arboretum, and the two systems have both continued to the present day in use for purposes of broadly defining zones of plant hardiness (see Figures 4-1 and 4-3).

Transportation Improvements

The achievement of production advantages based on climatic influences on plant growth was made possible by improvements in transportation of plants. As long as moving plants from grower to gardener was unreliable or risky, the cost of transportation or its associated risks prevented nurserymen from seeking new sites purely for climatic purposes. The major means of transporting nursery plants before the first world war was the railroad. Refrigerated cars had become widely available since the turn of the century, and railroad companies continued to build more track into the 20s, linking as many towns as possible into a national transport system.

By the twenties, though, automobiles and trucks had become prevalent in many areas and the building of more and more paved roads gave them access to much of the nation.[21] By the 30s, many nurserymen were shipping by truck, especially for distances under 1,000

miles. Railroads continued to carry large shipments, a car load or more, and those sent long distances, but for shorter hauls or for smaller loads on some long hauls, more and more nurserymen used trucks.[22]

Trucks became particularly important in marketing wholesale plants to retail nurseries in large metropolitan areas. They may have also encouraged the rise of smaller wholesale growers near the major markets by freeing them from a dependence on rail lines for nursery locations. In the large metropolitan areas of the Northeast and Midwest, as well as in California, the use of trucks permitted greater flexibility in the choice of locations which was an asset in serving a variety of large local markets.

Quarantines and Inspections

While shipment of plants was greatly facilitated by new trucks and highways, it was at the same time restricted by state and national quarantines. The spread of pests and diseases introduced in previous decades continued in this period, and most states enacted laws regulating the importation of plants and produce from infested areas. A large variety of selective federal quarantines also tried to stop the spread of infestations. In the early years, outright prohibition was used, but as the regulations proved more and more restrictive to nurserymen and other farmers they began to demand the right to ship or import plants which could be inspected and certified to be free from contamination.[23]

Efforts to establish a nationwide federal inspection program through the U.S.D.A. failed repeatedly, due to opposition within the

nursery business, primarily from large national wholesalers and mail order firms and from many states which felt their own regulations would do a better job of protecting their own interests. Instead, states began to coordinate their standards and practices of inspection and certification. By 1937, fifteen states had established reciprocal agreements, and by the early '40s most states with import restrictions recognized the validity of inspection and certification in other states. In addition, federal quarantines recognized state certifications, and although both state and federal quarantines continued, and in many cases were expanded, they were largely mitigated by certification programs which permitted shipments of clean stock across quarantine lines.

Perhaps no single domestic quarantine had as much impact on the nursery business as that established in 1919 to control the spread of the Japanese beetle. Federal quarantine prohibited shipment of plants from infested areas in central New Jersey in that year, but the insect continued to spread. By the next year it was found in eastern Pennsylvania and by 1926 quarantines had been placed on the entire state of New Jersey, most of eastern Pennsylvania, and parts of Delaware, New York, and Connecticut as well.[24]

The quarantine devastated the business of large wholesale growers in these areas; their regional and national markets were cut off. One large wholesaler saw its sales drop from $900,000 to $90,000 in a single year.[25] Nurserymen in the quarantine area formed a regional association, the Eastern Nurserymen's Association in 1921 and throughout the '20s worked to secure relief from the quarantine. By the early '30s the federal government had begun to allow shipment of inspected and

certified plants.

The beetle also continued to spread despite the quarantine. By 1933 it had been found in a total of fourteen states from Maine to West Virginia. The expansion of the infestation thus opened up a larger regional market within the quarantine area which also alleviated the effects of the restriction. By 1933 over 30% of the nurseries in the quarantine area were certified free from Japanese beetles and able to ship outside the area. Some 9,800,000 plants were sent under certification to non-infetsed areas that year. This represented about 15% of the sales of all nurseries in the regulated area.[26]

Other quarantines were also mitigated in a similar manner by certification, although many disease and fungus organisms proved too difficult either to eradicate or to inspect. Some quarantines thus remained effectively as barriers to shipment between areas of some types of plants.

Container-Growing

Among the changes in this period working to free nurserymen from their dependence on certain limited site conditions for their nursery locations was the development of the practice of growing plants in containers rather than in the ground. Some nurseries had for many years used clay pots to grow certain shrubs on a limited scale, but it was during the first world war that nurserymen in California began to use metal cans, discarded from seafood canneries, to grow large numbers of plants. Container-growing allowed planting out by gardeners during the summer months because it greatly reduced the shock and root damage in

transplanting. It extended the sales season for many types of plants beyond the normal spring and fall periods.

The practice was adopted first in northern California and spread slowly to a variety of nurseries throughout the state by the time of the second world war.[27] Nurseries in the southeastern states began to adopt the practice in the '30s and '40s and began to experiment with other materials as well. One midwestern nursery, the Cloverset Flower Farm of Kansas City, for example,[28] made stapled asphalted paper containers intended for potting up field grown shrubs for retail sales, but tin cans were used almost exclusively by most nurseries for growing plants to finished sizes.

Container-growing was most successful with evergreen shrubs, both broadleaf and needleleaf. The reduction in weight compared to field-grown, ball-and-burlap plants allowed for easier handling, cheaper shipping charges, and a longer planting season.[29] Container-growing was only just begun in this period, however, primarily in California, and its locational impacts did not become clear until the '50s.

New Ways of Marketing

The marketing of plants changed also in this period. Before the '20s, a person ordered plants at a local nursery, which often as not grew most of its own plants. The nursery then delivered the plants to the planting site and usually planted them as well. In the twenties there was a shift among many nurseries, especially in metropolitan areas, to more specialized retail services, such as landscape design, construction, and maintenance. Many of these stopped growing their own

plants and relied on purchases from large wholesale growers instead. Such large combination grower/retailers as Hick's Nurseries on Long Island, Hillenmeyer's Nurseries in Lexington, Kentucky, and the California Nursery Co. at several sites, concentrated their activities on their retail and landscape construction activities in the '20s and '30s.[30]

At the same time a new kind of retail outlet developed in the form of the garden center, selling plants, tools, fertilizers, and seeds, previously available only at separate nurseries, hardware stores, feed and seed dealers, etc. Many large chain stores such as supermarkets and department stores also opened small garden centers and sold plants. Much of this was made possible by the growing use of private automobiles which permitted customers to come in and buy plants and supplies supermarket-fashion. It tended to make plants into consumer items in a mass market, and the early moves toward container-growing may have been a response to this new way of treating plants.

The mailorder business grew rapidly in this period also. The 1929 Census of Horticultural Specialties found mailorder nursery sales of over $5 million, some 15% of all retail nursery plant sales in that year. A special survey conducted for the A.A.N., in 1927 estimated that mailorder sales made up 35% of all retail sales.[31]

Figure 8-1 shows the distribution of mailorder retail sales reported in the 1929 special census. Michigan was the national leader. Its $580,897 of catalogue sales made up 37% of that state's retail total and even exceeded the total for wholesale sales of nursery products. The leading mailorder states otherwise were in the old nursery belt from

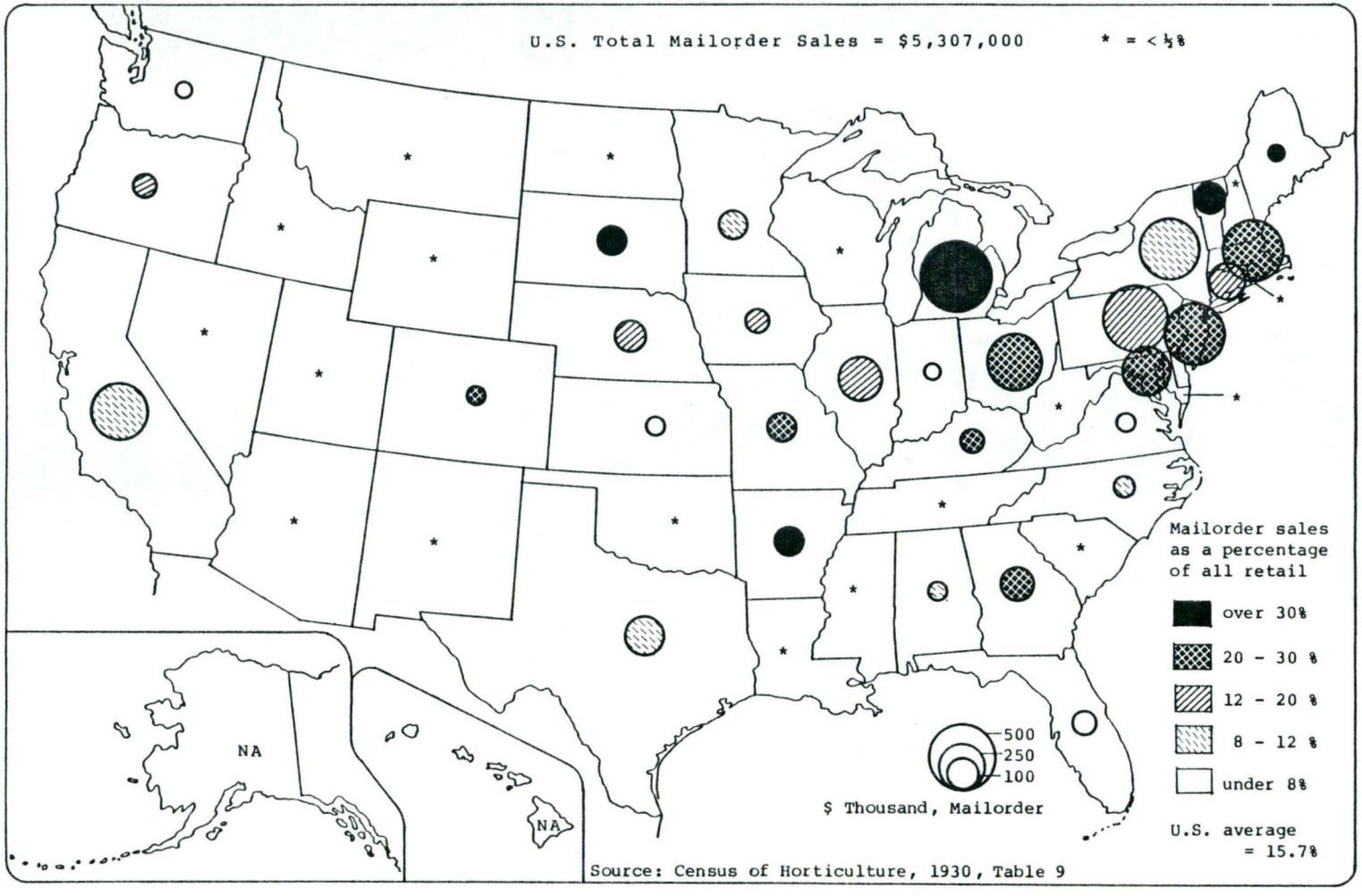


Figure 8-1. Mailorder Retail Sales, 1929, as a Percentage of All Nursery Sales

New England to the Midwest. It is interesting to note that the states in which mailorder sales made up the highest proportion of retail sales were in relatively peripheral locations: Maine, Vermont, South Dakota, and Arkansas. These were also states with small nursery sales overall. And the states which were characterized by large wholesalers such as California, Oregon, Texas, and New York, had a disproportionately small share of mailorder sales.

The mailorder firms formed their own trade association in 1934, the National Mail Order Nurserymen's Association, from the amalgamation of three smaller organizations formed only a few years before. The three areas which had earlier separate organizations were in the eastern Midwest (Michigan, Indiana, Ohio), Iowa, and the Del-Mar-Va peninsula.[32]

As some nurseries turned more and more to retail sales, some through mailorder catalogues, others turned more to wholesale growing and gave up their retail operations. Bailey Nurseries near St. Paul, Minnesota and Tomlinson's Select Nurseries in Brea, California were two which followed this route.[33] Census data for 1929 show the amount of retail and wholesale sales in each state, and Figure 8-2 shows their distribution. The national average of wholesale to retail sales was 42.4%. Fourteen states had over the national average, including three, Oregon, Iowa, and Alabama, where wholesale sales were twice as great as retail sales. Other states where wholesale sales exceeded retail were Rhode Island, New Jersey, Delaware, Ohio, Texas, and California. These can be taken to be the main wholesale producing states of the nation. Those states with above average proportions of retail sales are,

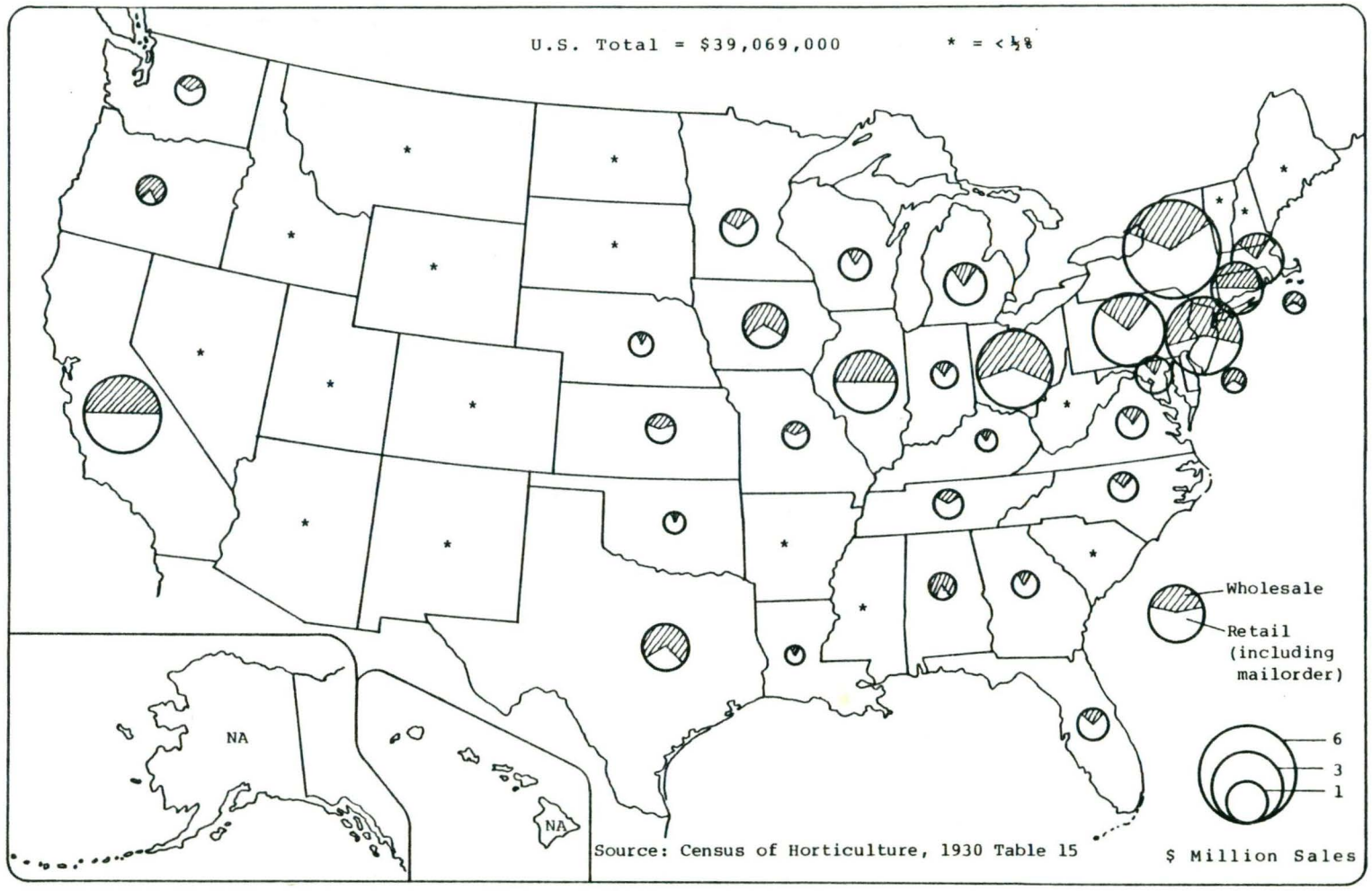


Figure 8-2. Wholesale and Retail Nursery Sales, 1929

presumably, the markets for these states, although with the growing importance of regional specialization and interstate shipment of plants, almost all states undoubtedly both imported and exported plants of different types.

Many large growers sold to other wholesalers, especially those doing mailorder or other retail business. Owners of plant patents used this outlet to increase their sales via royalty payments. Jackson & Perkins had 22 licensed outlets in 1936 for their various patented roses, for example, and J & P in turn sold some of the other growers' patented plants.

Sales promotion became an important activity of the A.A.N. in the 1920s as nurserymen, realizing that their product had become a consumer item in a mass market, sought to help create that market. In the words of Laurie and Chadwick, in their book The Modern Nursery, "The first job of the nurseryman who sells nursery stock is to create a desire in the mind of the client for what he has to sell."[34]

The A.A.N. initiated a national sales promotion campaign from 1919 to 1924, based on the two slogans "It's Not a Home Until It's Planted" and "It's Not a Farm Home Without Fruit." The campaign was based on voluntary contributions from association members, however, and too few helped support the idea for the campaign to be very effective.[35] From 1929 to 1932 a second campaign was run by the A.A.N., with the same slogans but with much more financial participation from the membership. The L. W. Ramsey Co. of Davenport, Iowa was hired to do a survey of the industry and its potential markets in 1927, and then in 1929 re-hired to run the publicity campaign. Educational booklets on home planting,

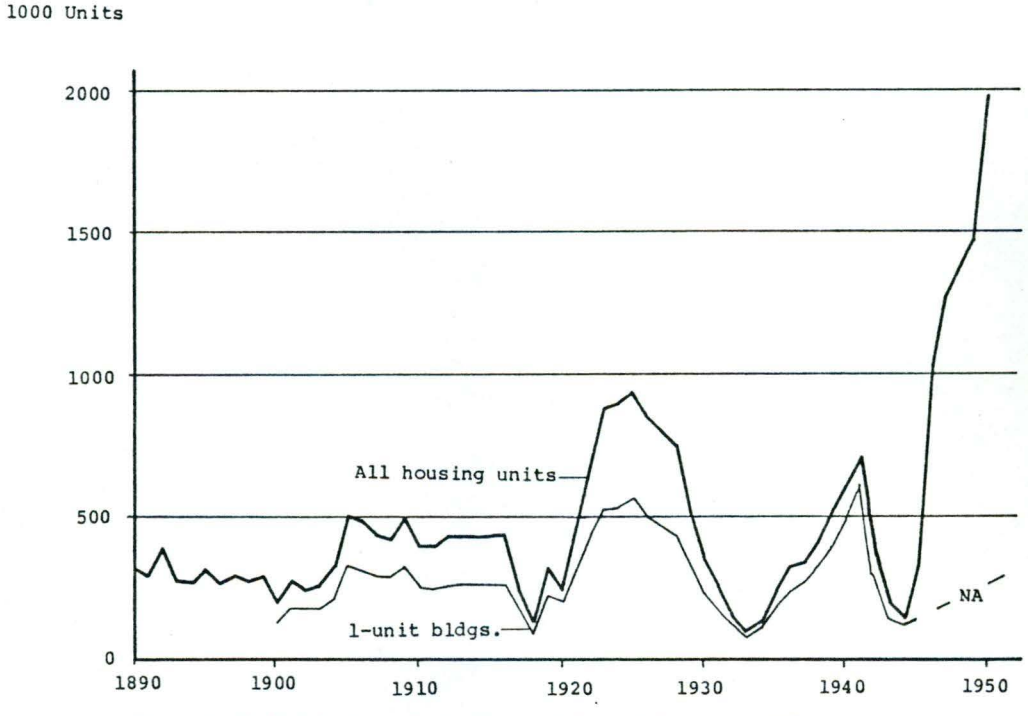
press releases to newspapers and radio stations, and a series of yard and garden contests in over 700 towns throughout the country marked the effort. The great depression cut short the campaign, however, when nurserymen could no longer afford to support it.[36]

The permanent accomplishments of the '29 - '32 campaign were influential in the later development of markets for the nursery business, though. They are, as reported by the A.A.N.'s history A Century of Service, establishing the concept of the "outdoor living room" for the nation's back yards, the initiation of gardening columns or departments in many magazines and newspapers, the general strengthening of home gardening as a hobby in America, and a significant amelioration of the effects of the depression: nursery business reportedly fell off only 16% below normal in 1932, compared to 67% in the building industry.[37]

New Markets, 1920 to 1950

The market for plants broadened during this period, but went through some major changes from decade to decade. In the 1920s, tremendous suburban growth took place in cities in all parts of the country. Between 1920 and 1929 over six million new housing units were built, Figure 8-3. Over two-thirds of these were single family houses. This was almost twice as many as were built in each of the previous two decades.[38]

With the increasing use of private automobiles and buses, suburban housing was freed from its dependence on fixed rail mass transit. Developers built farther from the center of town and with larger lots



Source: Historical Statistics of the U.S., Colonial Times to 1970, Series N 156, 159

Figure 8-3. Housing Starts per Year, 1890 to 1950

than had been common for the majority of units previously. The average lot was still a small one, however, far smaller than the upper middle class suburban ideals. It did permit a yard and a few trees and shrubs, though, and the market for ornamentals was greatly expanded by the proliferation of millions of suburban yards.

The millions of new home gardeners came from a much broader social spectrum than in the past, and while upper class tastes may have still influenced their choices of plants, they also had many of their own preferences.[39] No longer did one or a few arbiters set the tone for the nation's landscape tastes. Advice was available in a number of books and magazines concerned with home landscape design, and while it is almost impossible to find much uniformity in their views, they are illustrative of the general trends of the period.

One trend which had been growing since the turn of the century was the use of foundation planting along the front and sides of a house. Whether to screen an unsightly raised foundation or simply to display a line of specimen plants, the practice had become commonplace by the '20s. Some critics decried the common practice of overplanting the foundation. M. E. Bottomley, a Michigan landscape architect, wrote in The Design of Small Properties in 1926 "There should be nothing displeasing in the masonry foundations of buildings . . . . A good maxim is to use vegetation merely to soften, to enframe, or to add a touch of decoration . . .. a stretch of the wall here and there is rather satisfying."[40]

Most gardeners were not put off so easily, however, and they had other books and landscape architects to support the practice. Frank A.

Waugh, Head of the Division of Horticulture and Professor of Landscape Gardening, Massachusetts Agricultural College, Amherst, Mass., wrote in his preface to Leonard Johnson's Foundation Planting in 1927:[41]

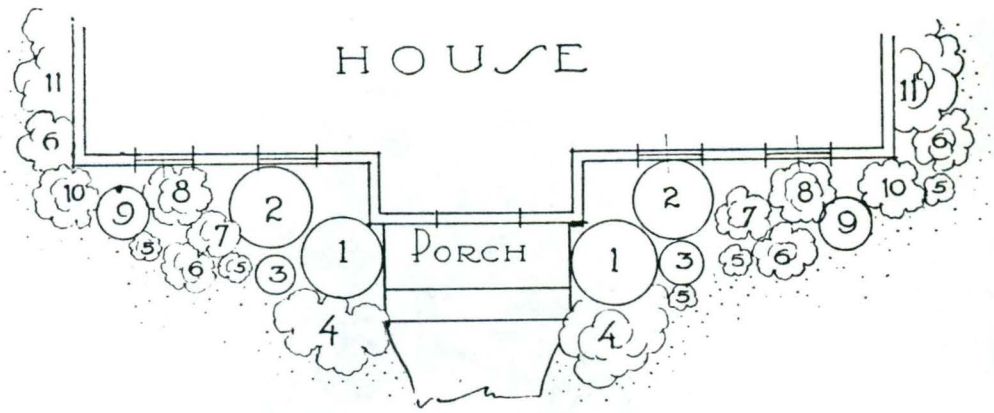
> In the Old Country the primary planting which gives a home its individuality is a hedge all along the street front. The American home is characteristically different in that it is open to the street. The plantings, instead of forming a hedge on the street line, are pushed back against the foundations of the house. They are foundation plantings. This type of planting is therefore fundamental to the whole of American domestic landscape architecture in a double sense. It is hardly too much to say that this is altogether the most important branch of landscape architecture, socially considered, in the entire field of practice.

Johnson's book goes on to show dozens of illustrated examples of both good and bad foundation planting. Figure 8-4 is typical. Whatever the merits of foundation planting, it provided a large market for shrubs of many kinds. The A.A.N.'s "Survey of the Nursery Industry" in 1927 found an average of 20 shrubs planted around the average home, over half of them as foundation plants, plus an additional 15 as hedges,[42] Table 8-1. Among woody ornamentals (not including fruit plants), the 1929 Census of Horticultural Specialties found deciduous shrubs to be the leading category, with some 42.8% of the total number of plants sold, followed by rose plants with 29%.[43]

The most common plants were, apparently, those popular a generation earlier, deutzias, weigelas, spireas, forsythias, lilacs, barberries, viburnum, and philadelphus.[44] Coniferous evergreen shrubs, many of them dwarf varieties of trees, were also popular for foundation plantings. And while some critics argued for using only the old standards, many gardeners continued to be fascinated with colored, variegated, and

An effective planting in which well placed evergreens and shrubs are made use of

1. Green Retinospora
   Retinispora plumosa
2. White-leaved Retinospora
   Retinospora flavescens variegata
3. Dwarf Golden Oriental Arborvitae
   Thuja orientalis var. aurea nana
4. Thunberg Spirea
   Spiraea thunbergi
5. Plantainlily
   Funkia subcordata grandiflora
6. Japanese Barberry
   Berberis thunbergi
7. Bumalda Spirea
   Spiraea bumalda
8. Jetbead
   Rhodotypos kerrioides
9. American Arborvitae
   Thuja occidentalis
10. Hybrid Lilac (Ludwig Spaeth)
    Syringa vulgaris
11. Vanhoutte Spirea
    Spiraea vanhouttei



Source: Johnson, Foundation Planting, 115

Figure 8-4. Example of Foundation Planting

Table 8-1. Number of Ornamental Plants Around the Average American House, 1927

Plant	Number
Trees (deciduous)	5
Street	1
Shade	1 1/2
Fruit	2 1/3
Shrubs (deciduous)	21
Roses	3 1/3
Other	17 1/2
Hedge Plants	15
Evergreens	3 1/3
Vines (incl. roses)	3 1/3
Small Fruits	1 2/3
Perennials	15

Adapted from "The Present and Potential Nurserymen's Market," Table 1, p. 4 in Laurie and Chadwick, The Modern Nursery.

cutleaf varieties.

Park and street plantings continued through this period. New park construction was greatest in cities of medium size, especially in the South and West. The trend in park planning in this period was toward building active recreation facilities rather than landscape plantings for passive recreation.[45] The many new parks built in the 1920s and '30s, though, continued to provide a market for trees and shrubs. In many cities rose fanciers encouraged the establishment of municipal rose gardens which, though providing only a small market for roses themselves, helped popularize residential rose plantings.

Street tree planting also increased in this period, though not as rapidly as in the previous one. But the large increases in the area of suburbs provided a continuing market for new trees during the periods of active construction in the '20s, late '30s, and late '40s. Species planted continued to be much the same as previously in most places, although selection of the ones most adaptable to local conditions brought some changes. Most common were the large shade trees: species of maple, oak, elm, ash, linden, etc.[46]

One new market that became important was that for highway planting. The rapid increase in road paving throughout the nation, but most significantly in metropolitan areas where the recreational nature of automobile driving was important, led to the designing of pleasure drives and parkways with ornamental landscaping. The parkways of Westchester County, New York, are perhaps the most famous of the period, due to the design skills of Gilmore Clarke, but many other cities and counties used extensive plantings to enhance the motorist's visual pleasure.[47]

In the 1930s the depression sharply curtailed the residential landscape market for plants and slowed down park, street, and highway plantings. But new markets were opened by some of the large public works projects of the decade. Especially important were the soil conservation programs which called for the planting of trees and shrubs to stabilize soil or protect it from wind erosion.

The large Great Plains Shelterbelt Project begun in 1934 (renamed in 1937 the Prairie States Forestry Project) and terminated in 1939, helped create an outlet for nursery sales of deciduous trees and shrubs as windbreaks in the region.[48] Government supported nurseries, however, were used to produce much of the deciduous and almost all of the coniferous plants used for this project and many others. These public nurseries, funded earlier by the Clarke-McNary Act of 1924, were a thorn in the side of commercial nurserymen in the Midwest throughout this period. In several states, though, nurserymen were able to work out a compromise with the government whereby deciduous plants were to be purchased from commercial nurseries while government nurseries produced the evergreens.[49]

In the late '30s, residential construction recovered to pre-depression levels for a few years, then fell off sharply again as the second world war prevented further building. The war also curtailed nursery production by making supplies and materials hard to obtain. Tin cans were requisitioned for the scrap metal supply of the war effort, for instance, until the A.A.N. convinced the War Production Board in 1943 that container-growing was beneficial to the war effort.[50]

One way the nursery industry contributed directly to that war

effort was by selling plants to the Army for camouflage around military installations. Another was by selling vegetable starts to the public for Victory Gardens; yet another was by converting nursery acreage to production of needed food and fiber crops.[51]

After the war came a tremendous boom in construction, which by 1946 had already surpassed the pre-war peak of 1925. Given the natural two to five year production time required for most woody ornamentals and the lingering memories of the strong recession which had followed the end of the first world war, most nurserymen were either unable or unwilling to produce enough plants to meet the increasing demand. As a result there was a serious undersupply of plants for a few years, but by 1949-50 most nurseries were in full production and had come to realize that the good times were indeed back again.

Locational Change and Regional Specialization

In 1919 the Census counted 4,049 farms in the nation growing nursery stock, down substantially from the 5,582 in 1909. Much of this decline was due to the effects of the post-war recession.[52] By 1929 the Census found 7,207 nursery farms, and in 1949 there were over twice that number, 14,744.[53] Most of these, though, were not nursery specialty farms, but general farms with a small production sideline of nursery plants. The 1949 Census of Horticultural Specialties found only 4,643 farms with over $1000 in sales of nursery products, but they were responsible for producing over 90% of the plants.[54]

Many new nurseries were established in the boom years of the 1920s and even a few in the '30s, though probably more went out of business

during the depression years. The 1949 special census included a list of leading counties in sales of nursery products. Figure 8-5 shows the 50 leading counties that year. It shows nursery production concentrated in three principal areas: the eastern seaboard from Delaware to Massachusetts (17 of the 50 counties), the southern margins of the Great Lakes (10 counties), and along the Pacific coast (8 counties).

This marks a sharp break with the pattern in 1899, the last year for which data are available by counties (Figure 7-3), when the bulk of the production was in the continental interior. This shift in locations had accompanied the shift away from fruit and nut stock production toward ornamental stock production. It marked a move toward the metropolitan markets for ornamental plants, and it also shows a shift in favor of special areas with climatic production advantages, away from the large urban markets, as along the Gulf and Pacific coasts.

It is interesting to note the areas where nursery growing continued to be important nationally from 1899 to 1949. Of the top 50 counties in 1899, fully 22 of them were still among the top 50 a half century later, Table 8-2. These are indicated by shading on the map in Figure 8-5. Despite the great shift overall from 1899 to 1949, away from interior continental locations to exterior and coastal ones, much of the nursery business either was in good locations early on or maintained itself through the years by aggressive marketing or the reputation of a good name. There were many of the former along the Atlantic and Lakes coasts, led by Lake County, Ohio, which was eighth in 1899 and fourth in 1949. There were only four of the latter, foremost among them Page County, Iowa, which was third nationally in both years. These were also

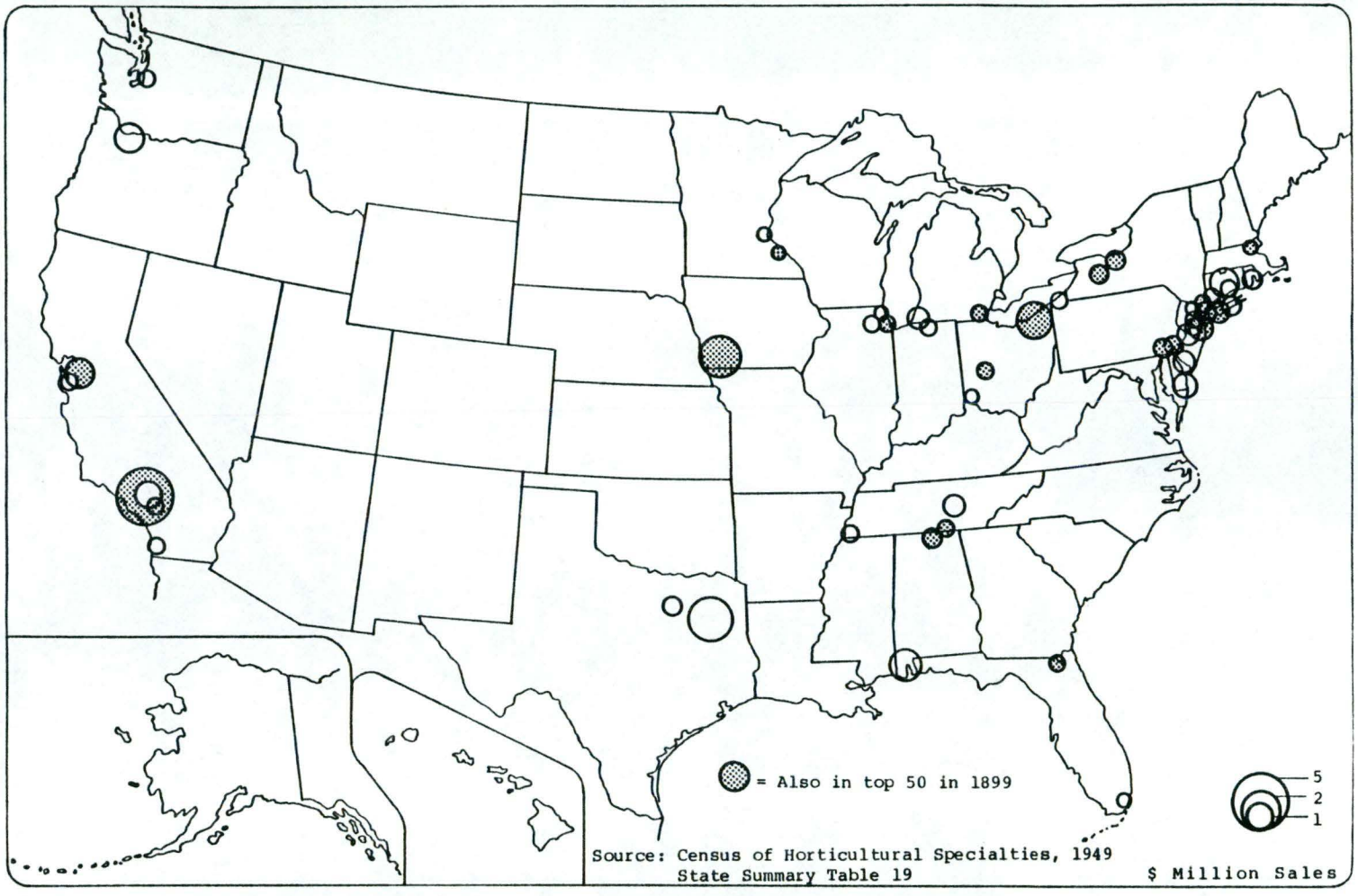


Figure 8-5. Fifty Leading Counties in the Sale of Nursery Products, 1949

Table 8-2. Fifty Leading Counties, 1899 and 1949.

County, State	Rank, 1899	Rank, 1949
Middlesex, MA	13	46
Nassau, NY	48	18
Queens, NY	49	15
Westchester, NY	32	38
Wayne, NY	4	21
Livingston, NY	17	19
Monmouth, NJ	27	11
Union, NJ	16	49
Chester, PA	5	20
Montgomery, PA	19	26
Lake, OH	8	4
Miami, OH	9	14
Monroe, MI	7	32
Cook, IL	29	28
Wabasha, MN	28	44
Page, IA	3	3
Franklin, TN	14	39
Madison, AL	18	24
Baker, FL	41	31
Alameda, CA	15	8
Los Angeles, CA	38	1
Riverside, CA	24	30

the only two counties which remained among the top ten in both years. Five others of the top ten in 1899 had dropped below 50 in 1949, and conversely six of the top ten in 1949 were not in the top ten in 1899. This marks the growth or decline of major centers of production over the 50 year period.

Along the Atlantic and Lakes coasts almost every county which was a leader in 1899 continued as a leader in 1949, with the important exceptions of Monroe and Ontario Counties in New York. These had been #1 and 2 in 1899, but both had fallen below 50 by 1949. Indeed Monroe County, home of the great Rochester nurseries, was not even among the top 100 counties in 1949.

The change in market demand, from fruits to ornamentals, and the accompanying shift in market locations, from rural to urban areas, can be seen in these broad outlines over the 50 years. In the shorter period from 1929 to 1949 the census data also reveal finer patterns of a shift toward regional specialization in the types of plants produced, Figure 8-6 and Table 8-3. In the two decades of the 1930s and '40s there was a 50% increase in the number of plants sold and some important shifts in plant types sold.

Deciduous shrubs, which made up some 42.7% of the plants sold in 1929 with 27,640,536 plants, were down slightly to 21,463,951 plants sold in 1949, despite the overall increase in nursery sales, and made up only 21.4% of the total in that year. Rose plants, on the other hand, had increased dramatically from 18,128,232 to 46,230,329 plants, and from 28.0% to 46.1% of all woody ornamentals sold. As impressive was the fourfold increase in broadleaf evergreens, from 3,127,310 to

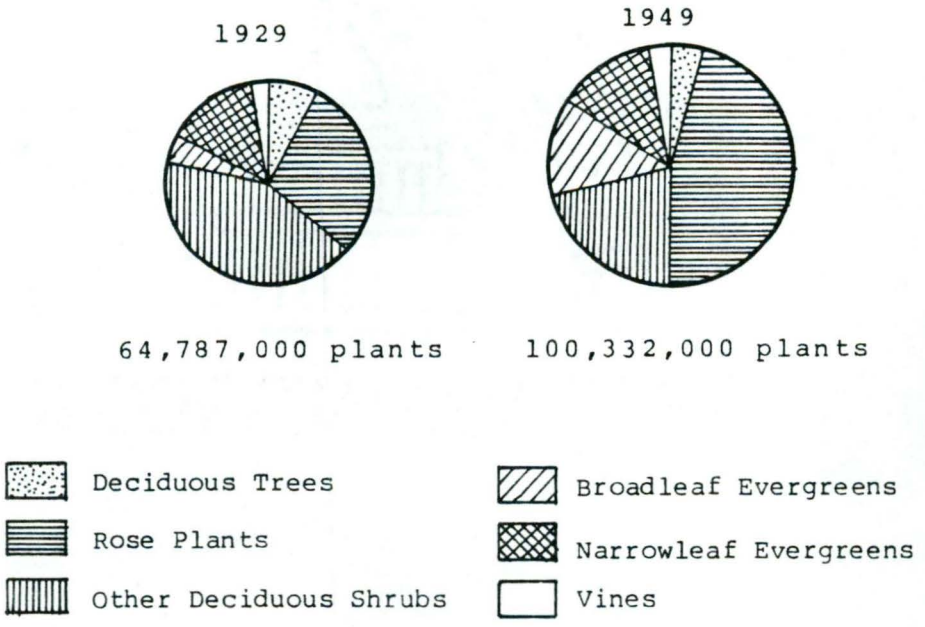


Figure 8-6. Woody Ornamentals Sold, by Type and Number, 1929 and 1949

Table 8-3. Woody Ornamental Plants Sold, by Type and Number, 1929 and 1949

Type of Plant	1000 Plants Sold 1929	%	1949	%
Deciduous trees	4,755	7.3	3,919	3.9
Rose	18,128	28.0	46,230	46.1
Other deciduous shrubs	27,641	42.7	21,464	21.4
Broadleaf evergreen	3,127	4.8	13,000	13.0
Narrow leaf evergreen	9,240	14.3	12,403	12.4
Vines	1,896	2.9	3,316	3.3
	64,787		100,332	

Source: U.S Bureau of the Census, Census of Horticultural Specialties, 1949, Chapter B, Table A.

13,000,322 plants (4.8% to 13.0%). Conifers also grew, though the percentage of the total declined slightly, whereas vines increased in both ways. Deciduous trees declined in a way comparable to deciduous shrubs, falling some 18% in numbers, and going from 7.3% of the total to only 3.9% in 1949.

In selected individual states from different regions of the country these general patterns took very different forms, Figure 8-7. In the Northeast, both Ohio and New York, the number of woody ornamentals sold decreased between 1929 and 1949. In New York the decline was due largely to the drop in deciduous shrubs and in roses grown in the state. The shift of rose-growing to California and Texas had a large impact on the New York nursery business. In Ohio the drop was due mostly to declines in deciduous shrubs and trees, and roses actually increased, along with all the other categories.

In Michigan the total declined slightly but showed a major shift from deciduous shrubs to conifers. In fact, in all three of these states conifers grew markedly in relative, if not absolute, importance. This marked a shift in tastes, perhaps, but also a shift to production of those types of plants which grew best in the North.

In the South production was more strongly specialized. In Tennessee, Florida, and Texas, a different type of plant predominated in each state. All three states increased production by at least 100% from 1929 to 1949, and the increase in rose production in Texas was over 600%. Almost all categories increased, deciduous trees being the major exception, but in each state by 1949 a single type predominated: roses in Texas had 82.7% of the total; deciduous shrubs in Tennessee had 51.1%;

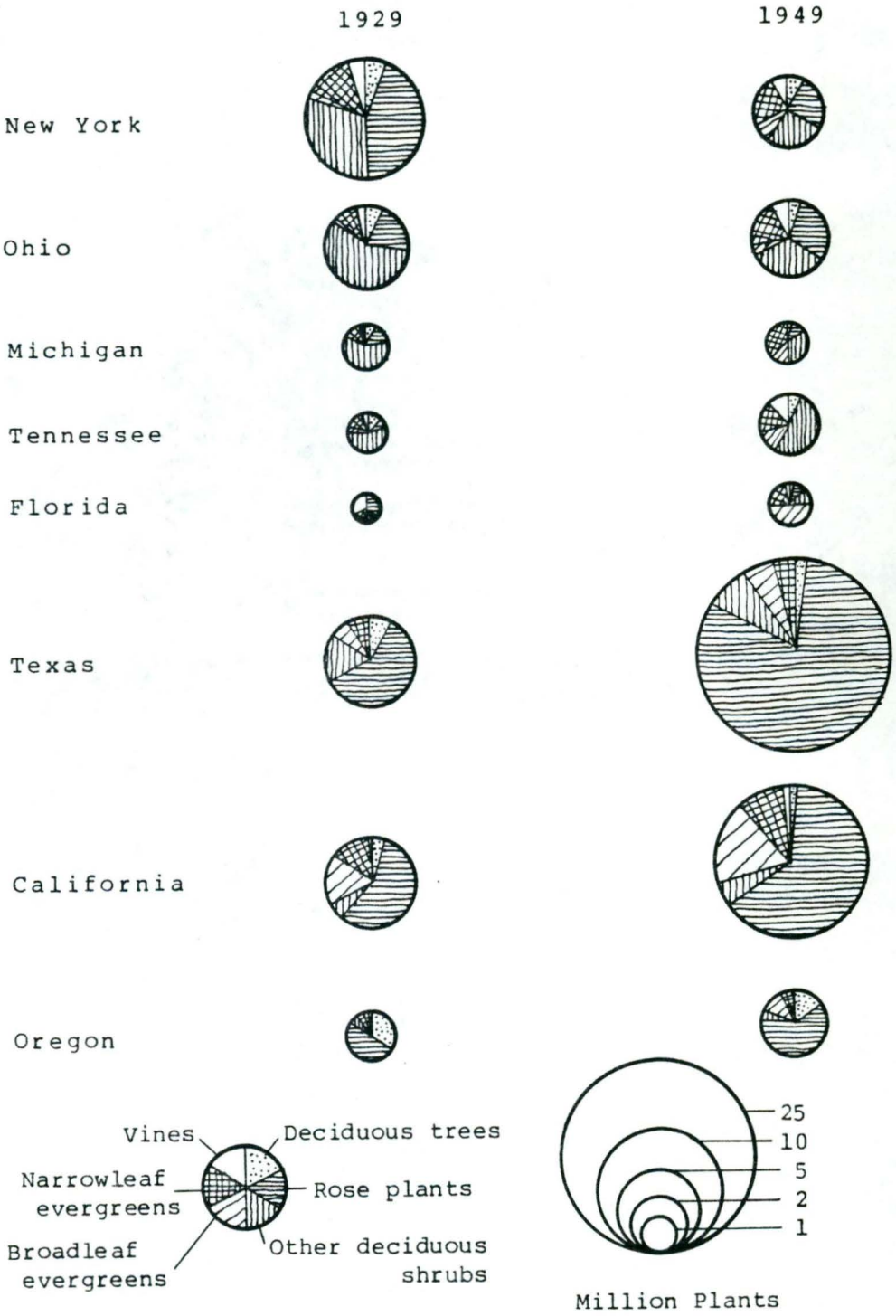


Figure 8-7. Nursery Production Specialization in Selected States, 1929 and 1949

and broadleaf evergreens in Florida had 47.7%.

In the Pacific states roses was the largest type in both California and Oregon, increasing in both absolute and relative terms. In Oregon, roses increased, apparently at the expense of deciduous trees, while in California the mix was essentially the same in 1949 as it had been in 1929 with comparable growth in all categories.

The shift in rose production from the Northeast to the South and West is especially clear when isolated on the map, Figure 8-8 and 8-9. While production grew in the nation as a whole from 1929 to 1949, especially in Texas and California, it dropped in New York, New Jersey, Massachusetts, Michigan, and Minnesota, and grew only slightly in Connecticut and Illinois. In Pennsylvania and Ohio rose production increased more, but still less than the national average.

The apparent large increases in Iowa and especially in Missouri may well be actual production gains, but they are more likely the result of census error, by mailorder firms reporting sales of plants grown on contract in other states. The 1949 census is the only one on record in which Missouri reported more than half a percent of the nation's sales of rose plants.

Production of broadleaf evergreens shifted equally dramatically from 1929 to 1949, particularly in the states east of the Mississippi, Figures 8-10 and 8-11. In 1929 New York, Pennsylvania, and New Jersey each produced more plants than any one of the southeastern states. By 1949 five southeastern states produced more than any of the northeastern states, and Alabama had become the national leader in production of broadleaf evergreens. Production was also up strongly in the Pacific

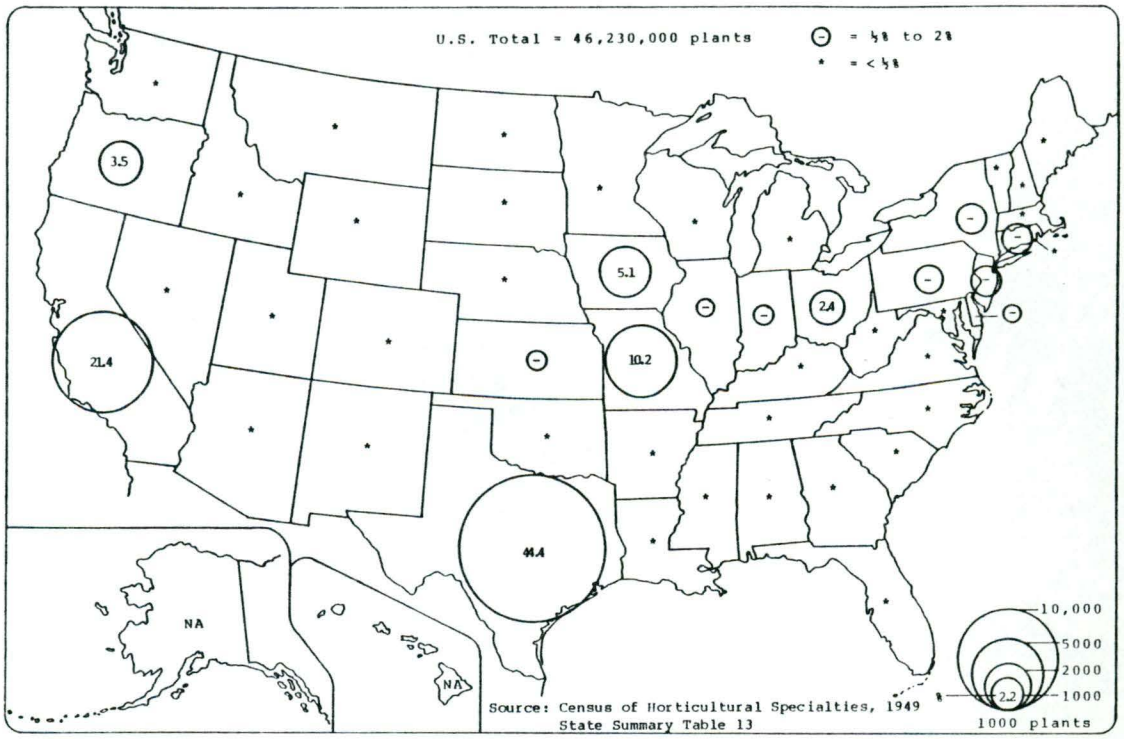


Figure 8-8. Production of Rose Plants, 1929

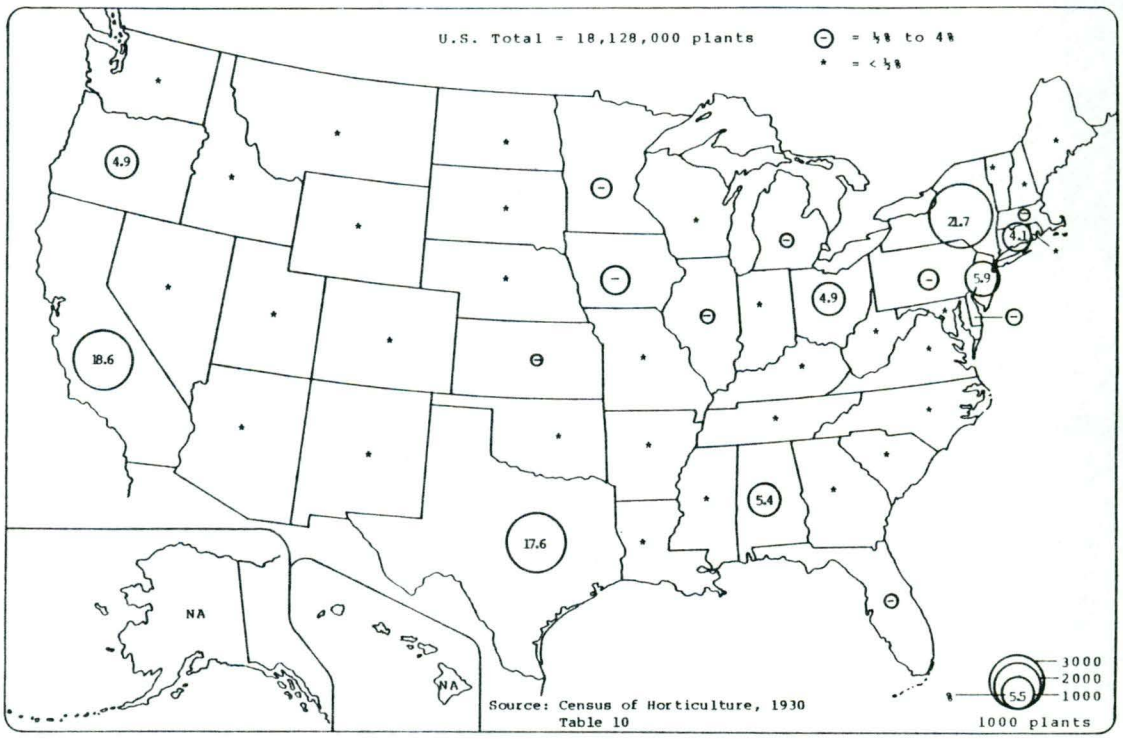


Figure 8-9. Production of Rose Plants, 1949

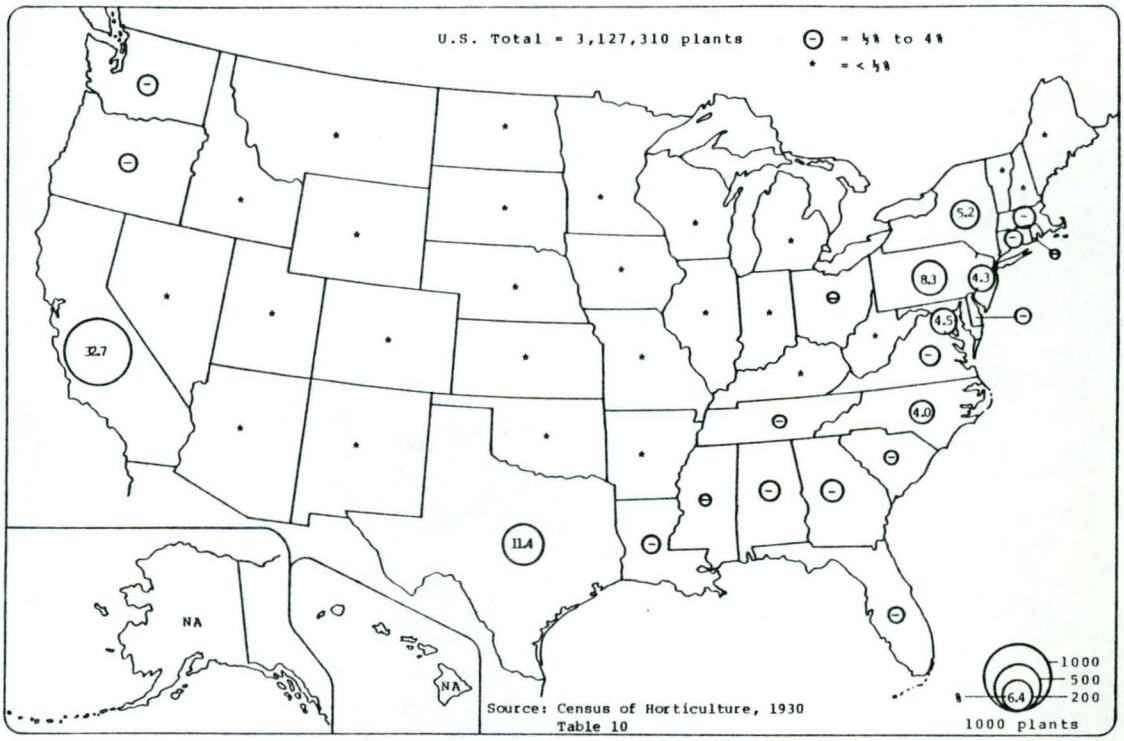


Figure 8-10. Production of Broadleaf Evergreens, 1929

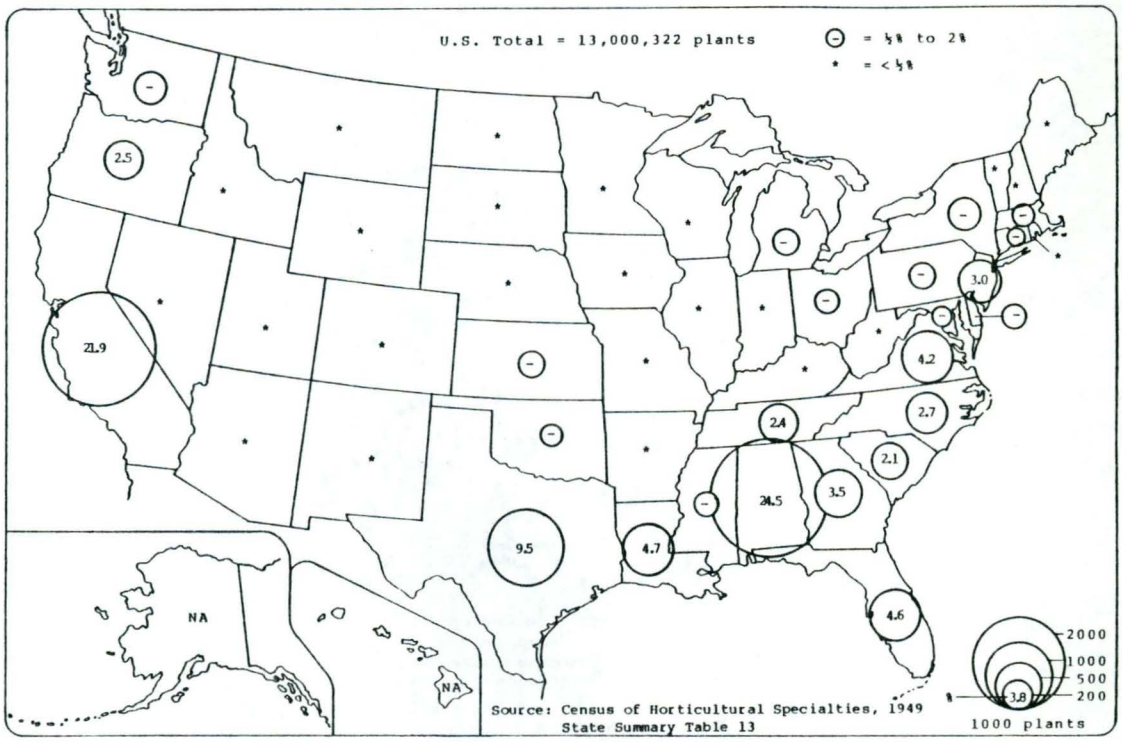


Figure 8-11. Production of Broadleaf Evergreens, 1949

states, Texas, and, surprisingly, in several midwestern states.

The kind of regional specialization based on climatic production advantages shown in the shifts in plant types and shifts in major producing areas in this period became even more important in the years after 1950. Innovations in production technology, handling, and transportation allowed for more freedom from many prior locational constraints to take advantage of climatic opportunities. Markets and tastes continued to change and diversify after 1950 also, and the channels of production and distribution continued to become more specialized.

The foundation for the present day nursery industry was laid down largely in the period from 1920 to 1949. The changes in taste which opened and closed markets for particular plant types had been developing over a century or more, but it was only in this period that they became tied directly to mass marketing for the residential market. The new forms of retailing through chain stores and garden centers first made their appearance, and the economic specialization which has characterized the business for several decades now was first expressed.

The use of trucks on national highways began in this period and is now the major means of transportation for nursery stock. Plant patents, breeding and selection programs, and the search for new varieties by American nurseries all first became important after the imposition of Quarantine No. 37 in 1919. Container-growing began in this period, and since then has developed into a highly refined production technique responsible for the majority of plants in many states.

Inspection, certification, and quarantines for the control of pests

and diseases have continued, but, unfortunately, so has the arrival of new dangers. The arrangements worked out to deal with the regulations and to coordinate the various state programs were first begun in the '20s and '30s and continue to be the basis for programs today.

And, as recent years have shown, the boom and bust cycle which characterized the years from 1920 to 1949 is still a feature of the business. But nurserymen today have learned something from the trials of the earlier period, and now have more secure credit sources and the hope that massive depressions like that of the '30s are a thing of the past.

Chapter Eight - Notes

[1]U.S. Dept. of Agriculture, Federal Horticultural Board, "Notice of Quarantine No. 37, Nursery Stock, Plant, and Seed Quarantine," Service and Regulatory Annoncements (Oct.-Nov., 1918), 101-110.

[2]The turn of the century production percentage is from White, A Century of Service, 457. The post-quarantine production is told by T. J. Maney and H. H. Plagge, "Hardy Stocks for Apple Trees," American Nurseryman 43 (May 1, 1936), 9-11.

[3]Guy E. Yerkes, "Rose Understocks in a Five-year Test," American Society for Horticultural Science 27 (1930), 463, describes the results of testing in Virginia from 1926 to 1930; and L. B. Scott, "Rose Understocks in a Four-year Test at Shafter, California," The American Rose Annual, 1932, 42-44.

[4]The American Rose Annual, 1921, 55.

[5]George C. Perkins, "The Production of Rose Bushes in California," The American Rose Annual, 1923, 94.

[6]J. C. Ratsek, "Rose Prospects for 1937 in East Texas," The American Rose Annual, 1937, 127-131.

[7]This was the judgement of a University of Texas professor; F. McAllister, "Rose Understocks Used in Texas," The American Rose Annual, 1932, 45-46.

[8]Roy McGregor, "The Greatest Rose-Producing Center in the World," The American Rose Annual, 1922, 106-108, describing the production of greenhouses in Springfield, Ohio.

[9]Frederic P. Lee, The Azalea Book (Princeton, New Jersey: Van Nostrand, 1958), 136. Kurume azaleas were first introduced to Europe and America by E. H. Wilson in 1916, following his trip to Japan in 1914. The Domoto Brothers were most active as importers in the years from 1917 to 1919.

[10]The various varieties and their origins are described in Hume, Camellias in America.

[11]This is the judgement of Donald Wyman, Shrubs and Vines for American Gardens, 1-2.

[12]White, A Century of Service, 128-132.

[13]Ibid., 132.

[14]Prominent among the azalea and camellia nurseries in the South were: Overlook Nurseries in Mobile, Glen St. Mary Nursery in Baker Co., Florida, Greenbrier Nursery in Norfolk, Virginia, and Wood's Nursery in Bristol, Virginia and at Treasure Island, Florida.

[15]This is the cause cited by George Perkins, "The Production of Rose Bushes in California."

[16]White, A Century of Service, 421.

[17]Ibid., 392.

[18]Alfred Rehder, Manual of Cultivated Trees and Shrubs Hardy in North America (New York: Macmillan, 1927).

[19]Alfred Rehder, Manual of Cultivated Trees and Shrubs Hardy in North America, 2nd ed., rev. and enl. (New York: Macmillan, 1940).

[20]O. E. Baker, ed., Atlas of American Agriculture (Washington: U.S. Dept. of Agriculture, 1936). Figure 7, "Average Annual Minimum Temperature," shows the 10°F isotherms.

[21]See John B. Rae, The Road and the Car in American Life (Cambridge, Massachusetts: M.I.T. Press, 1971); and Jean Labatut and Wheaton J. Lane, eds. Highways in Our National Life; A Symposium (Princeton, New Jersey: Princeton Univ. Press, 1950).

[22]There are actually no data or histories I could find on the early use of motor transport for nursery products. But a 1931 U.S.D.A. report on motor truck transportation of fruits and vegetables provides a good look at the state of motor transport in agriculture generally during this period: Brice Edwards and J. W. Park, The Marketing and Distribution of Fruits and Vegetables by Motor Truck, Technical Bulletin No. 272 (Washington: U.S. Dept. of Agriculture, 1931).

[23]White, A Century of Service, 176-180.

[24]William Middleton and Timothy Cronin, "Off Limits to Beetles," Yearbook of Agriculture 1952 (Washington: U.S. Dept. of Agriculture, 1953), 574-580.

[25]White, A Century of Service, 303.

[26]L. H. Worthley, "Farm and Nursery Products Move Along Long Distances Under Japanese-Beetle Certification," in Yearbook of Agriculture, 1934 (Washington: U.S. Dept. of Agriculture, 1934), 199-203.

[27]The story of the origins of container-growing has been told by various people in various, not always similar ways. See Van Laan, A Penny a Tree, 60-61 for a general history; and Carlo L. Lastreto, "Beginnings of the Container Nursery Industry: A Fascinating History of How the Nursery Industry Came to Use Containers," Nursery Business 27 (Sept., 1982) for a history of the "plantainer" pot.

[28]As advertised in The American Nurseryman 1 March, 1936, 21.

[29]Alex Laurie and L. C. Chadwick, The Modern Nursery: A Guide to Plant Propagation, Culture, and Handling (New York: Macmillan, 1931).

[30]Hillenmeyer's: White, A Century of Service, 406; Hicks: Frederick McGourty, Jr., "Long Island's Famous Nurseries," Plants and Gardens 23 (1967), 58-61. Roeding: Van Laan, A Penny a Tree, 33.

[31]American Association of Nurserymen, A Survey of the Nursery Industry (Washington: American Association of Nurserymen, 1927).

[32]White, A Century of Service, 248.

[33]As advertised in The American Nurseryman 1 July 1936, 15.

[34]Laurie and Chadwick, The Modern Nursery, 4.

[35]White, A Century of Service, 142.

[36]Ibid., 145-149.

[37]Ibid., 148.

[38]U.S. Bureau of the Census, Historical Statistics of the United States; Colonial Times to 1970, Part 2, Series N 156-169 (Washington: U.S. Dept. of Commerce, 1975).

[39]As an example, Riverside, Illinois, the upper class suburb of Chicago laid out in 1869 by Frederick Law Olmsted, was transformed in the 1920s by an influx of "Bohemians, Poles, and other non-Anglo-Saxon Americans." And though one older Riverside resident admitted they were "good thrifty citizens, mostly wealthy enough to build good homes and keep up a front in Riverside," he noted that others were worried that the newcomers were not "fitted with the 'Riverside Tradition.'" (Mayer and Wade, Chicago, 332).

[40]M. E. Bottomley, The Design of Small Properties; A Book for the Home-Owner in City and Country (New York: Macmillan, 1939), 14. Others were more direct: "We have a great dislike for the usual foundation planting - the multitude of small, conical evergreens strung across the front of the buildings. There is no other excuse for such a planting;" (H. Stuart Orloff and Henry B. Raymore, New Gardens for Old: How to Remodel the Home Grounds (Garden City, New York: Doubleday, Doran & Co., 1934), 42).

[41]Leonard H. Johnson, Foundation Planting (New York: De La Mare, 1927), x.

[42]Laurie and Chadwick, The Modern Nursery, 4.

[43]U.S. Bureau of the Census, Fifteenth Census of the United States, 1930, Vol. 15 Census of Horticulture, Section II, Table 10.

[44]Judging by the references in the various gardening books. Orloff and Raymore, for instance, in decrying the use of "small conical evergrens," remind their readers that the old deciduous shrubs "are available and cheap," New Gardens for Old, 46.

[45]See, for instance, the Introduction to L. H. Weir, ed., Parks; A Manual of Municipal and County Parks (New York: A. S. Barnes, 1928), xix-xx.

[46]E. H. Wilson, "The Best Street Trees for Town Betterment," House & Garaden 49 (March 1926).

[47]The best available treatment of parkways is Newton, Design on the Land, Chapter 39, "Parkways and Their Offspring," 596-619.

[48]Droze, Trees, Prairies, and People, 48-103.

[49]White, A Century of Service, 103.

[50]Ibid., 204.

[51]Ibid., 201-210.

[52]U.S. Bureau of the Census, Fourteenth Census of the United States, 1920, Agriculture, Chapter 13, Table 5 (Washington: U.S. Dept. of Commerce, 1920).

[53]U.S. Bureau of the Census, Fifteenth Census of the United States, 1930, Agriculture, Horticulture, Table 1. U.S. Bureau of the Census, U.S. Census of Agriculture 1950, Vol. 5, Pt. 1, Table A (Washington: U.S. Dept. of Commerce, 1952).

[54]U.S. Bureau of the Census, U. S. Census of Agriculture, 1950, Vol. 5, Pt. 1, Chapter B, Table 1 (U.S. Data.).

CHAPTER NINE

LOCATIONAL CHANGE AND REGIONAL SPECIALIZATION, 1950 TO 1980

In the years since 1950 the output of the nation's nurseries has continued to increase. The number of woody ornamentals sold in 1978 was 81% greater than in 1949, and the nursery industry had grown in almost every state over the years. Yet that growth has been unevenly distributed and some states and regions have grown much faster than others. Overall there has been greater increase in production in the South and West than in other regions of the country.

The distribution of nursery sales shifted significantly between 1949 and 1978 according to the data from the Census of Horticultural Specialties. The Northeast and Plains states have a much smaller share of the total, the Lakes states have maintained their share, and most of the states in the South and West have increased their share of the total. Because production is up overall, though, the increases in the South and West mark major expansions of the nursery industry in these areas, while relative declines elsewhere may actually represent small increases in the number of plants produced.

This has been accompanied by a continuing shift in the types of plants raised in nurseries largely in response to changing market demand. The nation's nurseries now turn out a greater percentage of deciduous trees and evergreens, both broadleaf and narrowleaf, than earlier and a much smaller percentage of roses and other deciduous shrubs. These changes have been both a cause of and a result of the

move to new areas or production. Population increases in the South and West have accompanied slow growth or decline in the Midwest and Northeast. At the same time the suburbs of cities throughout the country have grown in size and numbers. Together these two population migrations have been accompanied by changes in landscape taste which have changed the demand for different species and varieties of plants, and this has been reflected in some major shifts in the patterns of regional specialization.

The most dramatic increase has been among deciduous trees whose numbers have increased almost six-fold in the three decades from 1949 to 1978. And while production has grown in most parts of the country, it has done so most dramatically in the West and Mid-South. Production of other plant types has shifted as well, most noticeably with roses. As their numbers declined elsewhere they have risen in California, and by 1978 that state produced over 65% of the nation's rose plants. Production of deciduous shrubs, contrary to trends visible with other plants, has shifted to states in the north and east.

These regional shifts in production have led to major changes in specialization by plant type in almost every region of the nation. In most regions specialization by plant type has actually decreased, but this has been largely a reflection of the diversification of market demand nationwide. Within regions many states are more highly specialized by plant type, but the specialties have changed since 1949. Concentration of production in just a few leading states has also increased for most plant types in the last three decades. And California has emerged as the dominant nursery producer in the nation as the

leading state in production of several individual genera and plant types.

Increased Production in the South and West

The total value of nursery products sold in 1978 was $956,001,000 up almost 14 times over the 1949 total $60,419,000. As David Stump points out, this is considerably greater than the increase over the same period in the Consumer Price Index (202%), the Producer Price Index (188%), or the Producer Price Index for Farm Products (126%)[1] Lacking a price index for ornamental plants one can only say that the increase has been a substantial one in real terms. Regionally, one can compare the location of production by sales value over the period and see the impact of regional shifts in nursery production. Figures 9-1 and 9-2 show each state's relative share of the national total for sales of nursery products (including fruit and nut plants and herbaceous perennials) in 1949 and 1978. Most noticeable are the large increases in the West, especially California, and in Florida. Significantly smaller shares are evident in all the northeastern and Plains states as well as in Texas and Alabama.

This is reflected in the locations of the 50 leading counties in the sales of nursery products in 1949 and 1978, Figures 9-3 and 9-4. While in 1949, 17 of the top 50 counties had been on the Northeast seaboard, by 1978 only 7 of the leaders were there, including only 5 of the previous 17. Around the Great Lakes the number had dropped from 10 to 6 with only 3 the same. At the same time the number in the top 50

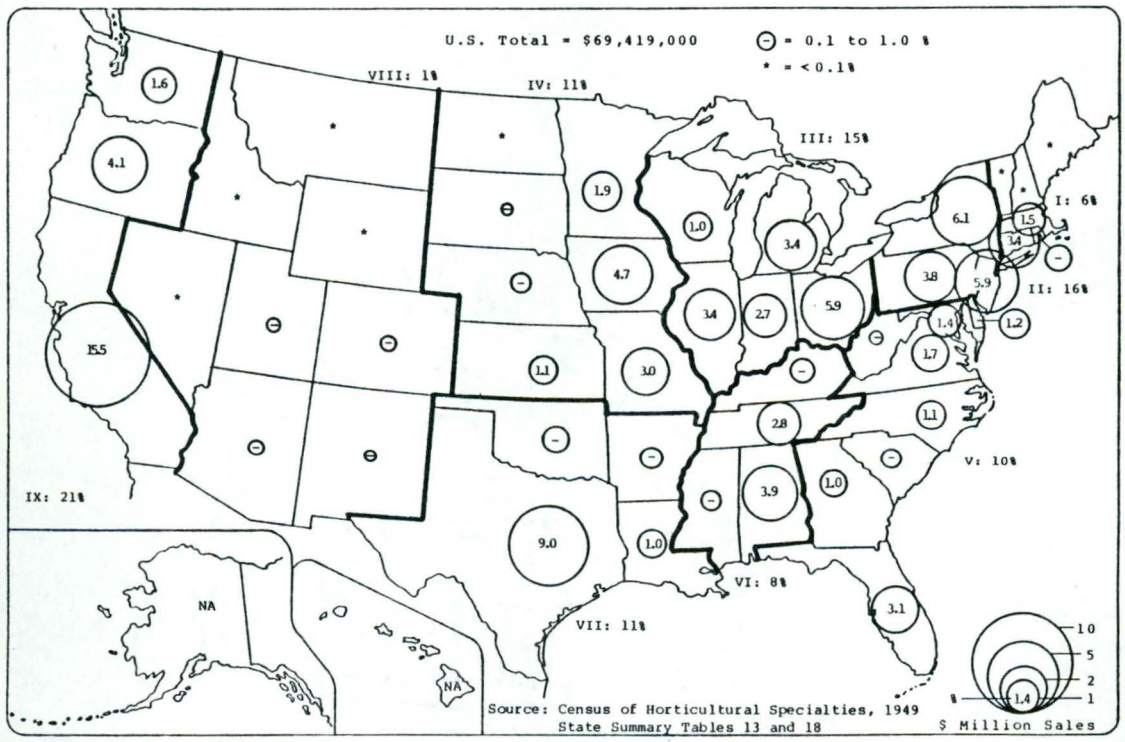


Figure 9-1. Nursery Product Sales by State, 1949

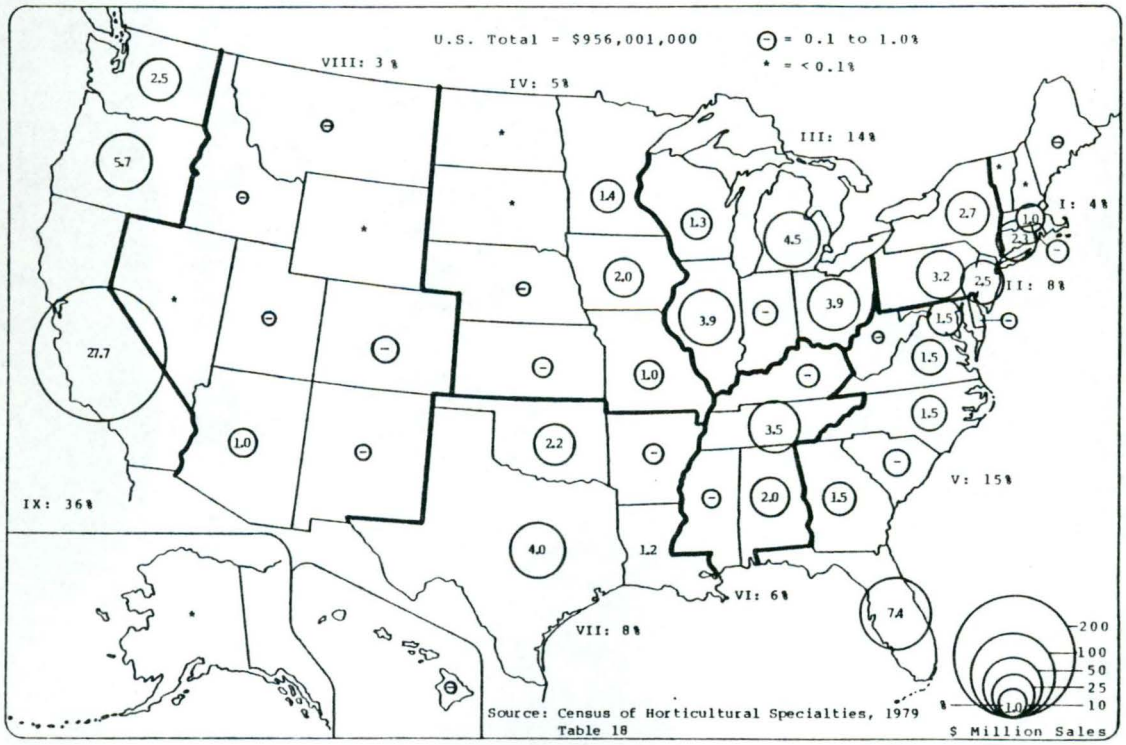


Figure 9-2. Nursery Product Sales by State, 1978

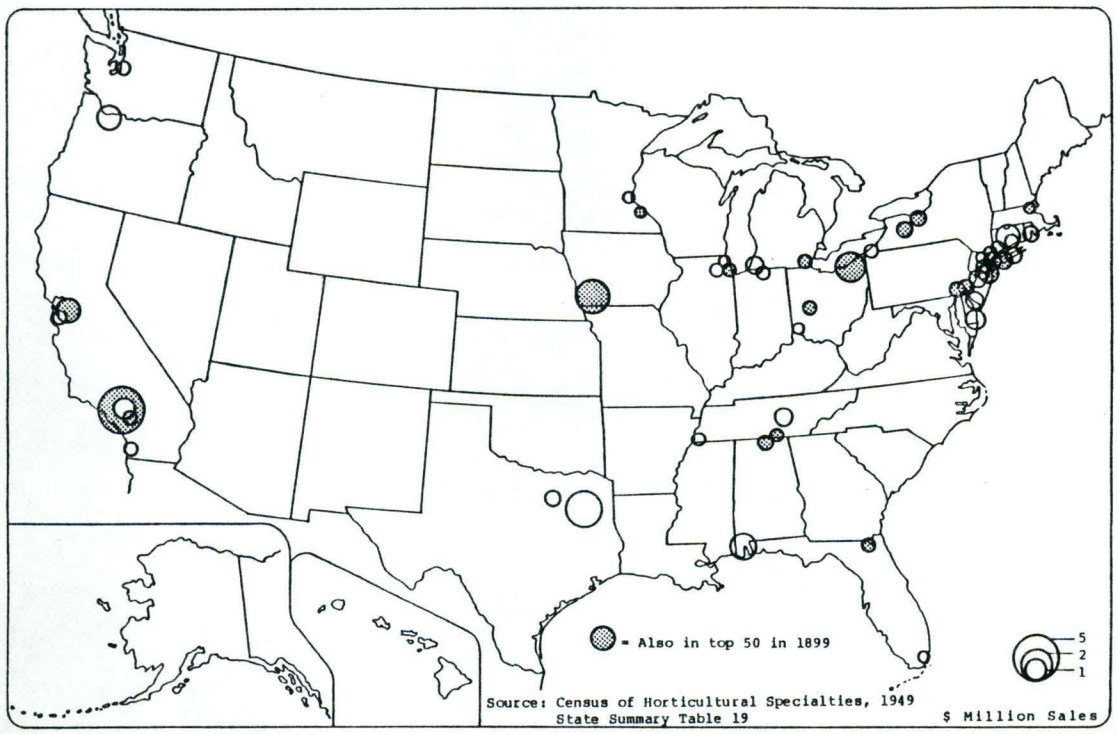


Figure 9-3. Fifty Leading Counties in the Sale of Nursery Products, 1949

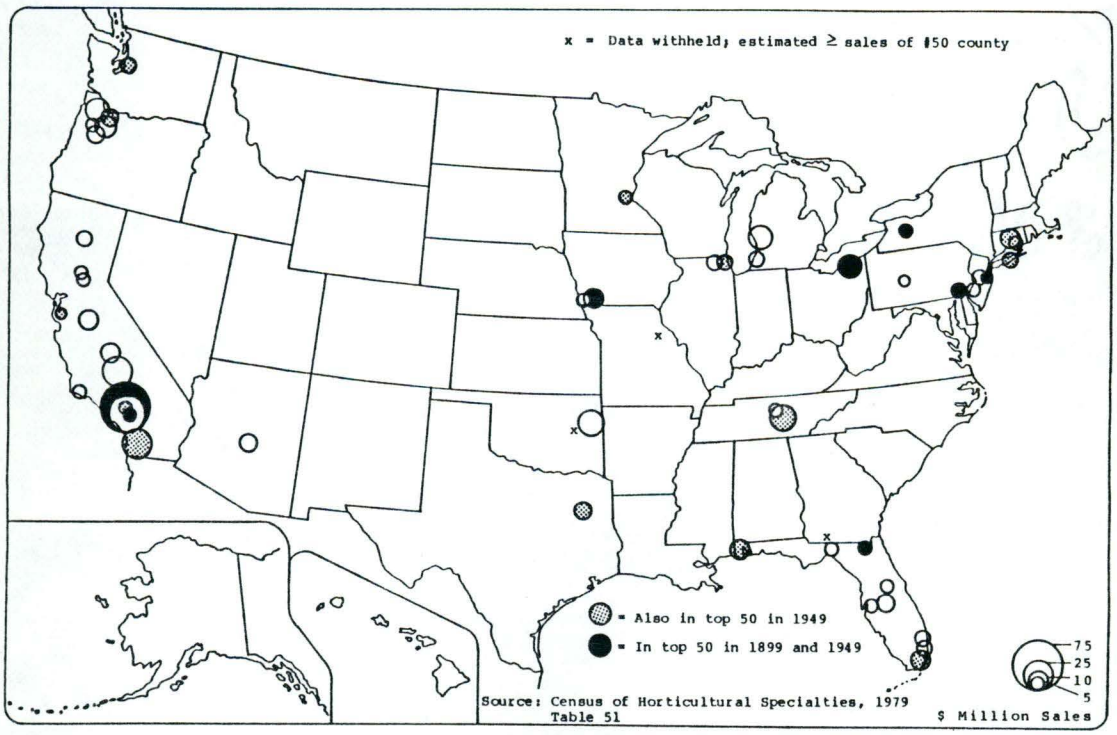


Figure 9-4. Fifty Leading Counties in the Sale of Nursery Products, 1978

risen from 2 to 6 in the Pacific Northwest, from 6 to 13 in California, and from 2 to 8 in Florida. The three states of Oregon, California, and Florida had 26 of the top 50 nursery counties in 1978, compared to only 10 in 1949. In 1949 the Great Lakes and Northeast states had 27 of the leaders, but only 13 in 1978. Clearly production has shifted dramatically to the South and West, although not to many new areas. Rather, older nursery areas there have expanded to adjacent counties. In the continental interior, away from either oceans or Great Lakes, the number of leading counties has dropped from 11 to 8, with four carrying over from before, but the losses have been in both the North and the South.

Of the 22 counties which stayed in the top 50 in both years the majority lost place in the standings, Table 9-1, even in the South and West. Much of this may be laid to the effects of urban sprawl. But in the West, at least, these urban counties were surrounded by nearby suburban counties rising rapidly in the ranks. Significantly, eight of the top 50 in 1978 had also been among the top 50 in 1899, Table 8-2. This remarkable resilience over eight decades is a tribute to continuing locational advantages and to the historical momentum built up by agglomeration advantages. Perhaps nowhere is this more apparent than in the cases of Page County, Iowa, deep in the continental interior, and of Lake County, Ohio, the only one to remain in the top ten from 1949 to 1978, as well as from 1899 to 1978.

The reasons for these major regional changes in production can be found largely in changing market demand, in improved transportation which has enabled growers to take advantage of climatic opportunities, and in the switch to container growing which has necessitated a move to

Table 9-1. Top 50 Counties Both 1949 and 1978

State	County	Rank 1949	Rank 1978
CT	Hartford	6	11
	Middlesex	29	41
NJ	*Monmouth	11	49
NY	Suffolk	22	22
	*Livingston	19	44
PA	*Chester	20	26
OH	*Lake	4	9
IL	Lake	48	29
MN	Washington	47	34
IA	*Page	3	16
TN	Warren	14	5
AL	Mobile	5	13
FL	*Baker	31	38
	Dade	45	12
TX	Smith	2	17
CA	San Diego	23	4
	*Riverside	30	40
	San Bernardino	9	33
	*Los Angeles	1	1
	Santa Clara	34	50
OR	Multnomah	7	19
WA	King	35	30

(* = also in top 50 in 1899).

areas with milder winter climates.

Regional Specialization

For individual plant types the shifts in production take on some very different patterns. The search for areas with climatic production advantages has been accompanied by major population migrations, both within and between regions, and by changes in taste and market demand for plants which is regionally different. These factors will be examined in Chapters 11 and 12, but it is important to study here the changes in the types of plants produced in different regions of the country.

While the total number of woody ornamentals sold is up 81% over the three decades from 1949 to 1978 the mix of types is now very different from before. As seen in Figure 9-5 and Table 9-2, the two leading categories in 1949, roses and other deciduous shrubs were both smaller in 1978, while all other categories had at least doubled in numbers. Most dramatic was the almost six-fold increase in the number of deciduous trees. Evergreens, both broadleaf and narrowleaf, also were sold in much greater numbers. This continued trends visible earlier from 1929 to 1949 for an increased use of evergreen plants and a decreased use of deciduous shrubs.

Roses

The shift in production that has accompanied these changes in type have been less dramatic overall. Major states in 1949 were generally major states in 1978, although with a lesser or greater share

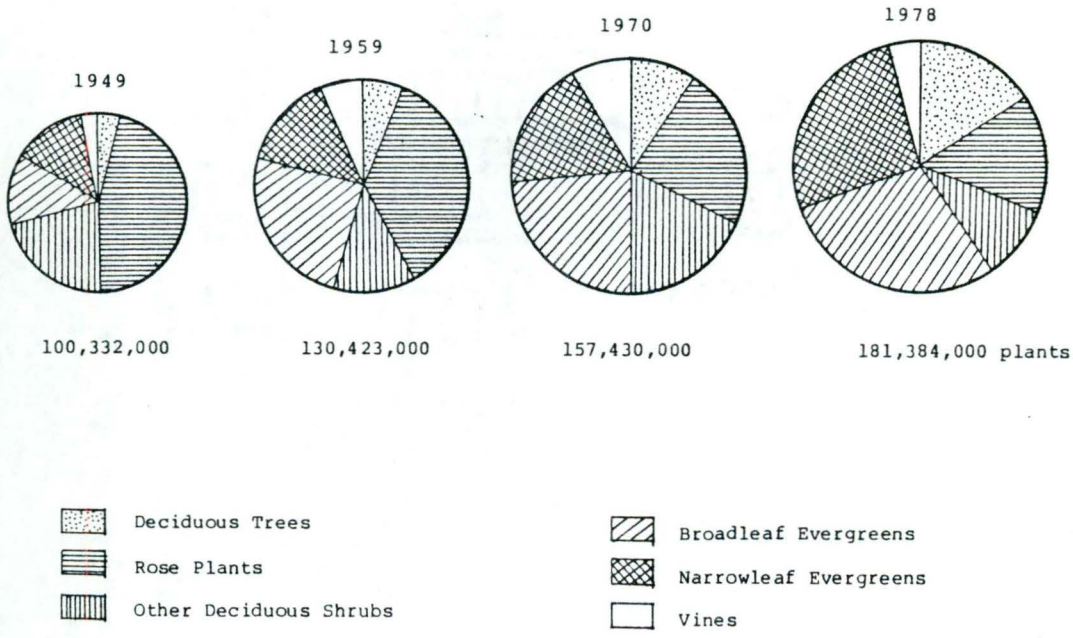


Figure 9-5. Woody Ornamental Plants Sold, by Type and Number, 1949, 1959, 1970, and 1978

Table 9-2. Number of Woody Ornamentals Sold 1949, 1959, 1970, 1978

Plant Type	(1000 plants sold) 1949	1959	1970	1978	%change '49-'78
All woody ornamentals	100,332	130,423	157,430	181,384	81
Deciduous Trees	3,919	7,541	14,136	26,567	578
Rose Plants	46,230	47,757	36,901	30,022	-35
Other Deciduous shrubs	21,464	16,220	27,611	17,036	-21
Broadleaf evergreens	13,000	32,673	37,238	52,626	305
Narrow leaf evergreens	12,403	18,505	28,433	48,100	288
Vines	3,316	7,327	13,111	7,033	112

of the total. With roses, however, the locational changes have been unprecedented. In 1949 rose plants were raised in relatively large numbers (over 1/2% of the national total) in fourteen states including eleven in the Midwest and Northeast, although the clear leaders were Texas and California, Figure 9-6. By 1978, only nine states had a rose industry of notice, and California alone had over 65% of the total, Figure 9-7. Production had shrunk drastically in most states and only four states in the entire northern half of the nation had over 1/2% each.

This major regional change in production location can be attributed to several causes. The rose market as a whole was declining over these years and competition heightened the benefits of both quality and rapid growth. In most of the Midwest and Northeast roses simply cannot grow as fast as in the southern and Pacific states where summers are longer and warmer. Many of the growers in the Midwest and Northeast had already realized this earlier and were in fact by 1949 growing a large portion of their crop in the South or West or else were having them grown there on contract by others. Jackson & Perkins, for example, originally from Newark, New York, near Rochester, had bought land in California as early as 1895.[2] By the 1950s they grew the majority of their rose plants there.

The concentration of rose growing in California is remarkable but not nearly as much as the concentration within that state. Fully 80% of California's roses are grown in the immediate area of Wasco, Shafter, and McFarland in northern Kern County in the southern San Joaquin Valley, (Figure 9-8). Large scale rose growing began there in the early

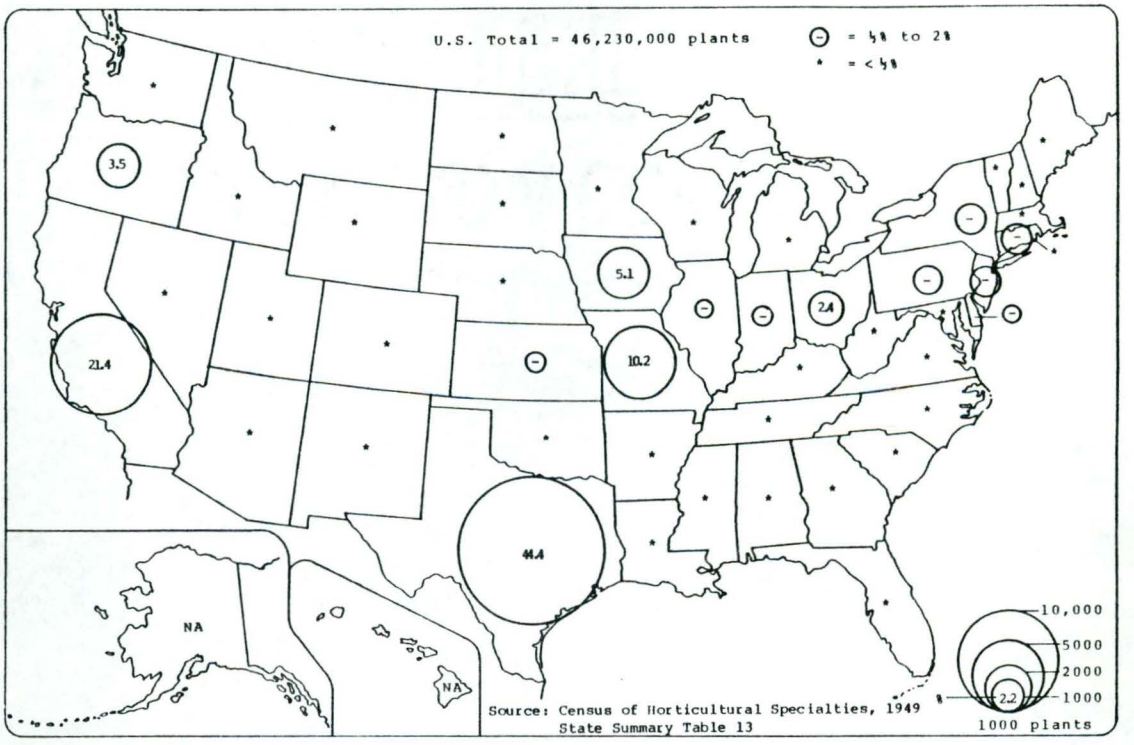


Figure 9-6. Production of Rose Plants, 1949

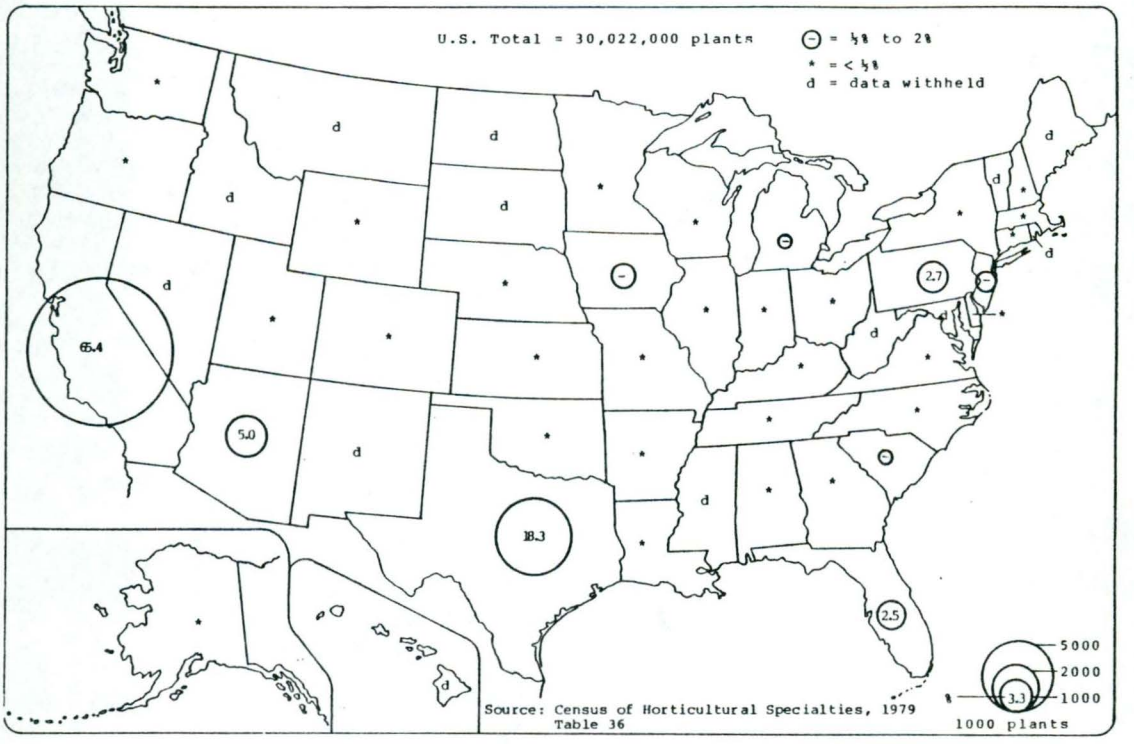


Figure 9-7. Production of Rose Plants, 1978

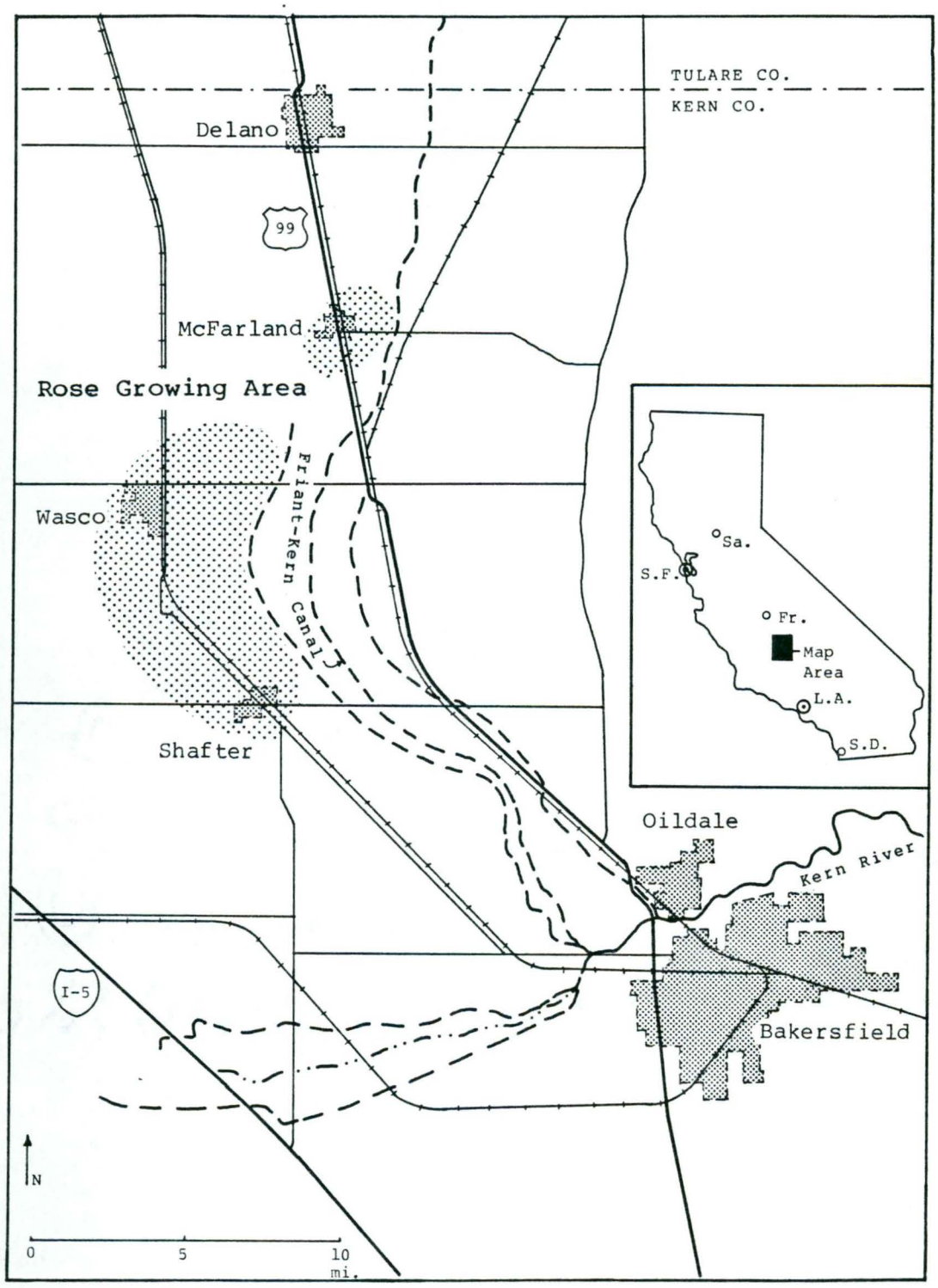


Figure 9-8. Rose-growing Area of Kern County, California

1950s when growers from the Los Angeles basin sought new land away from urban encroachment. Attracted by the area's climate, in particular its early frost free period, and its soils, especially the Hesperia series whose sandy loams contained large amounts of mica and had sharp angular sand grains that aid in the development of a finely branched root system, a number of growers bought large pieces of land there in the 1950s.[3] Among them were Armstrong Nursery and Jackson & Perkins, and today most of the major western rose growers own or lease land in the area or else have their roses grown there by contract growers. The Wasco area also benefits from a good water supply, via the Friant-Kern Canal opened in 1949, and a steady reliable source of labor in both American and Mexican workers drawn to the San Joaquin Valley's rich farmlands.

Deciduous Shrubs

Production of other deciduous shrubs has also declined and in the process has shifted its growing locations somewhat, although not nearly as dramatically as roses. Among the various commodities it is the only one to show increases in northern states and decreases in southern ones. As Figures 9-9 and 9-10 show the big gainers between 1949 and 1978 have been Minnesota, New York, and California, while Alabama, Tennessee, and Texas have decreased production markedly. Much of this may be due to differentiation in regional market demand. Evergreen shrubs, especially broadleafs, have become more popular in the South while deciduous shrubs, most of which are hardy fairly far north, have found more of a regional and less of a national market.

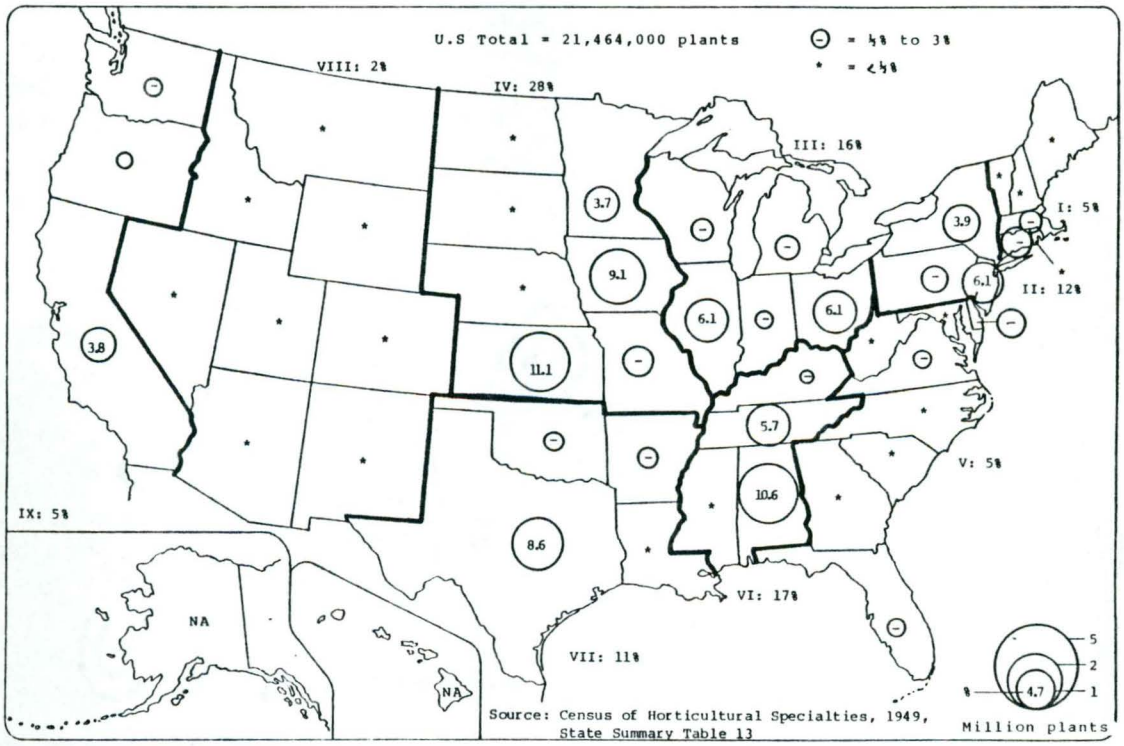


Figure 9-9. Production of Deciduous Shrubs, 1949

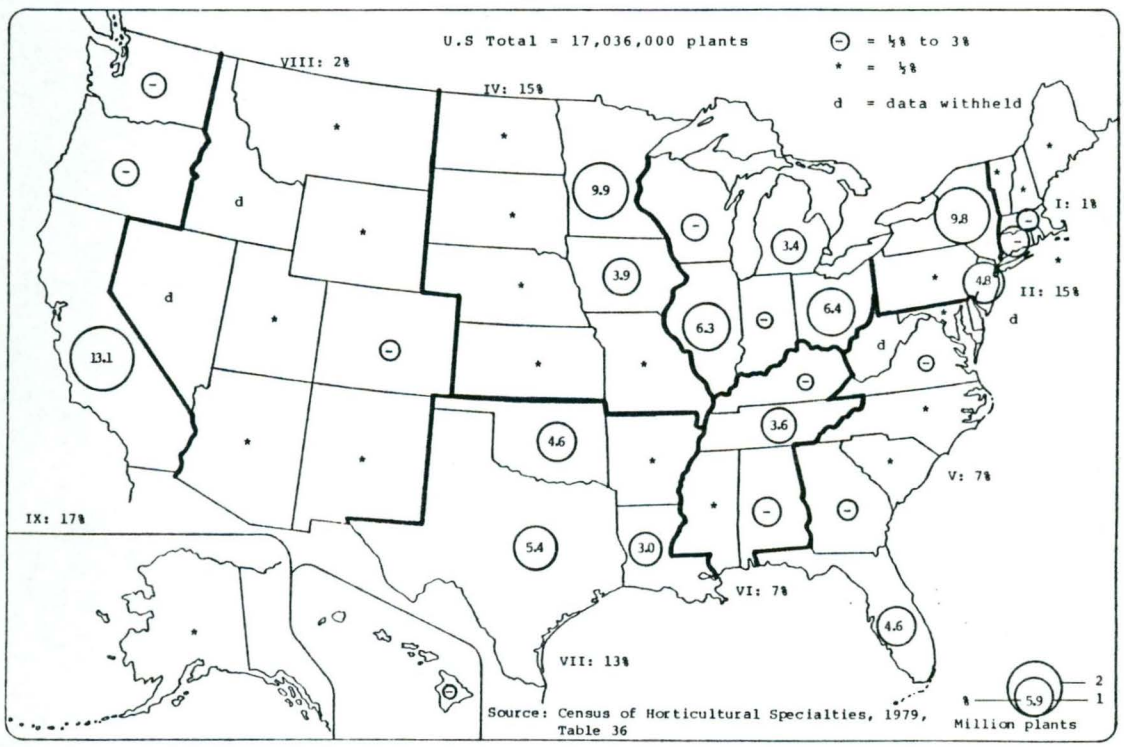


Figure 9-10. Production of Deciduous Shrubs, 1978

Narrowleaf Evergreens

Use of narrowleaf evergreens (conifers) is up across the country, from 12% of the plants sold in 1949 to 27% in 1978. As seen in Figures 9-11 and 9-12 production was up in almost every state. The greatest increases took place in just a few states but grew in all regions of the country, including the Midwest and Northeast. This dispersion of the increase and lessening of the regional concentration which is characteristic of other plant types is due in large part to the fact that many conifers are still grown B&B. This raises transportation costs and restricts locational freedom. Those conifers which are typically container-grown, especially junipers, are also the ones used ornamentally in the South and West and are now grown there in large numbers, as seen in Figure 2-3. The large increase in California's production of narrowleaf evergreens is due largely to junipers and other container-grown species such as some of the varieties of arborvitae and Chamaecyparis. Other important conifers such as pines, yews, and spruces, are more commonly sold B&B and have considerable production in the Midwest and Northeast close to the large markets there.

Broadlef Evergreens

Regional market demand has been important in the location of nurseries growing broadleaf evergreens. Since most of these plants cannot tolerate cold winters of the continental interior, being injured as much by dessication as by freezing, they are used mostly at the continental margins: along the oceanic coasts and to a lesser degree near the Great Lakes, where winter temperatures are warmer and humidity

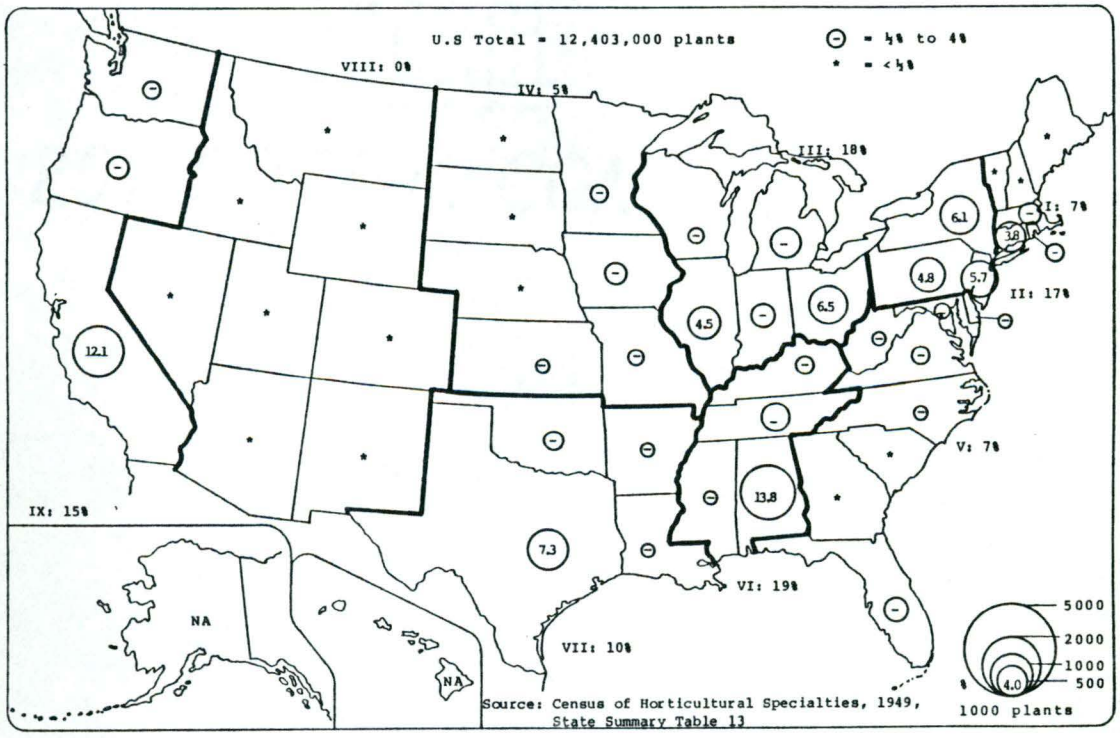


Figure 9-11. Production of Narrowleaf Evergreens, 1949

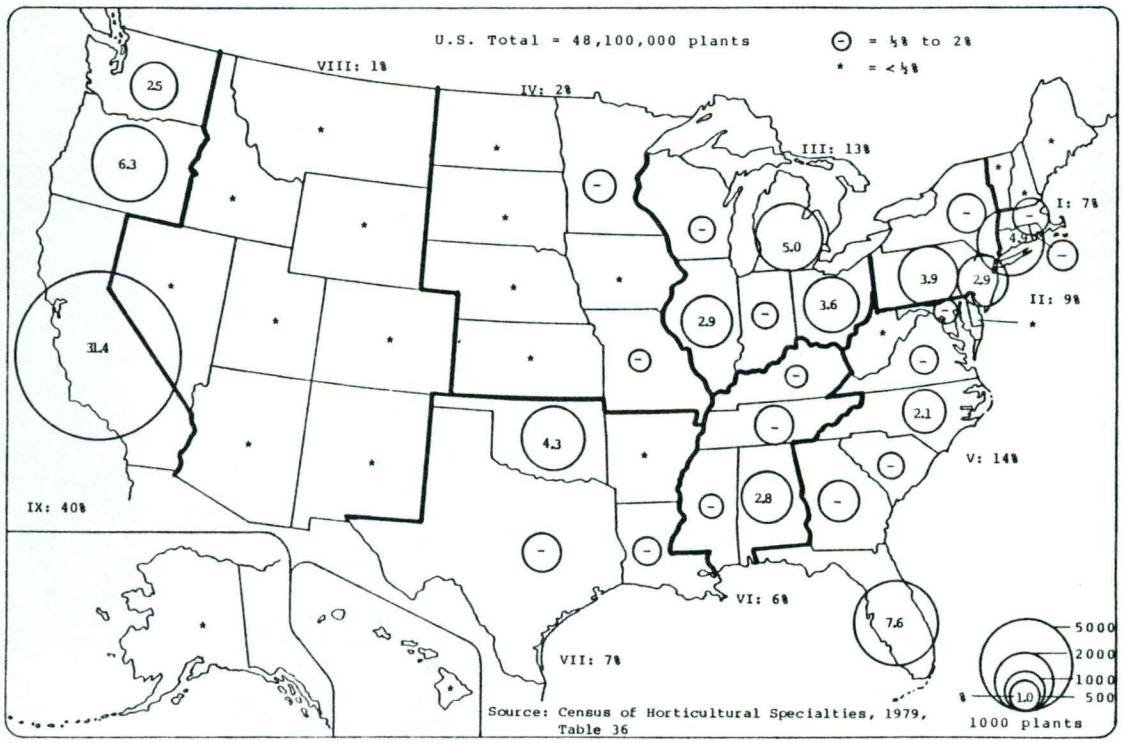


Figure 9-12. Production of Narrowleaf Evergreens, 1978

greater. The location of nurseries follows this same pattern, broadly speaking, as seen in Figures 9-13 and 9-14. Production shifts from 1949 to 1978 have been surprisingly slight. The most notable changes have been the large increases in Florida, North Carolina, and Pennsylvania. Elsewhere production has increased moderately in almost every state. The really big change in broadleaf evergreen production locations apparently took place much earlier than that of most other plant types, in the 1930s and '40s, as seen earlier in Figures 8-9 and 8-10, when it moved from the Northeast to the Southeast.

As the nation's taste in plants has diversified since the second world war nursery production in most regions of the country has also diversified. But most regions are still more specialized than the nation as a whole. Figures 9-15 and 9-16 illustrate the changes in regional production by number of plants and by plant type from 1949 to 1978. In numbers of plants the biggest changes have been declines in the West North Central and West South Central regions, large increases in the Pacific, Mountain, and South Atlantic regions, and moderate increases in the three northeastern regions. In the East South Central regions the numbers are little changed.

Regional nursery production by plant type has changed markedly. While most regions were less specialized in 1978 than in 1949 three were more specialized: New England with narrowleaf evergreens, the South Atlantic with broadleaf evergreens, and the Mountain with roses. In the East South Central there was almost no change except that deciduous trees replaced deciduous shrubs; the other types remained very similar. The Mid-Atlantic region, which had been the most diversified region in

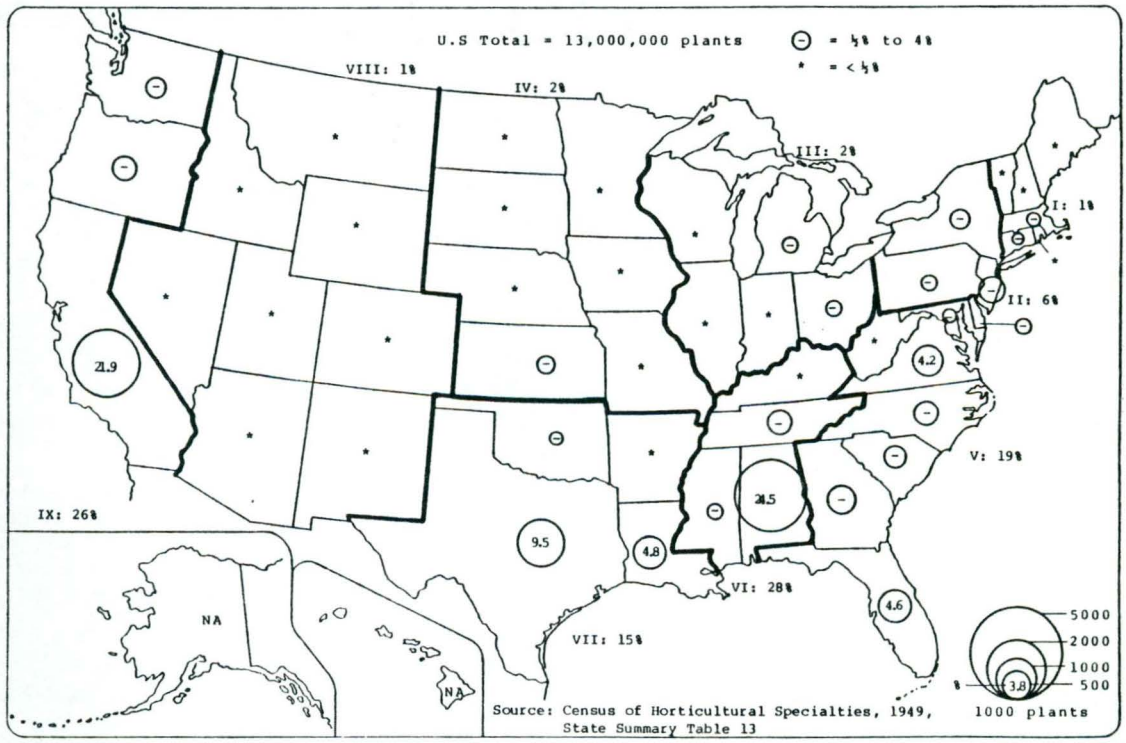


Figure 9-13. Production of Broadleaf Evergreens, 1949

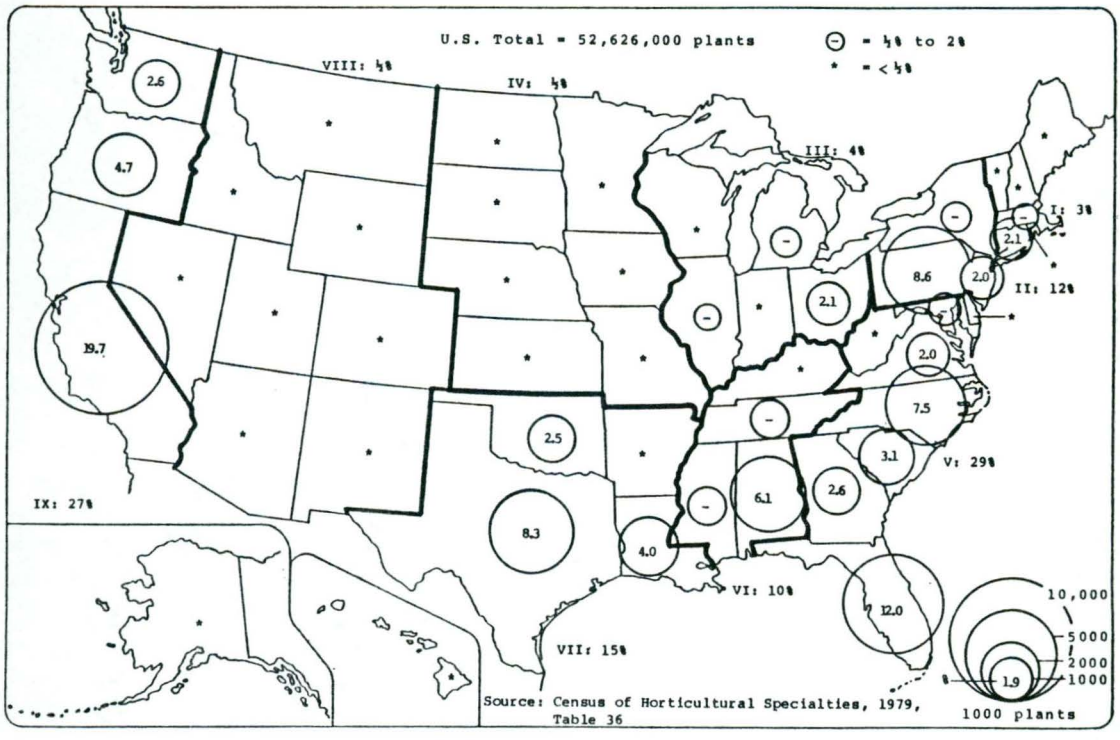


Figure 9-14. Production of Broadleaf Evergreens, 1978

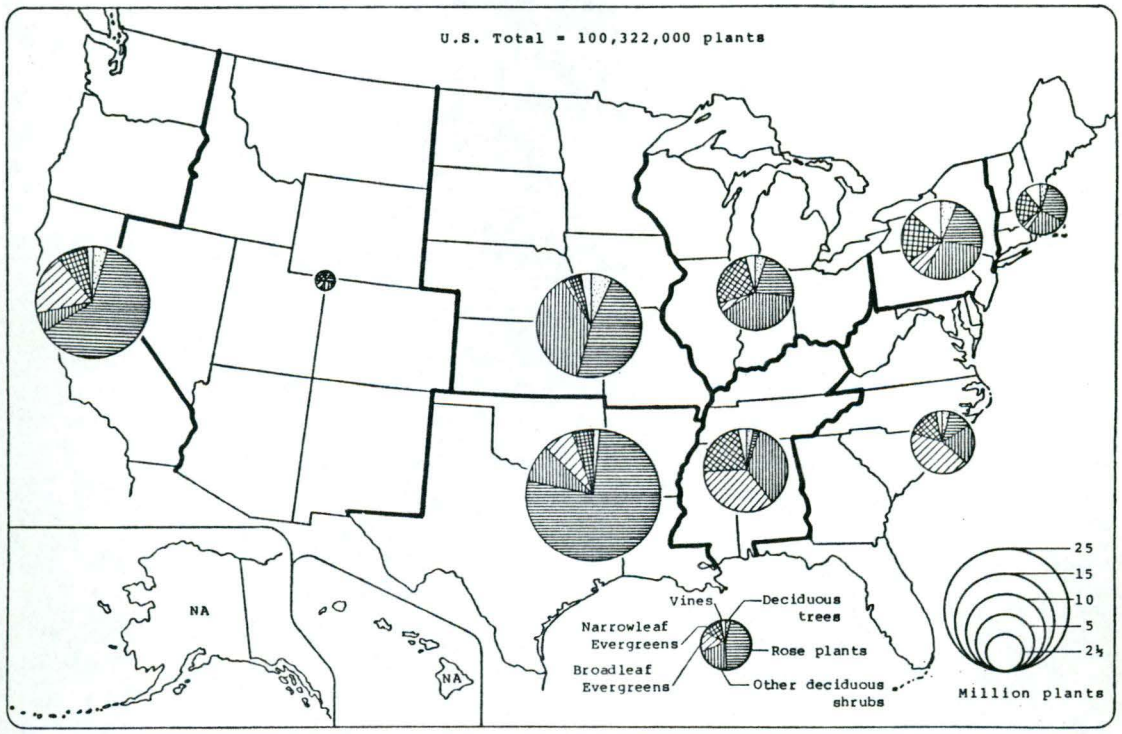


Figure 9-15. Regional Production of Woody Ornamentals by Type, 1949

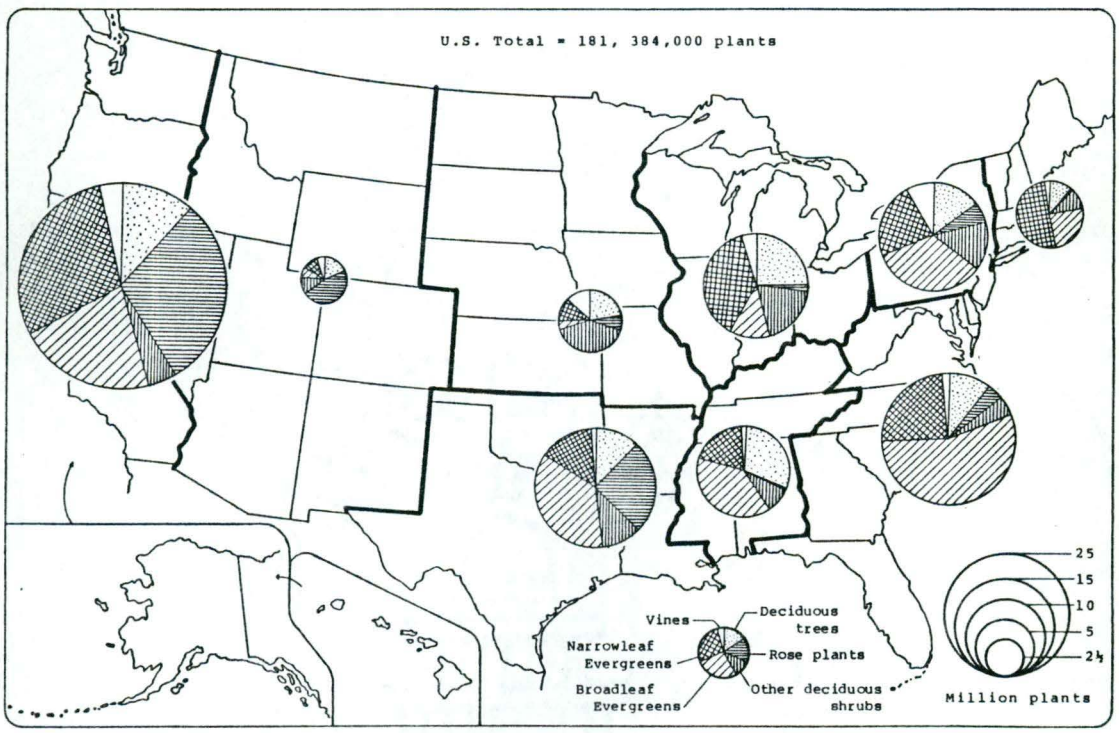


Figure 9-16. Regional Production of Woody Ornamentals by Type, 1978

1949, continued as the most diversified in 1978, most closely approximating the national pattern in that year. It is also the largest single market region and does not export many plants. Its production most closely fits its demand of any of the regions. In most other regions the declines in two categories, roses and other deciduous shrubs, were made up by increases in three others, deciduous trees, broadleaf evergreens, and narrowleaf evergreens, and this replacement of two types by three has been the essence of the diversification.

Within regions there have been more noticeable trends toward specialization, sometimes by whole states, for which census data are available, Figure 9-17, and other times within states, as in the case of rose growing in Kern County, California, for which data are irregular and scarce. In the Mid-Atlantic region, New York, for example, was less diversified in 1978 than in 1949, much less so than its region, and had a greater specialization in deciduous shrubs and vines. Michigan, contrary to the trend for its region, has grown increasingly specialized in production of narrowleaf evergreens and deciduous trees, almost to the exclusion of other types of woody ornamentals, though it still grows large numbers of fruit plants and herbaceous perennials also. Tennessee was in 1978 more specialized in deciduous trees than its region and even more than it had been specialized in deciduous shrubs in 1949.

During this same period the production of many plant types has become increasingly concentrated in a few states. As seen in Figure 9-18 nursery production of four of the six major plant types of woody ornamentals has become more concentrated. It is also notable that growing of broadleaf evergreens has become less concentrated at the same

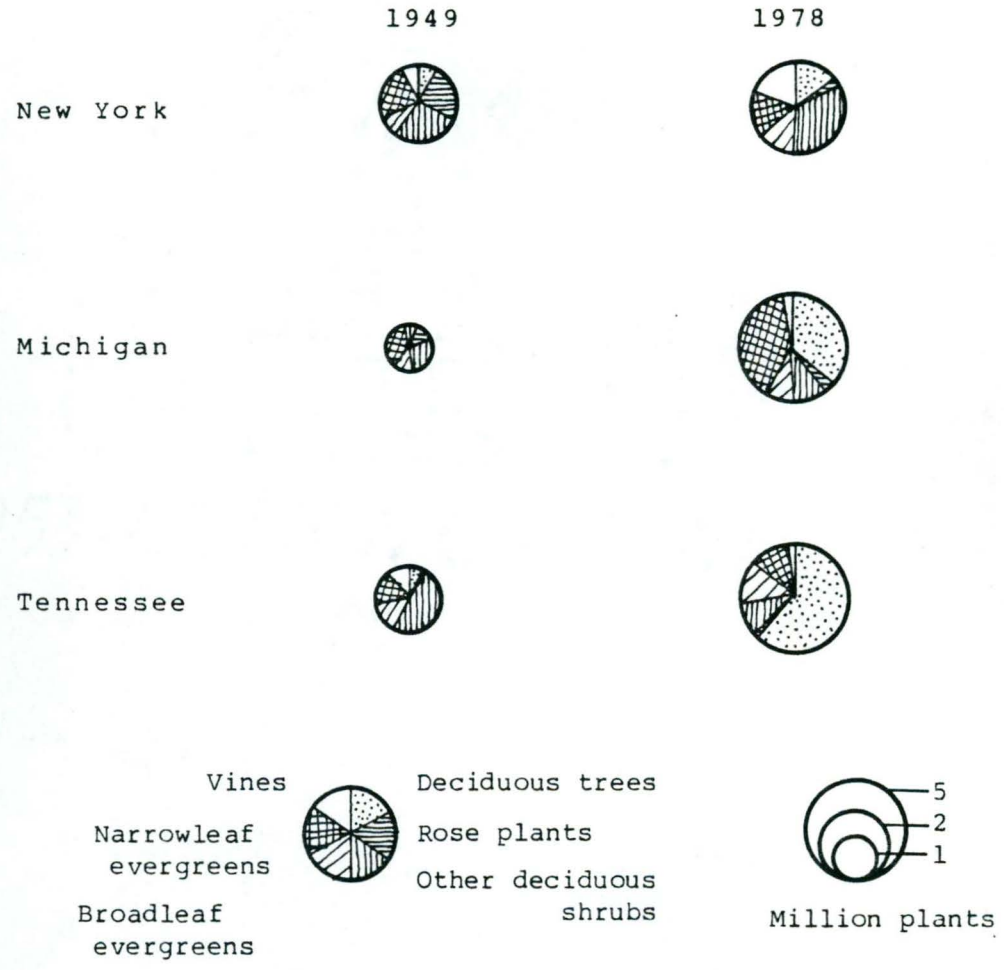
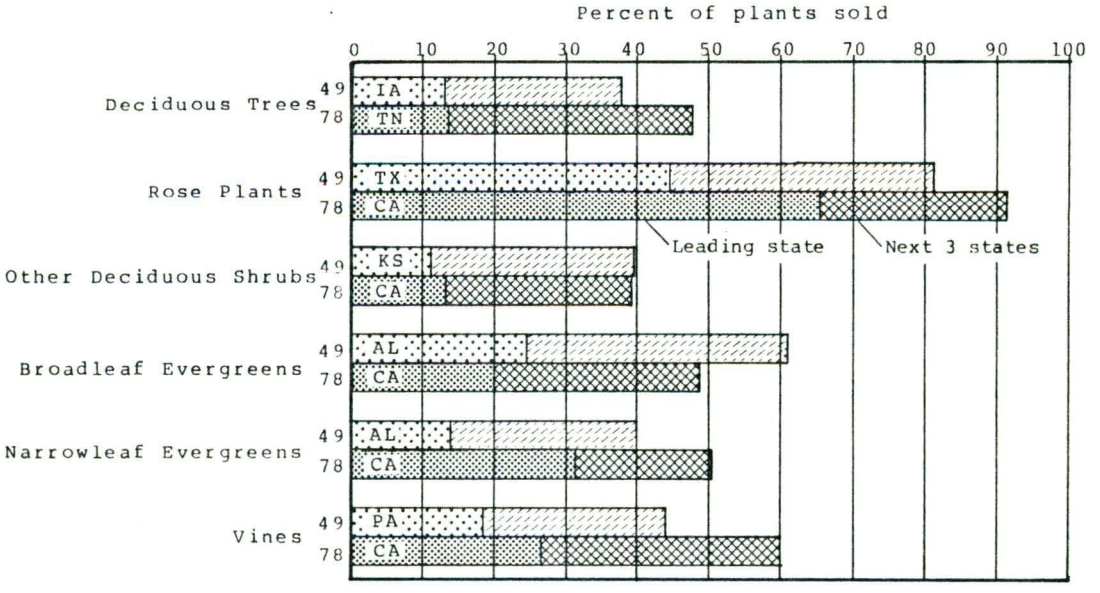


Figure 9-17. Production by Plant Type in New York, Michigan, and Tennessee, 1949 and 1978



Source: Census of Horticultural Specialties, 1949, State Summary Table 13;
Census of Horticultural Specialties, 1979, Table 36

Figure 9-18. Change in Production Concentration by Plant Type and Leading States, 1949 and 1978

time. Production has increased in many states to meet the growing demand for broadleaf evergreens as tastes have changed, and as seen in Figures 9-13 and 19-14 the increases have been fairly evenly distributed among almost all states rather than in just a few.

California has emerged as the dominant producer in five of the six plant types in 1978 whereas there were five different states leading in these six categories in 1949. Not only is nursery production now more concentrated in fewer states but it is more concentrated in just one state among them. The diversification of California's nursery industry in the three decades since 1949 has been the result of many factors. Most important among them have been the tremendous growth of its own retail market, its early lead in containerized production, improved transportation and distribution facilities nationwide, and its climatic production advantages, which will be discussed in Chapter 11.

The Case of Deciduous Trees

The one plant type in which California was not the national leader in 1978 was deciduous trees. This is also the type which has undergone the most dramatic increase since 1949, from 4% of the woody ornamentals sold to 15% in 1978. Production of deciduous trees is up in both absolute and relative terms in all nine regions of the country used by the Census of Agriculture. This is a result of a major growth in market demand stemming largely from the rapid increases in residential construction over the period, particularly single-family houses. Deciduous trees are also more often used in non-residential plantings. A shift in landscape taste and propriety now calls for them around commercial and

even industrial buildings, and they are being planted along more city streets and rural highways than ever before. These changes in taste will be discussed in Chapter 12. Here it is important to look at the ways production of deciduous trees has changed in different parts of the country since the second world war.

While it has increased in almost every state, nursery production of deciduous trees has grown most rapidly in just a handful of states, Figures 9-19 and 9-20. Tennessee, Oregon, California, and Michigan account for over half of the increased number of trees grown from 1949 to 1978. Other states with major increases, over one million trees, include New Jersey, Oklahoma, and Florida. These seven states are in six of the nine regions used by the Census. It thus appears that the raising of deciduous trees is increasing all around the nation. A more critical look at the map, however, and a finer look at the census data reveal some major regional differences which suggest another type of regionalization may be more appropriate for deciduous trees.

The data from the 1979 Census of Horticultural Specialties include figures for selected individual genera of both deciduous shade trees and deciduous flowering trees. Figure 9-21 shows production of deciduous shade trees in 1978 and Figure 9-22 shows this for deciduous flowering trees. While some states have an even balance between the two types, several of the most important producing states are clearly specializing in one or the other: Oregon, Iowa, Oklahoma, New Jersey, Masschusetts, Texas and Florida each produce roughly three times as many shade trees as flowering trees, while Michigan, Maryland, Pennsylvania, Alabama, and Tennessee each grow at least twice as many flowering trees as shade

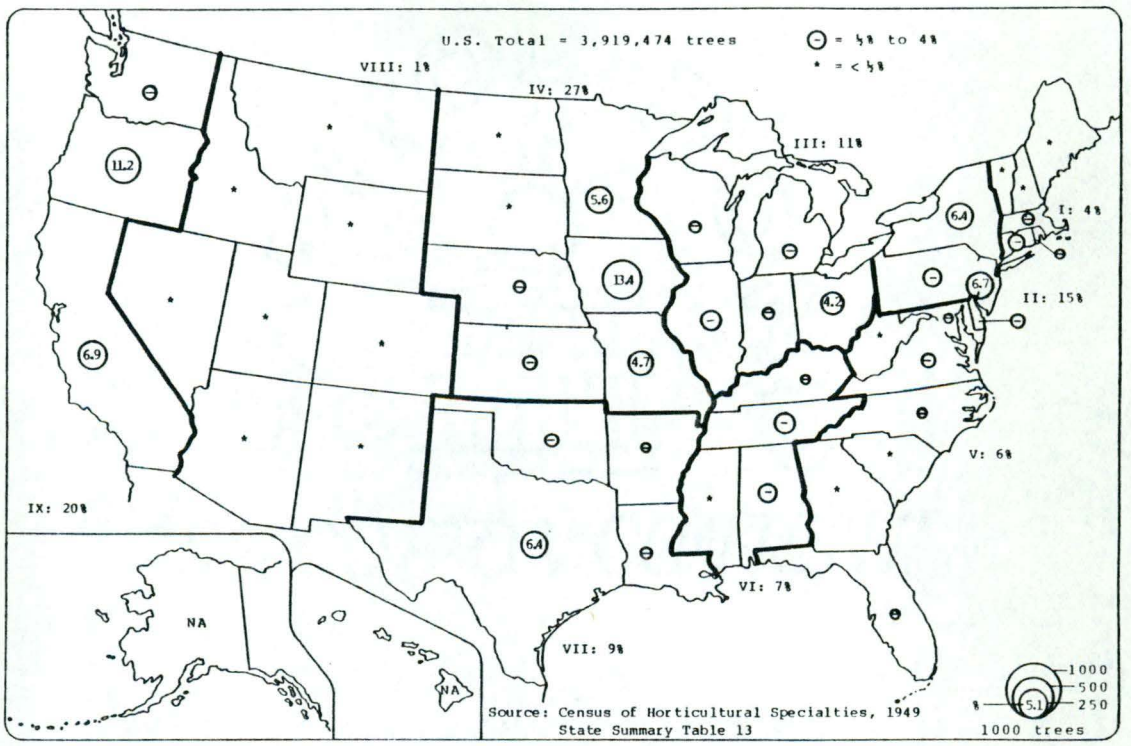


Figure 9-19. Production of Ornamental Deciduous Trees, 1949

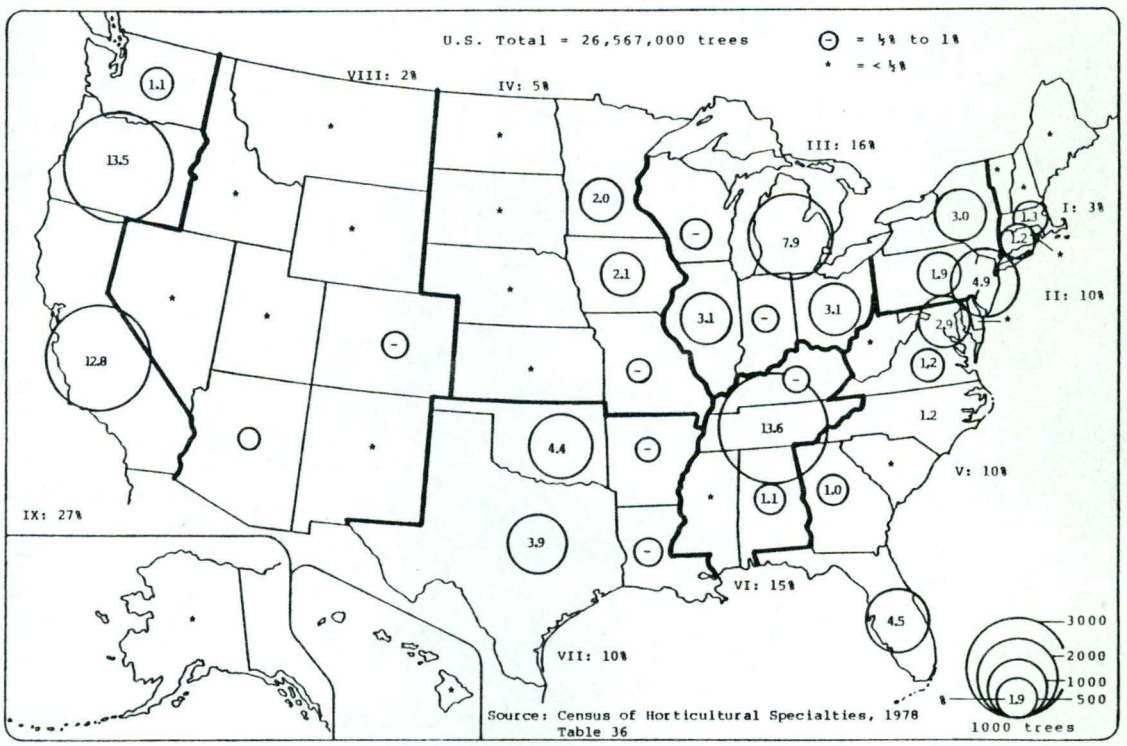


Figure 9-20. Production of Ornamental Deciduous Trees, 1978

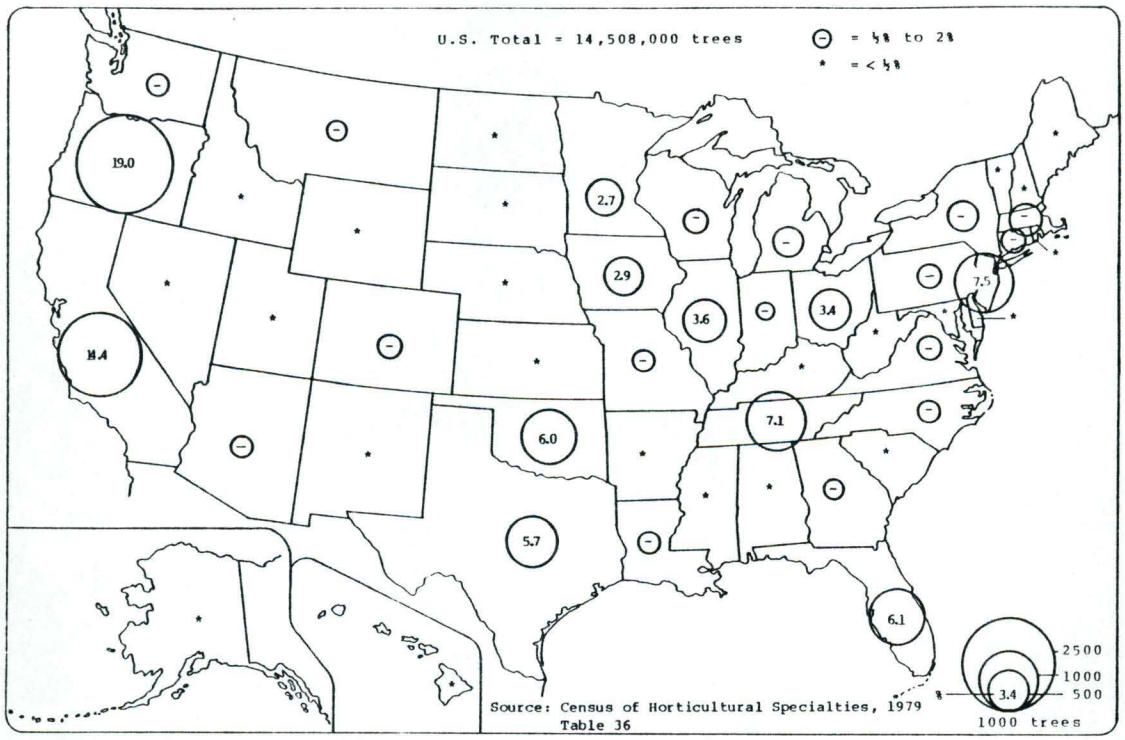


Figure 9-21. Production of Deciduous Shade Trees, 1978

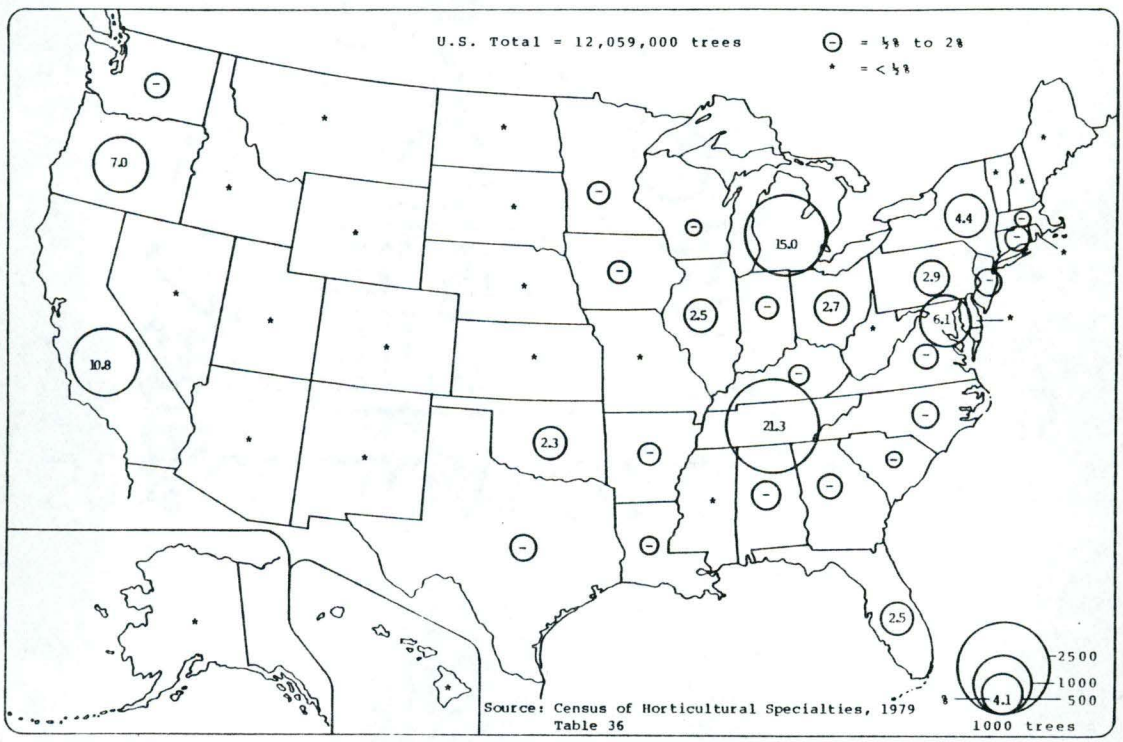


Figure 9-22. Production of Deciduous Flowering Trees, 1978

trees.

The differences in nursery production of individual genera are equally striking. Figure 9-23 showing production of flowering apple trees has an interesting pattern. Note that the southeastern states produce very few. Nurseries in the coastal states from North Carolina to Texas grew only 3% of the national crop in 1978, less than Minnesota alone. But three states just inland or north of them, Tennessee, Arkansas, and Oklahoma, grew over 20% of the total. And the states of the Midwest and Northeast, led by Michigan, produced over 60%.

Similarly production of ash trees, Febure 9-24, is distributed in a unique way. The Southeast generally has low production, but Texas and Florida each have sizeable numbers. And the states in the Rocky Mountain region, led by Montana, appear on this map, one of the few.

These strong regional differences undoubtedly reflect to some extent regional market differentiation. Many deciduous trees are sold B&B which restricts the distances they can be shipped, and production must necessarily be close to markets. Also important are the climatic needs of young nursery stock and the advantages to production given by some regional climatic factors. I suspect that the major climatic factor responsible for the distribution of flowering apple production is daylength during the growing season. With ash trees it might be the influence of regional climate on market demand, many ash species being more tolerant of colder winters and dryer summers than most other shade trees.

I feel the regional production of deciduous trees can be understood better by using another system of regionalization based on

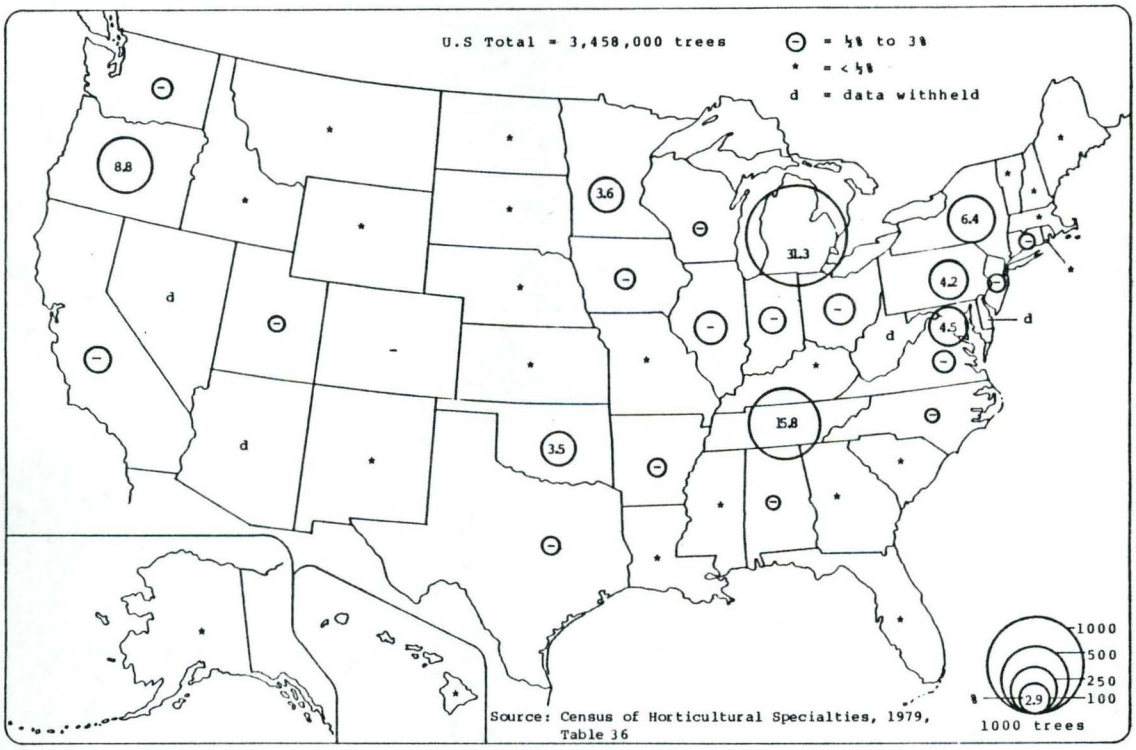


Figure 9-23. Production of Flowering Apple Trees, 1978

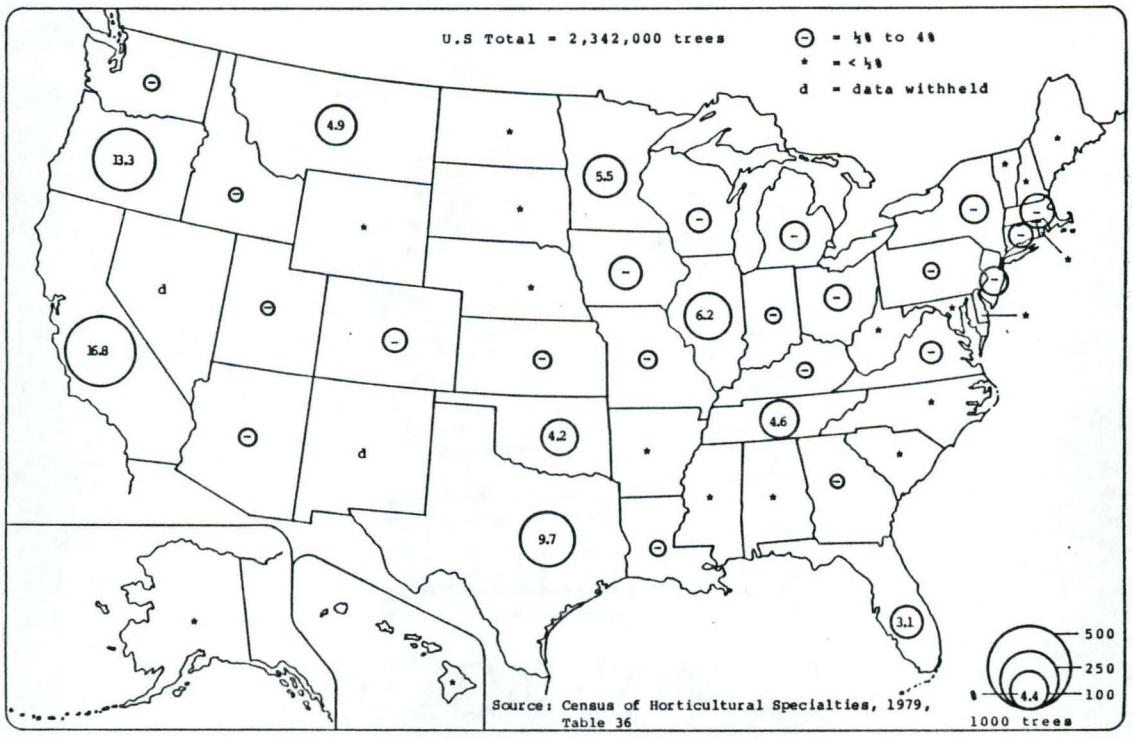


Figure 9-24. Production of Ash Trees, 1978

similarities of markets and of climates. Figure 9-25 shows the regions I feel better suit the distributional patterns for the production of deciduous trees as a whole. It recognizes eight important producing regions with distinctive climates, markets, and histories. Figure 9-26 chronicles the changes in each region from 1949 to 1978 in its percentage share of the national nursery production of deciduous trees. It also indicates each region's share of the national population, taken here as a very rough surrogate measure of market demand for deciduous trees.

I have chosen the Atlantic Northeast region on the basis of its market location, the urbanized corridor from Norfolk to Boston, and its climatic range; most of the nursery production of deciduous trees in this region is in U.S.D.A. Hardiness Zones 6 and 7 (Figure 4-1). Because of the similarities in markets and climate this region includes three states from the Census New England region and three from the northern part of the Census South Atlantic region. As seen in Figure 9-26 the Atlantic Northeast has always been a major producing region for deciduous trees, but much less than its share of the national population. Nursery production in the Atlantic Northeast is not enough to supply its own market demand and the region is a net importer of deciduous trees from other regions. There is strong competition for farmland, which might otherwise be used for increased nursery production, from urban land uses, and the region's deciduous tree production is weighted heavily toward B&B trees for its immediate retail markets with little room to grow liners or younger trees.

The Great Lakes region was chosen also as a major market region

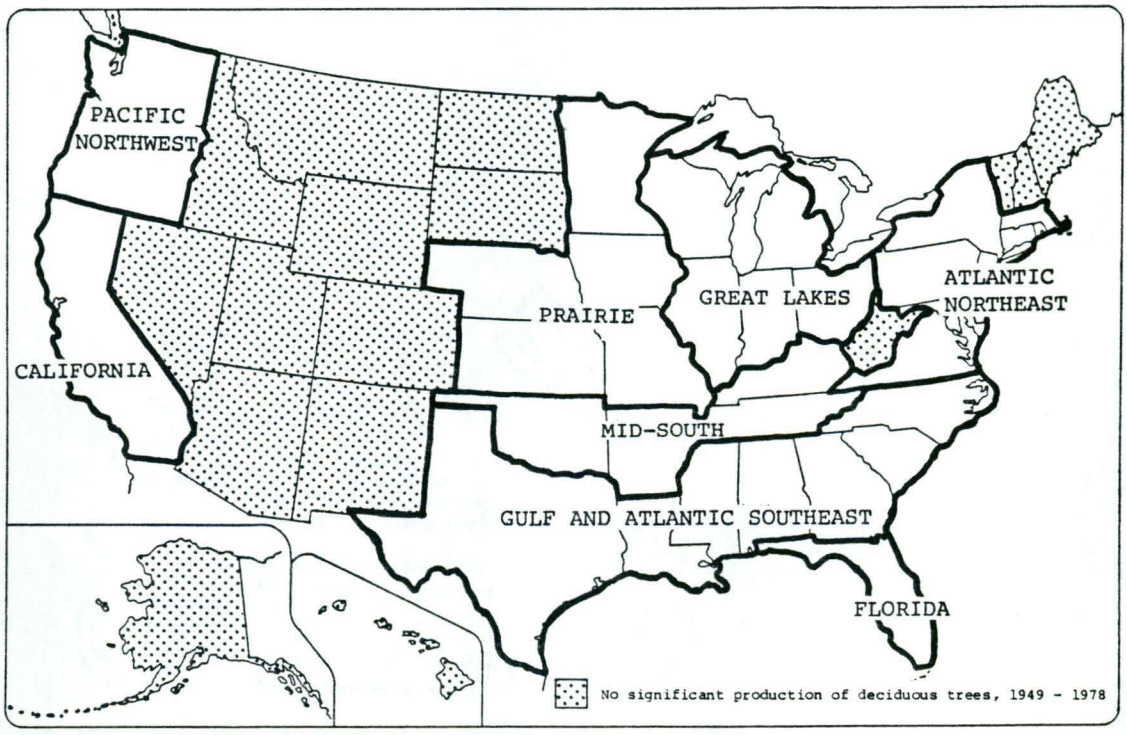


Figure 9-25. Production Regions for Deciduous Trees

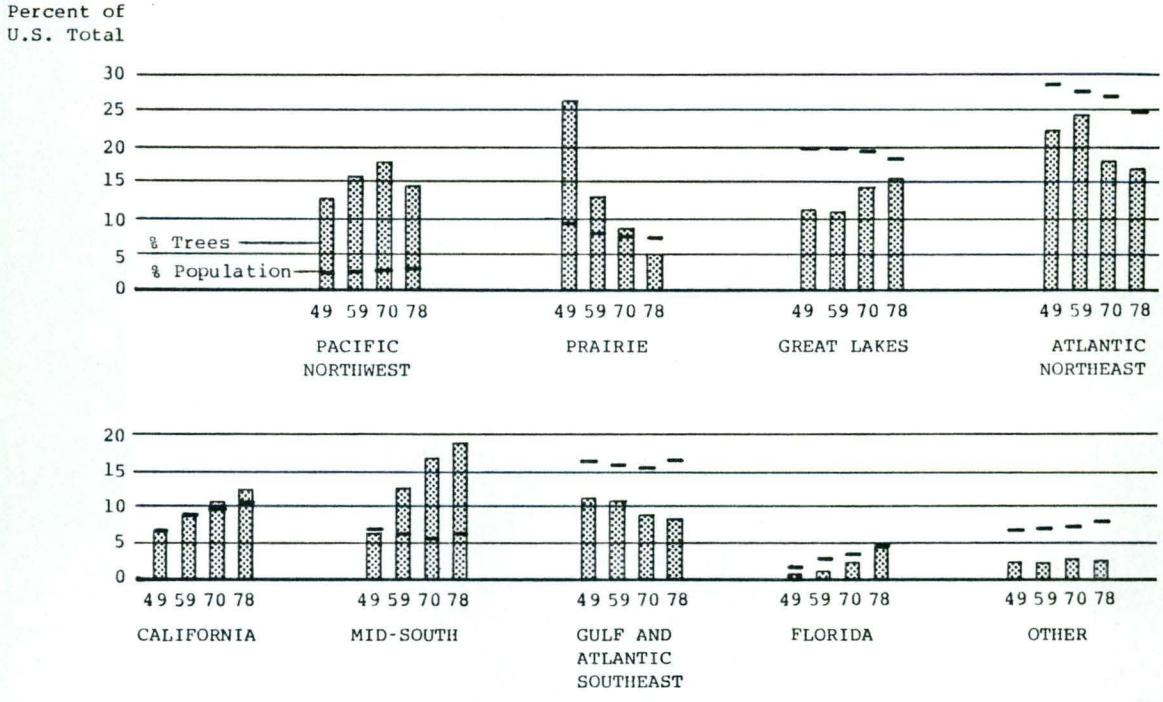


Figure 9-26. Change in Regional Percentage of National Production of Ornamental Deciduous Trees, 1949 and 1978

with nursery production in a limited climatic range, mostly Zones 5 and 6. Unlike the Atlantic Northeast, however, this region's share of the national production of deciduous trees has been increasing over the years. And, although this is still less than its share of the population, the discrepancy is decreasing and the region is a net exporter of certain types of trees while a net importer of others. There is still ample farmland available here for nursery expansion, although the supply is limited in the climatically favored areas near the lakes. One of the main reasons for the large increases in production of deciduous flowering trees in Michigan from 1949 to 1978 was the availability of farmland that could be put to nursery production along the east shore of Lake Michigan, one of the few parts of Zone 6 along the Great Lakes not under strong urban development pressure.

Nursery production of deciduous trees in the Prairie region has essentially held even over the last three decades, but in an expanding national market this has meant that its share of the total has dropped dramatically. From 27% in 1949 when it was the leading region in the country in deciduous trees it dropped by 1978 to only 5% of the total, the second smallest share of the eight regions used here. This regional stagnation of production has actually been accompanied by a doubling of production in Minnesota, mainly due to the growth of Bailey Nurseries just outside St. Paul. This region suffers from two main handicaps in today's nursery industry. Its climate is the most severe of any in the country and it is relatively far from major markets. With the end of the Prairie States Forestry Project its own market has also declined somewhat. With improved transportation other regions, notably

the Pacific Northwest and Mid-South, have been able to capture the lion's share of the expanding markets in the Great Lakes and Atlantic Northeast regions which it used to supply.

The greatest growth in regional share of national production has been in the region just south of the two Midwestern ones, which I call the Mid-South. Production has risen from 6% to 19% of the national total and growth has been greatest in the two states of Oklahoma and Tennessee with smaller increases in Kentucky and Arkansas. This region shares two unifying charcteristics, climate and market access. It is immediatley south of the Great Lakes region and suplies that market more than any other. As seen in the study of Tennessee's nursery industry, for instance,[4] over one third of that state's nursery export sales are to the five states of the Great Lakes region. The Mid-South also occupies the interior continental portions of Zone 7 where winter temperatures are much warmer than in the Midwest and the growing season is much longer. The region also has a climatic advantage over the one immediately to its south in its longer daylength during the growing season, whose importance will be examined more in Chapter 11.

Growing of deciduous trees in the coastal states of the Southeast from North Carolina to Texas, with the exception of Florida, has declined as a percentage of the national total even though absolute numbers are up almost five times over 1949 levels. The region is by all accounts still a net importer of deciduous trees. Many of these come from the Mid-South where climate favors nursery production of deciduous trees. 29% of Tennessee's nursery exports in 1980 were to states in this region.[5] reversing the general nationwide trend of nursery sales

going to the north of producing regions.

Florida is a separate region both in market and climate. While it supplies national markets with evergreens it appears to be supplying mostly its own market with deciduous trees, and the increases in production from 1949 to 1978 have been in association with equally large increases in population. Climatically Florida is unique in having large areas in both Zones 9 and 10. The short winters and the relatively short summer daylength are both limiting to the growth of many species of deciduous trees used farther north, especially the popular flowering ones, and this limits Florida's potential as an exporter of deciduous trees. It does have a sizeable industry propagating lining-out stock of deciduous trees but not of full-size nursery stock except for a few species of shade trees.

The states of the Rocky Mountain area are as yet only small producers of deciduous trees although there have been large increases in almost all states there since 1949. Montana, for example, was the sixth leading state nationally in production of ash trees in 1978, but among all the genera of deciduous trees grown nationally the Census Mountain region grew only 2% of the total in 1978. I have chosen to exclude these states from the major regions for deciduous tree production, along with others around the country which have had less than 1/2% of the national total in at least three of the four decennial censuses of Horticultural Specialites since 1949.

On the Pacific coast are two regions separated by their very different markets and climates. California is a major retail market for all types of nursery plants including deciduous trees, but its

production share has only recently begun to exceed its own population shares. The state is undoubtedly a net exporter of some species. Given its distance from other major markets California exports of deciduous trees much necessarily be mostly smaller bare root trees. The state is climatically diverse and the Sacramento and San Joaquin Valleys have winters with enough cool weather and summers with enough daylength to provide good growth of most deciduous trees, especially shade trees.

The Pacific Northwest region has deciduous tree production centered largely in Oregon's Willamette Valley with a secondary area in Washington's Yakima Valley. The region has been a major exporter of deciduous trees throughout the period. Far from major markets to the east it exports mainly smaller bare root trees to wholesale growers in the Great Lakes and Atlantic Northeast. Both winter and summer climatic conditions are very favorable to the growth of most deciduous tree species as will be discussed in Chapter 11. But the region has not appreciably increased its already large share of the national market since 1949. This is probably due largely to increasing self-sufficiency in the Great Lakes states and the major increases in production in the Mid-South region.

This scheme I have proposed for a regionalization of deciduous tree production could be repeated with other types of ornamental plants, using market access and climate as major criteria. They would show some different patterns and regions, however. Nursery production of each plant type has certain broadly similar climatic and market characteristics that differ from those of other plant types. To understand the important changes in regional production and specialization that have

occurred in the past several decades one must consider these factors in some detail. The next three chapters will do this for the nursery industry as a whole, Chapter 10 for soils and water supply whose locational roles have changed markedly in recent decades, Chapter 11 for the most important climatic factors, and Chapter 12 for the changing market demand for woody ornamental plants.

Chapter Nine - Notes

[1]Stump, The Census of Horticultural Specialties, 15.

[2]"Open Diamond Jubilee Rose Garden," American Nurseryman 122 (15 July 1947), 16-17.

[3]Interview with David Stump, former President, Jackson & Perkins Co., Medford, Oregon, September 1983. In the 1950s Stump worked for Armstrong Nurseries of Ontario, California and was actively involved in the site selection process. A. C. Anderson, John L. Retzer, Bruce C. Owen, L. F. Koehler, and Ralph Cole, Soil Survey of the Wasco Area, California, Series 1936, No. 17 (Washington: U.S. Dept. of Agriculture, 1942).

[4]M. B. Badenhop, "Marketing Woody Ornamental Plants by Tennessee Nursery Wholesalers," Tennessee Farm and Home Science 120 (1981), 8-10. See also the discussion at the beginning of Chapter 11.

[5]Ibid.

CHAPTER TEN

SOILS AND WATER SUPPLY AS LOCATIONAL FACTORS

With the rapid increase in container-growing in recent decades, soils have become much less important as a locational factor in the nursery business as a whole. The use of artificially combined planting media has allowed container-growers to use sites with soils which would be unsuitable for field-growers. Field-grown stock, of course, is still very dependent on soil quality, and for those plants grown in the field it is perhaps second only to climate as an overall locational factor at the national level. At a local level within a climatic region it becomes, with water supply, even more important.

And while container-growing has made soils less important to locations it has conversely made water supply more important. Container nurseries use larger amounts of water than field nurseries and use it in a more concentrated area. Establishment of new nurseries or expansion of old ones can be difficult in areas where water is expensive or in short supply. This chapter will examine the current importance of soils and water supply as locational factors, for both field-growers and for container-growers, in different parts of the country. It will especially look at the ways that the continuing switch to container-growing is changing the relative importance of these two factors.

Soils for Field-Grown Plants

The soil requirements of field-growers are much the same today as

they were three hundred years ago: good drainage, permeability, tilth, fertility, depth, etc. The soils that Prince Nurseries used on Long Island are the same soil types used by field growers on the island today. The different requirements of bareroot and B&B growing methods, as described in Chapter 3, can often lead to segregation of nurseries in an area according to soil types. B&B soils usually need to be heavy loams, with a higher clay content, to make a firm root ball. Bare-root soils need to be lighter, with more sand or silt and less clay, to enable winter harvesting and easy removal of the soil from the roots.

Some examples will illustrate these conditions. In the northern Willamette Valley in Oregon are many growers of bare root deciduous trees. In eastern Multnomah and Clackamas Counties most of the farms today are on silty loams. Examples are Moller's Nursery on a high terrace above the Sandy River, located on approximately 500 acres, mostly of Mershon silt loam, a moderately well drained loam formed in loess and medium textured old alluvium, and Cornelius silt loam, a moderately well drained loam formed in silty materials over old alluvium.[1] A mile to the south is J. Frank Schmidt & Son, another large grower of dedicuous trees, with 1700 acres at several different sites. One is their Crystal Springs farm, approximately 100 acres, on Cazadero silty clay loam, a well drained loam formed in old alluvium mixed with loess and volcanic ash.[2] Some 40 miles to the southwest is Carlton Nursery, another large grower of deciduous trees, including fruit trees, with some 1500 acres overall, centered on their headquarters south of Dayton in Yamhill County. The farm is mostly on Woodburn

silt loam, a moderately well drained loam formed in silty alluvium on terraces above the Willamette River.[3]

In Warren County, Tennessee, in the area around McMinnville, are several nurseries growing primarily deciduous trees and shrubs. The Boyd Nursery west of McMinnville, a large grower of shade and flowering trees, is mostly on the Dickson silt loam and Mountainview silt loam, both moderately well drained soils formed in loess.[4]

In Lake County, Ohio, east of Cleveland along the south shore of Lake Erie, a large number of growers have found a variety of sites on old lake and glacial till deposits. Many are on Red Hook sandy loam, a somewhat poorly drained soil on old lake plain beach ridges, and Tyner sandy loam, a well drained soil on the upper sides and crests of postglacial beach ridges.[5]

And on Long Island in New York there are many nurseries in Suffolk County also on glacial soils. The most common soil in areas where deciduous trees are grown is the Haven loam, a deep well drained soil with a sandy loam subsoil formed in glacial outwash between the two moraines which run the length of the island, and the Riverhead sandy loam, a deep well drained and moderately coarse textured soil with a sandy gravelly loam subsoil.[6]

Plants that are dug and stored bare root are often later sold with a root ball. The root ball soil material can be added to the plant's roots after harvest and held there by some sort of wrapping or container. These are called packaged or peat balled plants, and they are given an artificial root ball to make them easier to sell and handle as

retail items.

Plants dug with a natural root ball from the field and wrapped in burlap for storge, shipment, and sale are known as balled-and-burlap plants, or B&B in the trade. Their soil requirements are different from those of plants dug bare root. To form a firm root ball which will not break apart in handling, the soil must have a clay component, especially in the sub-soil or B-horizon which usually forms the lower part of the root ball containing the most fragile feeder roots. For this reason clay loams are preferred for B&B evergreens.

Plants grown to be dug with a natural root ball include most evergreens, both needleleaf and broadleaf, beyond their first year, and some deciduous shrubs and deciduous trees, especially those grown for the retail trade. Most of these, especially the evergreens, are dug in the spring or early fall rather than in the late fall or winter like bare root plants, and the soil is not as liable to be as wet for as long a period of time. The soil can then be heavier, with its clay content, and still be useable. Nurseries raising B&B plants, therefore, are usually on fine silty or clay loam soils with clay or silty clay subsoils.

In Lake County, Ohio, in addition to the sandy loams where many bare root plants are grown are silt loams with poorer drainage where many B&B plants are grown. The Lake County Nursery Exchange, for example, is located mostly on Conneaut silt loam, a somewhat poorly drained soil with a silty clay loam subsoil, often needing artificial drainage, found on silty glacial till of the old lake plain.[7]

And in Warren County, Tennessee, the Forest Nursery Company to the

south of McMinnville raises a wide variety of material, including both lining-out and finished stock of evergreens, azaleas, deciduous trees and shrubs, and vines, most of which are dug B&B, but including some bare root stock as well. Their land is on three soil types: Waynesboro loam, a deep well drained soil formed in alluvium but with a clay loam subsoil, Cumberland silt loam, also a deep and well drained alluvial soil with a clay or clay loam subsoil, and Huntington silt loam, also deep and well drained alluvium, but with a sandy gravelly subsoil.[8]

Digging plants with a root ball removes soil from the land and over time this can seriously deplete the local soil resource. Montebello, California, just east of Los Angeles was a center of the nursery business in southern California for several decades in the middle of this century.[9] Most of the nurseries there took advantage of the Ramona loam soil with its silty loam topsoil and clay loam subsoil. A wide variety of plants were raised, from bare root roses and B&B evergreen shrubs to greenhouse bedding plants and ground covers. By the early 1950s the natural fertility of the soil had been depleted through continuous cropping, and it required the input of fertilizers and organic matter. Continued removals of top soil in the B&B process had also reduced some nurseries to growing plants on the exposed subsoil. Nurseries went from importing fertilizer and organic matter to importing sand and topsoil as well, to mix with the remaining soil.

Many Montebello nurseries began to switch over to container-growing using sand and peat as the principal ingredients, and one nursery, Chemical Gardens, adopted hydroponic culture for its cut flower business, using only sand. Some other nurseries began buying or leasing

land elsewhere to grow their plants, and eventually most of them moved out of the area. The Montebello Rose Company, for instance, is today located in McFarland, California, in Kern County some 100 miles to the north. The pressure of increasing urbanization and rising land values was probably an equally important factor, but the destrubtion of the B&B soil resource and the independence from local soil conditions brought about by the requisite shift to container-growing were major elements in the decline of Montebello as a nursery center.[10]

Where the soil is deep and the subsoil is not markedly different from the topsoil, the B&B process can go on, however, for a long time. Many nurseries add large quantities of sand and organic matter to the remnant subsoils and can thus continue to use them for growing almost indefinitely. The removal of soil is a sort of resource depletion, though, and nurserymen have tried to have B&B operations included under the Internal Revenue Service's depletion allowance taxing provisions, similar to that used by mining and oil companies, but Congress and the I.R.S. have failed to see the merits of their case.[11]

Other soil factors are important in the location of nurseries. Some plants, especially certain broadleaf evergreens like rhododendrons and azaleas, require well drained acid soils with large amounts of humus. These can be limiting factors for some types of nursery locations, but they can also be created artificially by adding various acid solutions to the soil and by incorporatig peat or other types of organic matter into it. The trend in recent decades has been to container-growing of many of these types of plants, in which case the rooting medium is usually prepared from a recipe of appropriate

ingredients.

Most nurseries with field grown plants practice crop rotations regularly. After the nursery plants have been in the ground for two or three years, the soil needs a rest and a chance to regain porosity and aeration in its upper layers. Most nurserymen follow their field grown ornamentals with either a fallow season, a cover crop, or a cash field crop, usually some type of grain. They also re-till and usually sub-soil the land before planting out the next crop of ornamentals. The cover crop or grain crop and the extra field work are beneficial in re-establishing soil texture and tilth. Maintaining a loose friable topsoil is essential for good root development in field grown plants.

Container-Growing

The development of container-growing in California in the years between the first and second world wars laid the groundwork for a major revolution in the nursery business. The ability to grow plants in pots filled with artificially combined ingredients has freed many nurseries from dependence on natural soil conditions in their choice of locations. It has also allowed for easier handling of the plants and for a longer sales season, but these have had less impact on the location of nurseries.

One of the distinguishing features of container-growing is the use of soils or soilless media which are brought into the nursery from elsewhere and are not derived from the local soils of the nursery site. This developed in the years between 1920 and 1950 from the practices of some nurserymen that required extra soil amendments or additives for

certain phases of production, usually propagation. Greenhouse growers had long recognized the advantages to be had with the creation of their own soil mixes for plants grown in pots. By 1940 Alex Laurie of Ohio State University had published Soilless Culture Simplified[12] and several state experiment stations were helping greenhouse growers, especially those producing cut flowers, to adopt new techniques of production. Propagators of woody ornamentals had also begun to experiment with other soil ingredients and mixes but not on a standardized formula.

Most common as soil amendments or added components to natural soils were: sand, especially sharp sand, used to aid rooting of cuttings; vermiculite, used much like sand to provide a porous texture but much lighter in weight; various kinds of peat, used to provide organic matter which could retain more moisture and nutrients; bark, used much as peat; and compost of various origins, used most often as a topsoil additive in field growing. Peat was also a common mulch and soil amendment for field growing, especially for broadleaf evergreens.

When nurseries began growing woody ornamentals in containers in the 1920s and '30s, they often simply used local topsoil, with or without some of the added ingredients. In the 1940s, though, nurseries in southern California began to use a potting mix made up of sand and peat for woody ornamentals in containers. The sand was often from local sandy loam soils, but also frequently was beach or quarry sand. The University of California Agricultural Experiment Station and Extension Service meanwhile had been testing a system of soilless culture for container growing. In 1957 they published Manual 23, The U. C. System

for Producing Healthy Container-Grown Plants.[13]

The U.C. System involved the use of steam sterilization of the soil ingredients and mechanized handling of the soil mixing and much of the planting process. Cleanliness was an important part of the system, and the use of sand and peat as the principal ingredients of the potting mix was designed as much as anything to take advantage of their ability to be easily sterilized. The use of the U.C. system spread from southern California to container-growers in central and northern parts of the state, most of whom had been using field soils in their pots. From California it spread east to other nurseries which had also begun to adopt containerization.[14]

The success of the U.C. System can be seen in the fact that the soilless mix of sand and peat is reported to be the most common mix in use today by container-growers.[15] Many other ingredients are also used in other mix formulas for different types of plants by many nurserymen, of course. The most common other ingredients are vermiculite and bark. Most nurseries use more than one mix, and some like Monrovia Nursery in Azusa, California, use as many as twelve different mixes in different parts of their operations.[16]

The use of artificial soils does not free a nursery entirely from its local site conditions, however. The ingredients for container soils are an expense which can be minimized by reducing costs, especially those for transportation. Sand being the heaviest of the ingredients is most affected by transportation costs. Container nurseries need to have a reliabile source of sand in their neighborhood. This is rarely a serious limitation, however, since sand is readily available in most

parts of the country due to its use in many construction activities. Sources are many: coastal, lacustrine, and riparian deposits, both recent and ancient, and glacial deposits of many kinds.

Peat is much lighter and transportation costs are much lower than for sand. Although some is taken from marshes and bogs in the U.S., especially in the northern states, some 80% of the peat used horticulturally in the U. S. today comes from Canadian sphagnum deposits.[17] The largest supplier, Premier Brands, is a Canadian firm with offices in Riviere du Loup, Quebec, and New Rochelle, New York. Their peat comes from bogs in Quebec and Manitoba.[18] Peat is available in a variety of grades and textures, and is usually sold by the packaged bale (5.5 cu. ft.). Large container nurseries can use enormous quantities of the stuff. Monrovia Nursery used 40,000 bales of sphagnum peat in 1981, for instance, all of it bought in wrapped bales.[19]

The major benefits to nurseries from the use of container-growing have come from increases in production efficiency through the ease of handling, reduction of risks, etc., and from the higher market value of container plants. It has also had major impacts on the locational factors involved in the nursery business. By and large these have led to greater freedom of choice for nursery locations, but they have in some other ways also limited the locational freedom of nurseries.

Among the limitations the most serious is the increased sensitivity of plants in containers to cold injury, compared to field grown plants. The elevation of the roots above the ground exposes them to air temperatures which can be much colder than soil temperatures. Even with

protection by bunching or covering, the roots of containerized plants are still usually at least 25°F more tender at any given location than their field grown counterparts. This has resulted in a general southward or coastward shift in growing areas for many plants, toward areas with warmer winter minimum temperatures. This will be discussed in more detail in Chapter 11.

Other locational limitations inherent in the container-growing system are less critical, usually involving the management of water on the site. Container growing can require more water than field growing, if overhead irrigation is used, because the potting media are more porous than natural soils and especially because plants in containers can dry out more quickly, requiring more frequent watering. This is rarely a serious problem except for very large container nurseries in areas with serious water supply problems. The use of chemical wetting agents to increase the water holding capacity of the potting medium and the use of drip or trickle irrigation can greatly reduce the need for water, though. These will be discussed more fully in the next section.

Once the water has passed through the pot, or simply missed it altogether and fallen on the ground, it must be taken from the site. Container-growing relies on hard surfaces, usually crushed gravel but sometimes concrete or asphalt, and these inhibit or prevent percolation of surface water into the soil. All drainage must therefore be surface drainage. This requires that the production blocks in the container nursery be graded carefully to direct the runoff and that a hierarchical system of surface drains be constructed on the site with access to adequate drains off the site (Figure 10-1). When the Greenleaf Nursery

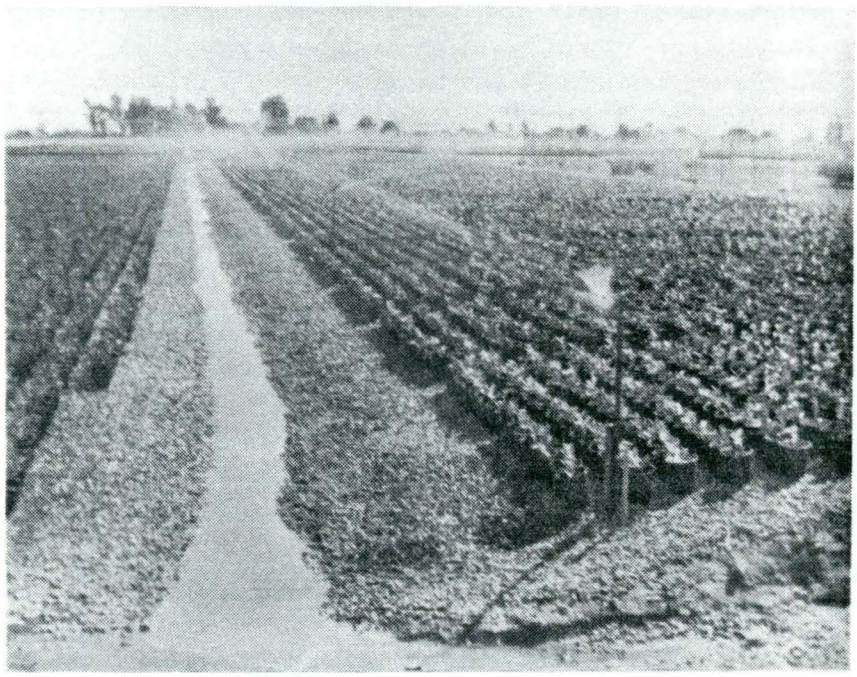


Figure 10-1. Irrigation and Drainage at Oki Nursery, Sacramento California

Co. of Park Hill, Oklahoma went looking for a site for their new Texas container yard near Houston in 1971, the presence of two natural creeks which could handle the nursery's drainage overflow was one of the features that attracted them to the site they finally chose.[20]

On some sites this excess drainage can also limit available sites if the runoff from the nursery will become a significant point source of pollutants to natural streams that form the only available drainage. By and large these are only minor locational obstacles, though, and in some cases they can be turned to advantage. The greatest locational advantage from container production is the freedom from requirements for only certain types of naturally occurring soils. Since container nurseries buy and mix their own potting media and require, in effect, an industrial-grade land surface, they can locate on a variety of soils previously unacceptable for nursery growing. Carlton Nursery near Dayton, Oregon, for example, opened a 94 acre container yard in 1980 on a site covered with poorly drained heavy clay soils which had not been used for crops at all in recent years, only for pasture. They removed the topsoil into a series of berms around the site, graded and gravelled the remaining surface, and built a series of drainage ditches to carry runoff away.[21]

This relative freedom from local soil conditions has allowed other locational factors to influence the decisions of container-growers. Many nurseries which convert from field to container-growing remain at the same location because it continues to serve their needs. Others find the increased frost tenderness an incentive to move, and still others may be looking for new sites for a variety of other reasons.

Container-growing allows those who want to move to use land that might otherwise be less fit for nursery production and to be able to take better advantage of other opportunities such as climate, transportation access, water, labor supply, etc.

One of the main benefits to accrue to nurseries with container operations is the ability to grow plants at a much greater areal density than with field grown stock. Containerized plants can be put much closer together than field grown plants, and the land does not require crop rotations or fallowing. This allows nurseries to operate on much smaller sites. The Monrovia Nursery took up 500 acres in 1981 and estimated then that it would have taken 2500 acres to grow the same number of plants in the ground[22] (Figure 10-2).

The Horticultural Research Institute found in 1982 that container nurseries were on the average from six to seventeen times smaller in area than field nurseries with comparable sales figures.[23] While some of this can be due to a higher value per plant for many of the species grown in containers compared to those grown in the ground, most of it is due simply to the more concentrated use of land. The H.R.I. also noted that container nurseries in most size classes were very small, less than 12 acres on the average, except in the category with sales over one million dollars a year, Table 10-1.

The locational implications of this increased areal productivity are important. They give container nurseries a much higher return per acre, keep overall size demands low, and thus allow them to compete for locations with many non-agricultural land uses, especially in the suburban land market near metropolitan areas where field growers have

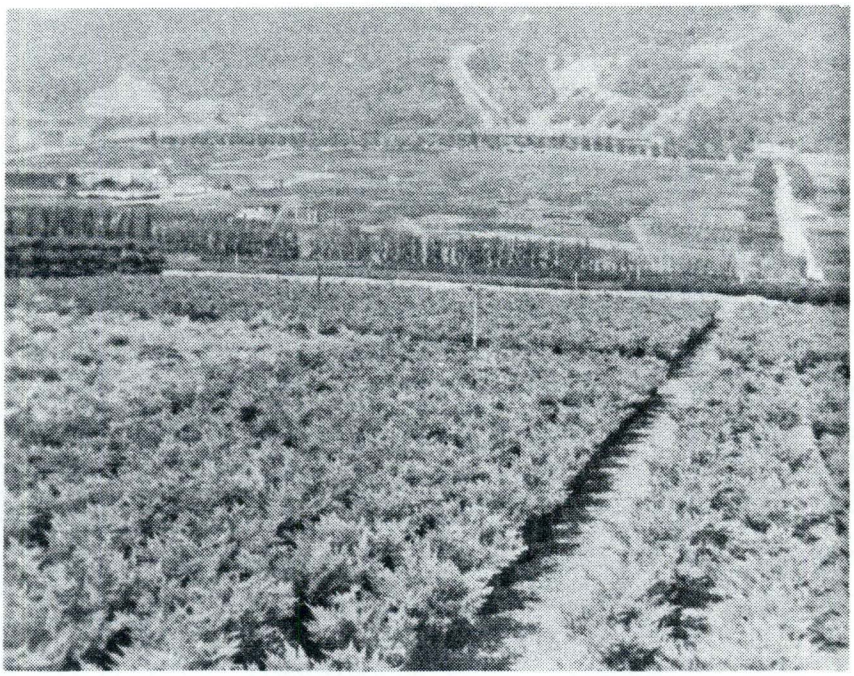


Figure 10-2. Monrovia Nursery in Azusa, California

Table 10-1. Average Acreage and Sales of Container and Field Nurseries

Company Size	Average Sales C	Average Sales F	Avg. Acreage C	Avg. Acreage F	Avg. Sales/acre C	Avg. Sales/acre F
$25,000-100,000	$56,000	$56,300	4	25	$14,000	$2,252
100,000-300,000	189,200	195,000	6	56	31,533	3,482
300,000-500,000	388,600	363,100	11	111	35,327	3,271
500,000-1,000,000	680,700	741,600	11	185	61,882	4,009
1,000,000 and over	5,186,000	3,136,200	95	534	54,589	5,873

C = Container Nursery F = Field Nursery

Source: Horticultural Research Institute, Scope IV, 12.

greater difficulty. This allows for more flexibility in finding locations with access to markets.

Water Supply and Nursery Locations

Like other types of agriculture, nurseries for woody ornamentals also have moisture requirements which vary with the type of crop, and these can impose constraints on their locations. In general, nursery plants are very demanding of water and most nurseries use irrigation in one form or another. Even field-grown stock have relatively small and shallow root systems which require regular applications of water especially during the growing season. Natural rainfall is rarely frequent or heavy enough to supply the amounts needed. Container nurseries have even greater water demands, both because of their greater density of plants and because of the greater water requirements of containerized plants compared to field grown plants. In addition to water availability, nursery locations can be limited by water quality. High concentrations of minerals and salts can be harmful to some plants, as can strong alkalinity or acidity.

Field-grown plants require moisture in excess of natural precipitation in most areas of the nation usually only during the summer and immediately after planting or transplanting at other seasons. But needs then can be high: a minimum of an inch of water per week, or at least four inches per month if evenly distributed.[24] As shown in Figure 10-3, the area receiving over 4" per month in both April, a common month for transplanting, and August in the summer growing season, is relatively restricted, in the Southeast and scattered along the

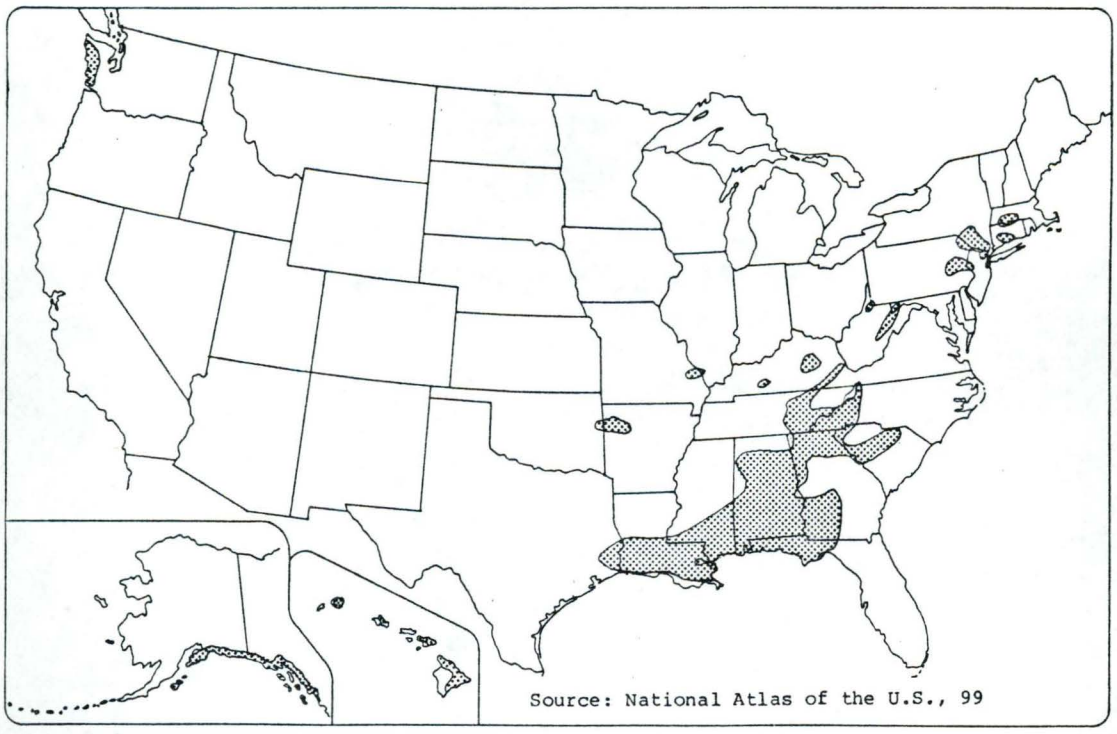


Figure 10-3. Areas with More than 4" Rainfall in April and August

northeast coast. Given that much of this precipitaiton is often unevenly distributed in several isolated storms, it is clear that in most of the nation field nurseries must rely on irrigation water for many of their plants.

Container nurseries use even more water, up to 3" per week during the summer,[25] and they continue to need water during the other seasons of the year. In part this is due to the much greater porosity and permeability of container planting media and in part to the fact that water not directly entering a container lands on the ground outside the pot and is unavailable to it, unlike with field-grown plants.

Furuta and others have estimated that one gallon container plants in Santa Ana, California, require between 15.7 and 23.4 gallons of water per year.[26] Depending on the spacing between containers and the method of application of the water, much more than this needs to be applied. Overhead spinrkler irrigation, commonly used in most container nurseries, waters the pavement as well as the containers. With pots as close together as possible they still cover only 91% of the surface area. Moving one gallon pots 2" apart in a triangular spacing reduces the coverage to 51%, and moving them 4" apart reduces it to just 33%.[27] This requires the use of two to three times as much water as is actually entering the containers. For many plants, however, such spacings are required for full development of a wide-spreading top. A ten acre container nursery can easily use from 15 to 30 million gallons per year, often more if available.

These amounts are often unavailable in many parts of the nation, however, and limitations of water supply can be a major limitation of

location of container nurseries, and to a lesser degree for field nurseries. In areas with competition for limited water supplies, such as most of the west outside the Pacific Northwest, and near many large metropolitan areas throughout the nation establishment or expansion of container nurseries can be problematic.

Many container nurseries are actively exploring ways to reduce their water consumption. They include the use of soil ingredients with greater water retention, chemical wetting agents for the same purpose, chemical anti-transpirants to reduce plant water use, drip and trickle irrigation to reduce wastage of water, and recycling of runoff water. Of these, the use of drip irrigation and recycling appear to hold the most promise for reducing water demand.

The conflict between limited water supply and large scale container nursery production is strongest in California. The region's water resources are limited by low rainfall and a projected cut in the state's share of Colorado River basin waters at the end of this decade.[28] Container nurseries in the southern part of the state in particular are faced with drasticaly reduced allocations in the years ahead and are moving rapidly to both drip irrigation and recycling of water. Monrovia Nursery has already in place a large recycling system. Its needs of over 600b million gallons per year are met in part by recycling irrigation runoff in a new facility with a capacity of 2.3 million gallons per day, with an additional fresh water blending capacity of 2.6 million gallons per day[29] (Figure 10-4). Other nurseries are beginning to use drip irrigation extensively, especially for those plants which need to be spaced relatively far apart for optimal growth

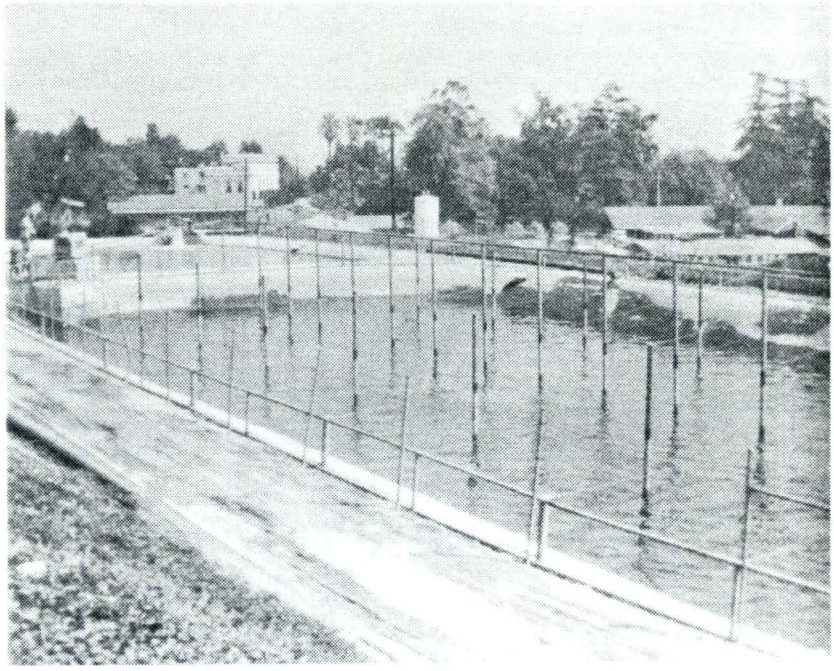


Figure 10-4. Monrovia Nursery's Water Recycling Reservoirs

Figure 10-5. Drip Irrigation to 5-gallon Junipers at Hines Wholesale Nursery, Irvine, California

(Figure 10-5).

Outside of the arid west other container nurseries are also adopting these methods. Wight Nurseries near Cairo in southern Georgia, a large container grower recently opened a new 225 acre container yard which is built in a bowl-shaped valley, with the site carefully graded to direct runoff to a central seven acre pond. Using overhead irrigation they can recapture up to 75% of the water which does not actually enter the plant containers.[30] In Florida where groundwater supplies are often limited many nurseries are using growth retardants, drip irrigation, and controlled reductions in the amount of water given to each plant.[31]

Field grown plants are more efficient in their water use, because most natural soils are much more water retentive than most container media, and because a much greater pecentage of the water applied is actually available to the plants. A large part of the water need can come from natural precipitation, moreover, especially for plants left in the ground with an untrimmed root system, such as many B&B specimen-size trees, in areas with regular summer rains.

In much of the west, however, summer rainfall is far below evapotranspiration, and field-grown plants require extensive irrigation. In most areas this is applied by overhead sprinklers, usually through moveable plastic or aluminum pipe. In several of the large valleys, though, such as the Yakima in Washington or the San Joaquin in California, surface irrigation is used (Figure 10-6). While efficiencies are generally lower than with sprinklers on a farm by farm basis due to seepage from earth lined ditches, for a water basin as a whole the

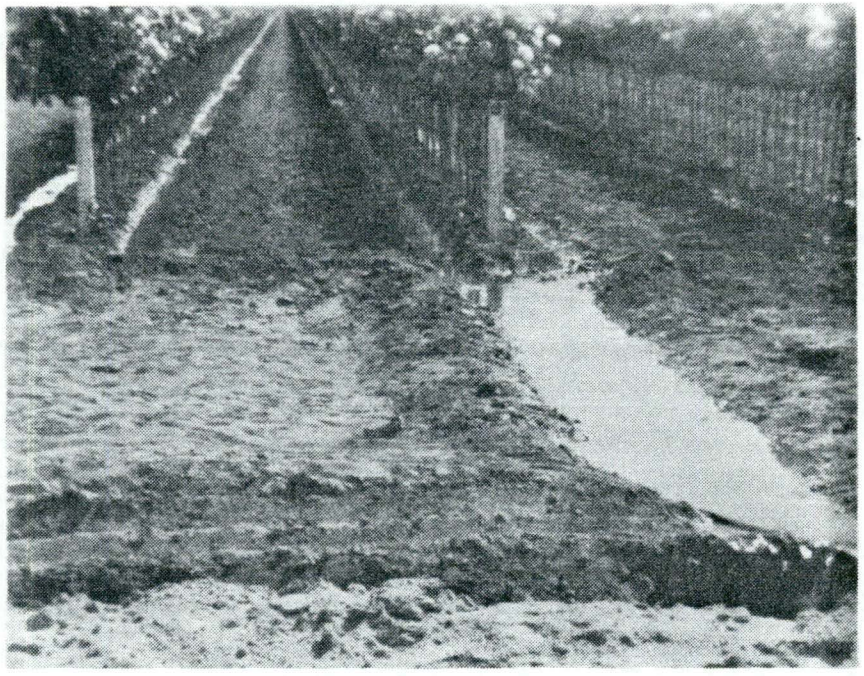


Figure 10-6. Surface Irrigation of Roses at Jackson & Perkins Nursery in Wasco, California

efficiencies are comparable because much of the seepage can be recovered as groundwater via wells.[32]

In addition to arid and semi-arid regions and those with poor aquifers, nursery water supplies are also often limited in many urban areas due to the competition from other uses, mainly residential and industrial. The advantage which container nurseries enjoy over field production in requiring less land, enabling them to locate more readily in metropolitan regions, can easily be offset by their greater water needs. On the southwest fringe of the Portland, Oregon, metropolitan area, for instance, new residential and industrial development is competing with agriculture for geologically limited groundwater supplies in one of the major nursery areas of the nation. Total groundwater use in the Newberg area, covering some 360 square miles, was 5500 acre-feet in 1975. Some municipal wells, though, have already been drawing down the water table at a rate exceeding one foot per year and several municipalities have had to switch to more distant and expensive surface water sources.[33] To establish even a medium-sized ten or twenty acre container nursery in this area, requiring anywhere from 50 to 200 acre-feet of water per year would be difficult.

Salinity, alkalinity, mineral and other ionic content of the water is also important. It is difficult to grow acid-loving rhododendrons and azaleas, for example, with water with a pH of 8.0, derived from a dolomitic aquifer. This can be corrected, however, by adding acidic solutions to the water. More difficult is reducing salt buildup in the soil from water with high salt content, either in the arid west or in coastal areas with saline intrusions. One limitation on the ability of

drip irrigation to reduce water use to a minimum is the need to flush excess salts from the soil to prevent salt build-up. Slow steady drips or trickles are usually incapable of this unless an application rate in excess of the needs of the plant is used, simply to carry away salts.[34]

Chapter Ten - Notes

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[7]U.S.D.A., Soil Survey of Lake County, Ohio.

[8]U.S.D.A., Soil Survey of Warren County, Tennessee.

[9]The following account is taken from Wilfried William Wegener, "Nurseries of Montebello, California: A Geographical Survey of the Dynamic Cultural and Economic Factors," Master's Thesis, Univ. of Nebraska, 1953.

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[17]"Premier Takes the Lead in Peat/Soilless Mix Industry," Nursery Business 28 (Dec. 1983), 60-61.

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[19]Monrovia Nursery Company "Information Sheet."

[20]Brent Marchant, "Operating an Established Container Nursery; Greenleaf Nursery's Texas Div.," American Nurseryman 155 (15 Jan. 1982), 54-69.

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[22]Monrovia Nursery Company "Information Sheet."

[23]Horticultural Research Institute, Scope IV, 12.

[24]David F. Hamilton, "Consider Crop, Economic, and Environmental Factors When Selecting Nursery Site," American Nurseryman, 152 (1 Sept. 1980).

[25]Tokuji Furuta, Environmental Plant Production and Marketing; A Management Tool for Nurserymen (Arcadia, California: Cox Pub. Co., 1974), 137.

[26]Tok Furuta, Tom Mock, and Ruth Coleman, "Estimating the Water Needed for Container-Grown Nursery Stock," American Nurseryman 145 (15 Apr. 1977), 68.

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[29]Monrovia Nursery "Information Sheet."

[30]Brian Smucker, "An Old Nursery Builds a New Nursey," American Nurseryman 153 (15 June 1981) 8-9, 86-94.

[31]See, for example, the Woody Ornamental Research Report 1982 of the Ornamental Horticulture Department, Institute of Food and Agricultural Sciences, University of Florida, Gainesville: James E. Barrett "Effects of Growth Retardants on Plant Water Use," 17-19; Dewayne L. Ingram and Cathy C. Harrell, "Effects of Irrigation Schedule on Woody Plant Growth in Containers," 22-23.

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CHAPTER ELEVEN

CLIMATE AS A LOCATIONAL FACTOR

The effects of climatic locational advantages can often be more easily demonstrated than they can be fully explained. Many factors are involved, and the few for which data are readily available may show correlation but not necessarily cause. A combination of factors leads to nursery growing areas being in warmer hardiness zones than those of the markets for nursery plants. This was shown in Chapter 4 using the example of the nursery products of Virginia. Unfortunately, there are no other states whose markets and sources of supply are so well documented. One other example is found in the markets for Tennessee nursery products in 1980.[1] As shown in Figure 11-1, most of the sales were to states in cooler climate zones; the East North Central states led with 29.4% of the sales, although southern states received a large part of the sales as well. Overall, 49.5% of the state's sales were to cooler areas, 24.5% to warmer areas, 8.6% to similar areas, and 13.5% in-state (2.9% went to other states not listed and foreign countries). What little data which are available for other states show a similar pattern of the majority of exports going to cooler areas.[2] How can this pattern be better explained?

This chapter will examine certain key factors in the advantages which climate gives to nursery locations and will discuss the importance of various climatic factors in helping to condition the lcoational freedom of nurseries today. The key factors to be examined in more

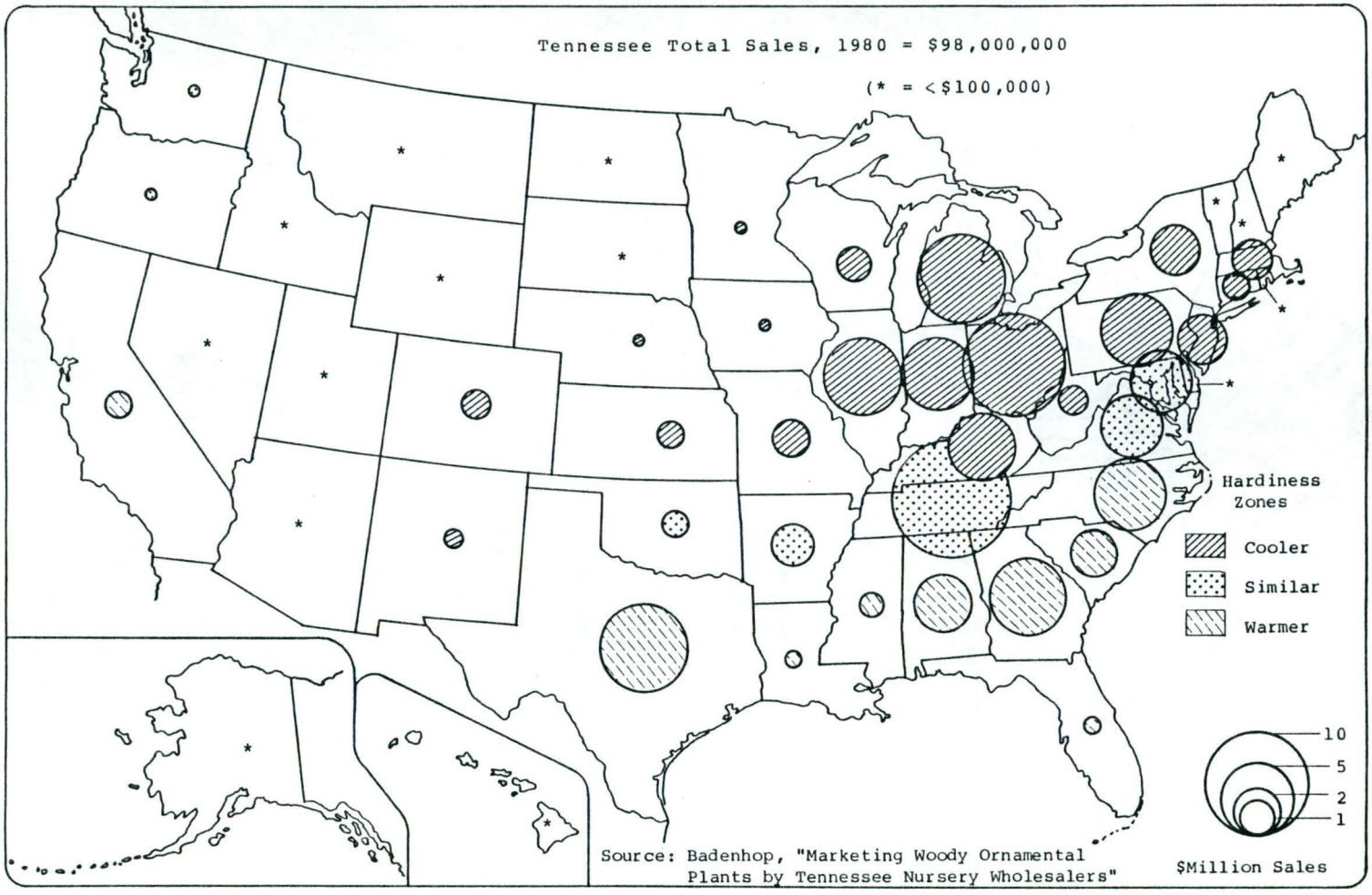


Figure 11-1. Destination of Nursery Products Produced in Tennessee, 1980

detail are the climatic requirements of nurseries growing plants in containers and the apparent influence of summer conditions on the growth rates of deciduous trees. In addition it will discuss the broad scale continental aspets of climatic regions for nursery growing as well as microclimatic influences on location in a few selected ares.

Climatic Conditions and Container-Growing

As mentioned in Chapter 10, container-grown plants are more susceptible to winter injury than field-grown plants. This is because their roots are more exposed to ambient air temperature in containers, and this is usually much lower than soil temperatures when cold and much warmer than soil when hot. Winter injury to containerized plants most commonly consists of freezing and death to parts of the root system or all of it, which results in death of the whole plant.[3]

The problem lies in the fact that the roots of plants are usually less hardy than their above-ground parts. Soil temperatures are always slower to change and more moderate than air temperatures, and plants have evolved mechanisms to tolerate cold in their above-ground parts which are much more effective than those for their roots which rarely face temperatures as extreme. Havis has studied root killing by freezing to containerized plants.[4] He found that the temperature which would kill at least half the roots of 20 species of woody ornamentals was an average of 20° to 30°F warmer than their reported limit of above-ground hardiness.[5] This is the same as two to three climate zones, or the difference between average annual minimums in Cleveland, Ohio and Mobile, Alabama, in the hardiness of tops vs.

roots.

Needless to say, most container-growers practice some form of winter protection for their plants to minimize the danger by keeping temperatures higher. The most common methods are bunching the containers together to reduce air circulation, to lay them on their sides and cover them with a sheet of plastic, and to cover them with or put them inside temporary plastic covered greenhouses, usually with supplemental heat.[6] The goal for most nurseries seems to be to keep root temperatures from dropping below 22° to 25°F, a critical threshold for injury.

Even in the South there is a danger of occasional weather cold enough to injure container plants. Growers often bunch their plants together behind windscreens and water them thoroughly before an anticipated cold spell. In the North more extensive measures are taken, including the use of plastic foam insulation sheets and heated greenhouses. The benefits of container-growing are so attractive, though, that many growers in the North are experimenting with ways to overwinter container stock. Researchers in Minnesota are developing a system of container production using permanent holes in the ground with removable containers, to take advantage of natural ground heat.[7]

Researchers in the Southern Regional Research Project have found that winter protection of container-grown Pfitzer junipers in U.S.D.A. zone 7 costs from 5¢ to 10¢ more per one gallon plant than it does in zone 9. The reduced transportation costs from zone 7 to northern markets can compensate for this, but protection of container plants is always a guessing game balancing risks against expenses, and

container-growing has been adopted by many more growers in warm winter areas than in colder ones. Today container-growing is used most extensively in the Southeast and Southwest. Figure 11-2 shows the proportion of the value of all nursery products (including fruit and nut plants) from containerized plants in 1978 in the various states.[8] While container plants accounted for 40.6% of the value of all nursery products nationally in that year, all the states above that average were in the Southeast or West. Idaho, Utah, and Colorado actually have average annual winter minimum temperatures as low or lower than Illinois or Ohio and therefore appear to have anomolously high percentages of value in container plants. But the duration of winter cold spells in these mountain states is usually much less than in the Midwest and nurseries consequently need to spend less on protection. Anomolously low values show up for Kansas, Kentucky, and Tennessee. In Kansas the most important nursery product is deciduous fruit trees and these are not usually grown in containers. In Kentucky the most important are shade and flowering trees grown either bare root or B&B, but rarely in containers. In Tennessee there is a large and diversified nursery business, however, with 17% of nursery sales derived from evergreens. (59% comes from shade and flowering trees and 24% from deciduous shrubs, almost all field-grown).[9] Even so, only 9.2% of the states sales were containerized in 1978, and a separate state study for 1980 showed only 7% of wholesale sales were containerized.[10]

In the Northeast the main continer-growing states are Ohio and Pennsylvania, but these each had only 27% of their value in container plants in 1978. Container-growing has been increasing in the Northeast

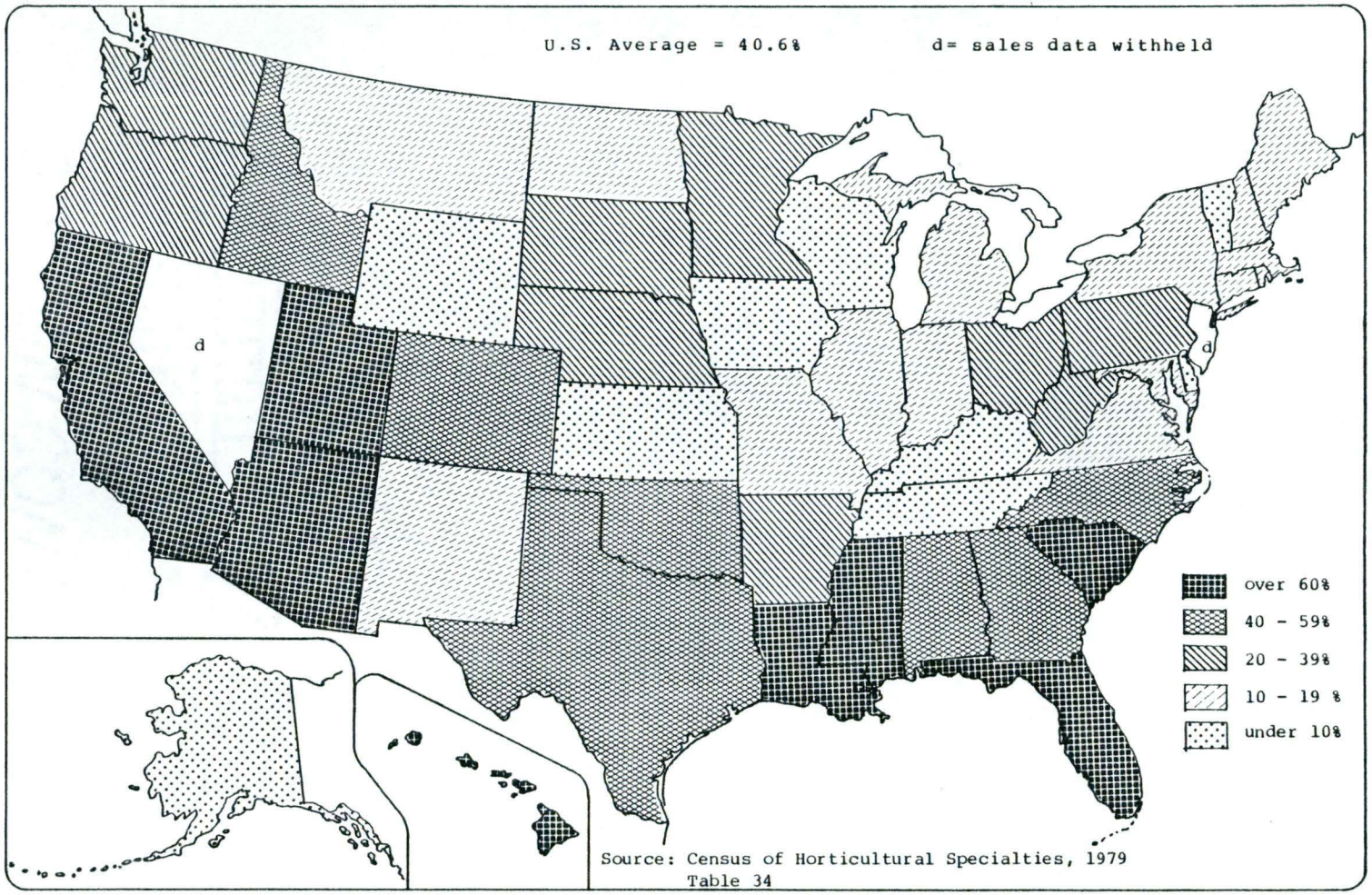


Figure 11-2. Value of Container Stock as a Percentage of All Nursery Product Sales, 1978

in recent decades, however, and with the development of increasingly ingenious systems for winter protection it should continue to spread in the future. The benefits make it attractive to growers even in Canada. But the main container-growing areas continue to be in the South and West, and the development of large new container nurseries there in recent years contrasts with the slow increases in the North.

The story of one company may illustrate much of the recent pattern of climatic locational advantage involved with container-growing.[11] The Greenleaf Nursery Company was founded in Muskogee, Oklahoma as a retail nursery in 1945. In the 1950s they began growing a few container plants, and in 1957 bought land 35 miles to the east, near Park Hill in Cherokee County, for a large container operation. This has since grown to 310 acres, producing by one estimate some $9,800,000 in sales in 1982.[12] The winter of 1962-63 was harsh and the nursery lost a large part of its plants in the freeze. Particularly hard hit were broadleaf evergreens. The nursery reduced production of these, built winter shelters for the future, and began looking for a new site in a warmer area to grow broadleafs.

In 1971 they purchased a 160 acre site 75 miles southwest of Houston, in Wharton County, some 30 miles from the Gulf of Mexico. There they now grow broadleaf evergreens, along with palms and a variety of other plants, almost all of them in containers, at an estimated value of $6,000,000 in 1982.[13] The Texas farm is in U.S.D.A. zone 9a, where winter lows average 20° to 25°F. The Oklahoma site is in zone 7a where they average 0° to 5°F. This expansion was prompted essentially by the need to keep the containerized plants' roots in the same

temperature zone that they would be in if still growing in the ground.

Unfortunately, even the new site near the Gulf of Mexico is not completely frost-proof. Bad as the winter of 1962-63 was, December of 1983 was much worse. In the last week of the month a devastating cold wave swept down the continent. Temperatures fell below 20°F for five days at Houston and were nearly as low at the Greenleaf nursery. Many plants were killed and others were severely injued. All in all the nursery lost some $3 million worth of containerized broadleaf evergreens. The weather was equally destructive at the Oklahoma site, with 15 1/2 days below freezing and $3.5 million worth of damage there.[14] The freeze of December, 1983 was the worst on record throughout much of the South from Texas to Florida, and it taught container growers along the Gulf Coast that they too must be prepared for hard freezes like their northern neighbors. Even so, container-growing is on the increase, and the regions most favored for it are the Gulf and Atlantic Southeast and the Pacific coast, in all of which marine climates moderate winter temperatures.

High temperatures can also be important as a limitation to nursery production, especially for container-growing. The roots of containerized plants can be injured by high temperature just as they can by low ones and are more exposed in pots than they would be in field soils. In areas where daily maxima get over 100°F with any frequency containers in direct sun can heat up to temperatures which can injure roots. Growers need to be able to cool them off, and this is commonly done by watering or for the more delicate plants by shade structures. Heat injury is rarely a limiting locational factor.

Of more concern to growers in these warm winter areas is winter temperatures low enough to satisfy chilling requirements for the breaking of dormancy of many species of temperate plants. Nurseries raising plants for sale in colder market areas must grow varieties and species that are adapted to those areas and not necessarily to the warmer nursery growing areas. Many temperate species require certain minimum times below certain critical temperatures in order for their winter buds to open properly in the spring. If these plants are grown in areas that are not cool enough in winter they may refuse to open their buds, do so irregularly, or produce deranged growth.[15] It is not enough, then, for container-growers to simply migrate south in search of safety from winter freezes. Some plants can be grown profitably only in areas with cool winters. This and the increased cost of transportation from far southern localities insure that a certain segment of the container production will be carried out in the North, using winter protection.

Climatic Factors in the Production of Deciduous Shade Trees

Deciduous trees are mostly grown in the field rather than in containers, although there are now many nurseries who grow a number of trees in containers for certain retail markets. Most, however, grow with their roots in the soil and are therefore not susceptible to the special root hardiness problems of most containerized plants.[16] Deciduous trees, like other plants, are grown usually in hardiness zones slightly warmer than their major markets. Figure 9-20 shows the distribution by states of the number of deciduous shade and flowering

trees produced in 1978. The three leading states, Tennessee, Oregon, and California, which together accounted for just under 40% of the total, all have their growing areas located in U.S.D.A. zones 7 through 9, while the major metropolitan markets in the Northeast and Midwest are in zones 5 through 7.

There is a great diversity of genera and species included under the category of deciduous flowering trees, and they can cover a wide range of hardiness, from crabapples hardy in zone 2 to magnolias hardy only in[7] zone 8 or 9. Deciduous shade trees most commonly used in the U.S. show much less climatic diversity, however, and make a more amenable subject for the study of climatic influences on production locations. The most popular species of the three most commonly used genera, maple, oak, and ash (which together account for 57% of the shade trees produced in 1978) are mostly hardy down to -20° or -30°F (zones 4 and 5 lower limits).[1] It can be seen from the distribution of state production of deciduous shade trees, Figure 9-21, however, that the seven leading states are in zones 6 though 9, and five of the seven are coastal states.

With plants like these that are winter-hardy throughout most of the nation one must begin to look for factors other than average annual minimum temperature to help explain the location of production areas. In the nursery business most shade trees are grown for only a few years before being sold but the time taken to achieve saleable size varies with the growth rate of the tree. Climatic factors influencing the growth rate of shade trees, then, ought to be important in the location of nurseries.

Among the environmental factors studied by plant physiologists, the

ones that seem to have the greatest influence on the growth rates of trees are photoperiod (daylength, or more properly the length of the dark period) and temperature regime. Different genera and species, and even different ecotypes within species, have evolved in different environmental conditions and have different responses to alterations of these conditions. Much nursery production involves growing plants outside their native environments, and the effects of increased or decreased photoperiod and temperatures can vary widely with species and with the amount of change in environments. Some species seem to be almost unaffected in certain growth characteristics by changes in environmental conditions while others respond strongly to seemingly minor changes.

Unfortunately, the few studies that have been done on shade tree species have almost all focused on the effects of single factors. For almost all shade trees there is very little if any information available which would allow one to assign more importance to any one factor, or even to a particulr group of factors. In addition to experimental physiological studies there are a very few published studies on comparative growth of shade trees in landscape plantings, usually in the form of growth trials comparing the growth of different varieties and species, or else comparing the effects of different cultural practices - fertilizing, spacing, etc. - on tree growth.

Tree species can have very different patterns of annual growth.[18] Those classified as "predetermined" growers usually contain within the winter bud all of the leaves they will produce the following year. Growth consists essentially of elongation of the shoot, growth of the

leaves, and initial development of the next year's terminal winter bud. Sugar maple and American beech (Fagus grandifolia) are examples. Other species grow in a series of "flushes" often growing a bud at the end of one or two flushes, only to begin growing again later and then finally forming a winter bud. Many maples do this. And then there are those genera and species which continue throughout the frost-free period and stop growth only just before, or in some cases, after the first frosts; American elm (Ulmus americana) is an example. Most of the latter group do not develop a true terminal bud but only a final lateral bud which remains at the branch tip after the final leaf and shoot tip die.

For those trees that are responsive to changes in environmental conditions there appear to be some consistent types of response to changing photoperiod regime but a variable response to changing temperature regime. In general, moving a tree from its place of origin to a location with longer photoperiod during the growing season (northward in the northern hemisphere) will increase both the duration of its growth period and the total amount of its annual growth, especially its height. Conversely, moving it to areas with shorter photoperiod (southward in the northern hemisphere) will shorten the time and annual amount of growth, all other factors being equal, that is.[19]

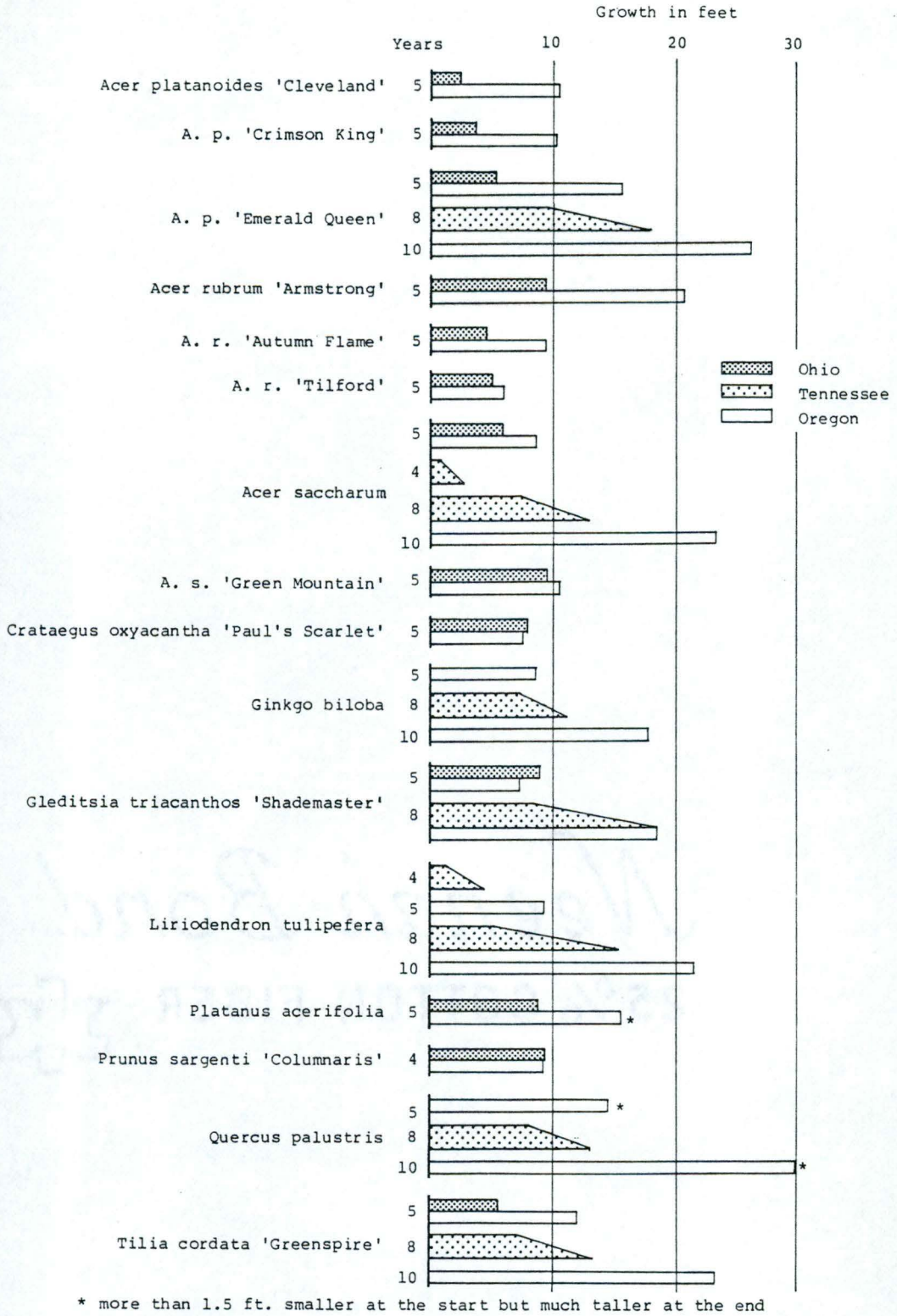
It is rare, however, that all other factors are equal, for moving a plant north in the northern hemisphere usually puts it into areas with colder tmperatures and shorter frost-free periods, and moving it south does the opposite. There are areas, though, where this is not necessarily the case: along both the Atlantic and Pacific coasts and near the Great Lakes temperatures are moderated and growing seasons extended

by the climatic effects of the water. These are areas that might benefit from increased growth of certain species that respond positively to increased photoperiod at higher latitudes.

Temperature is also an important variable especially for initiating growth in the spring. Some species appear to have threshold temperatures, either maxima or minima, above or below which they will open their buds in the spring, while others appear to have little temperature control; rather, they have a photoperiod control over bud opening.[20] Also important, but unfortunately little studied, is the role of the diurnal range of temperature and the effects of daily minima and maxima on duration and amount of growth.[21]

The evidence from tree growth trials gives another perspective, and while it makes no attempt to define the factors responsible for growth it does demonstrate comparative growth among species and varieties that reflect some sets of climatic influences. Tree evaluation studies conducted by state agricultural experiment stations at Wooster, Ohio,[22] and Aurora, Oregon,[23] form the basis of a regional comparison, and studies on the effects of fertilizers, spacing, and mulching by the Tennessee Agricultural Experiment Station at Oak Ridge, Grand Junction, and Crossville[24] provide a partial comparison for some species. Unfortunately all of these studies involved the planting of relatively large trees, generally 6-8' in height, with the objective of evaluating the performance of landscape plantings rather than that of nursery stock. I am making the assumption that relative regional growth rates for these trees mirror those for smaller nursery plants.[25]

Figure 11-3 shows the height growth of selected species and



* more than 1.5 ft. smaller at the start but much taller at the end

Source: see text

Figure 11-3. Comparative Growth of Ornamental Deciduous Trees in Oregon, Ohio, and Tennessee

varieties of shade trees over specified periods of time. For the trees in Tennessee a range of sizes is indicated, reflecting the influence of the various cultural practices being studied, fertilizing being perhaps the most important. I have limited the comparisons to only those which were of the same variety or species, were of approximately the same size when first planted out (no more than 1 1/2 ft. difference in most cases), and whose period of growth record was comparable. Each of these trials involved multiple individuals of each variety or species and the data reported reflect averages among individuals.

The data show that trees of most species and varieties grew faster at Aurora, Oregon than either Wooster, Ohio or the sites in Tennessee. Most of the maples, lindens, and the plane tree grew much faster in Oregon than in Ohio. But two maple varieties, the hawthorn, and the cherry all grew at roughly the same rate in both Oregon and Ohio, while honeylocust grew faster in Ohio. Comparing the Oregon and Tennessee data is not as easy, but it appears that the maple, oak, and linden grew faster in Oregon while the ginkgo, tulip poplar, and honeylocust grew at approximately the same rates.

Several nurserymen with whom I have talked also attest to the faster growth of many nursery trees in western Oregon compared to the Midwest. Two large midwestern nurseries, Bailey's of Saint Paul, Minnesota, and Mt. Arbor of Shenandoah, Iowa, have in fact recently established branch operations in the Willamette Valley expressly for growing certain species of deciduous trees and shrubs. Among trees, Mt. Arbor grows in Oregon mostly maples of several species, but also large numbers of linden, ash, and birch. They also have a farm in eastern

Washington in the Yakima Valley where they grow mainly fruit trees and a few ornamentals, including honeylocust which do not grow as fast on their Oregon farm as they do across the mountains.[26] The choices of this nursery operation corroborate the data from the Ohio and Oregon tree growth trials: most maples and lindens grew faster in western Oregon, while the honeylocust did not.

How is one to account for these variations in growth rates? I can form no solid hypotheses given the limited information available to me, but I can make a few suggestions and raise questions about possible influences. The differences in growth of most varieties of Norway and red maples and the similarities in growth of sugar maples between Oregon and Ohio make a good starting point. Both red maple and sugar maple have been the subject of several differing studies of the effects of climate on growth, but Norway maple has not.

Sugar maple is one of the predetermined growers whose annual growth is set in its winter bud and simply elongates in the spring.[27] It is a quick grower, but its time of bud opening is apparently genetically determined by photoperiod at its native habitat.[28] There is no way of knowing if the sugar maples in the Ohio and Oregon growth trials are from the same native area originally. The small difference in growth rates reported might be due to different original source locations of the parents of the trees tested. The variety 'Green Mountain,' however, should be asexually propagataed and be genetically identical, hence from one original source location. Its growth rates in Ohio and Oregon are very similar. Kriebel's study of sugar maples from throughout the species' range in the eastern U.S. and Canada found that variations in

the time of initiation and cessation of growth each year were strongly correlated with photoperiod of the source region and were little influenced by temperature.[29] The similarity of growth rates for 'Green Mountain' sugar maple in Oregon and Ohio may, then, reflect this relative insensitivity to ambient environmental conditions.

Red maple, however, is much more environmentally sensitive. Its time of bud-break in the spring is apparently a response to daily temperature with a minimum threshold.[30] Its yearly growth is not predetermined, like sugar maple, and its rate of growth and duration of growth period both show strong response to altered photoperiod.[31] Growth of red maple is also affected by genetic preadaptations to local night and day temperature regimes similar to those of its natural habitats.[32]

Flemer states that most of the red maple in the nursery trade today comes from sources in U.S.D.A. zones 6 and 7.[33] Most of this range is between latitude 41°N and 35°N. Moving trees from there to Wooster, Ohio at 41°N would not greatly alter the photoperiod, but moving them to Aurora, Oregon at 45°N would significantly increase the photoperiod. This should increase the amount of growth and the length of the growing period, and the earlier arrival of the frost-free period at Aurora (mid-April, compared to mid-May at Wooster) would also extend the growth period. On the other hand, the temperature regime in Ohio is more similar to that of the native range of the species than is that of western Oregon where both daily maxima and minima are lower. Unfortunately, none of the experiments with red maple considered the combined effects of these various factors. The complex of influences at work

remains to be deciphered. Clearly, though, something in the environment of the Willamette Valley favors increased growth of red maple.

Nursery growers with whom I have talked have suggested that the faster growth of most maple varieties in Oregon may in fact be the result of the cooler summer temperatures. They report that most maples put on more flushes of growth and grow later into the summer there than they do in the Midwest. They attribute this to the sudden increases in temperature in the Midwest with the onset of summer compared to the slow advance of temperatures in western Oregon, implying that the arrival of the first really hot days of summer causes the growth of maples to cease or slow markedly. The daily maxima and minima in July average 82° and 54°F at Canby, Oregon, adjacent to the Aurora experiment station, while they average 86° and 61°F at Wooster, Ohio. Most studies suggest that warmer summer temperatures stimulate growth, but the Oregon nursery experience and these growth trials seem to suggest otherwise, at least for maples and certain other species.

Faster growth in Oregon of all the Norway maple varieties may also reflect the influences of preadaptation, both to photoperiod and temperature regime of the native range of the species in northwest Europe. Aurora, Oregon is at a similar latitude and has a similar summer temperature regime as does Lyon, France. Wooster, Ohio, on the other hand, is at a similar latitude and has a similar summer temperature regime as does Madrid, Spain (with different summer humidity, however).[34]

Some of the same factors may be at work in the greater growth of littleleaf linden, also a European native, in Oregon, as well as in the

greater growth in Ohio of the honeylocust, a midwestern native. Most nurserymen and the test data available indicate that summer heat is a benefit to the growth of honeylocusts. But whether the factors responsible are daily maxima, daily minima, daily means, humidity, soil rather than air temperature, or some other influence, no one is yet able to say.

These correlations between summer climatic conditions and growth rates in tree trials do not, of course, explain why or how climate gives a production advantage to the growing of shade trees in western Oregon. They do, however, suggest possible influences and open questions which only controlled and systematic observations can begin to answer. What is needed is a long-term study of initiation, cessation, and rates of growth for each year, coupled with data on maximum, minimum, and mean air and soil temperatures, humidity, day length, and cloud cover for a large number of sites around the country, using the same asexually propagated varieties of a number of commonly used ornamental species. Unfortunately this is beyond the scope of this dissertation. Flint has summarized research on phenology and genecology of woody plants which would form a background for such a study,[35] and a station model of sorts exists in the network of the International Phenological Gardens in Europe.[36]

The advantages that faster growth, from whatever climatic influences, gives to Oregon nurserymen must be large enough to offset the transportation costs from western Oregon to markets in the Midwest and East Coast, 2000 to 3000 miles away. These amount to between 20¢ and $3 per tree, depending on its size and the distance shipped. Unlike

other phases of a nursery's operation they are a fixed cost which neither efficiency nor good weather can reduce. This limits Oregon growers to shipping only bare-root trees east, for the most part, since B&B trees with a ball of soil would be so heavy as to be prohibitively expensive to ship so far. The advantage which Oregon trees enjoy in eastern markets derives from their greater height and well-developed branching systems for trees of their age.

Oregon maples are usually sold either as whips (4-8' range) which are mostly one year budded tops on two year old rootstock, or as branched trees (from 5-10' tall up to 1"-2" caliper) that are grown for another year or two. A major section of their market is other wholesale growers in the Midwest and East who buy these small trees and grow them on for retail nurseries as specimen-size trees, usually from 1 1/2" to 6" caliper, mostly sold B&B. The extra growth and branch structure development that maples achieve in Oregon makes them better able to establish themselves and grow faster when transplanted for this B&B growing, so that they may reach a particular sales size one or two years earlier than trees initially grown in that same area.

The foregoing disucssion has focused on the growth of maples, relying on evidence of more rapid growth in particular of two species, Norway maple and red maple, and of equal growth of sugar maple. The data also indicate that ginkgo, pin oak, and Greenspire linden grew faster in western Oregon than even the best fertilized or mulched of the Tennessee trees of the same species or variety, while tulip poplar and honeylocust grew at similar rates in both states. Summer climatic conditions in Tennessee and western Oreon are very different in many

ways, especially temperatures (much warmer both day and night in Tennessee) and photoperiod (much longer in Oregon). It would be almost impossible to sort out the factors responsible for these growth differentials given the current state of research on climatic influences on shade tree growth. But along with the data from Ohio they indicate important climatic advantages for production of some species in each of the three areas.

Other Climatic Factors

In addition to winter and summer temperatures and photoperiod, several other climatic factors can provide locational advantage by favoring the growth of certain types of plants or the use of certain production systems. The length of the growing season and the date of the last killing frost in the spring are important in several ways. Early arrival of the frost-free period in spring can favor more growth, since most species initiate growth under the influence of temperature while many of them stop growth under the influence of photoperiod. Others which cease growth under the influence of temperature can also benefit from a longer growing season. The effects of the length of the growing season and the earliness of the frost-free period must be seen in conjunction with other climatic factors, however, such as photoperiod and summer temperature regime. These are best seen in the context of regional climates which will be discussed in the next section of this chapter.

Humidity and rainfall, or lack of it, are important in only a few instances, surprisingly. As was discussed in the last chapter, rainfall

is no longer relied upon by many growers except those raising relatively large field-grown trees and shrubs. All propagators and container growers and most growers of bare-root and B&B plants use irrigation extensively and benefit from summer rain only to the extent that it lessens the need for irrigation, rarely a major savings. Humidity can be a benefit to the growth of many broadleaf evergreens, especially when temperatures are high, but many growers now keep them under shade cover of one sort or another which both reduces the temperature and retains humidity in the air derived from irrigation. High humidity and extra heat are required for propagation of most rooted cuttings and of many seedlings, and this is usually provided by mist irrigation systems in greenhouses. In areas with naturally high relative humidity and warm temperatures, specifically along the Gulf and southeast coasts, growers can often do as well with less elaborate propagation facilities, relying on the natural heat and humidity to aid propagation.[37] As Figure 11-4 shows, however, these areas with 80% or greater relative humidity in July are in a relatively restricted zone along the coast for the most part.

Wind can be an important factor if it is damaging to plants, but rarely is it of direct benefit except temporarily to reduce temperatures in summer. Wind damage, through excessive evapotranspiration or abrasion and overturning of containerized plants can compound problems caused by temperature or low humidity, but can often be controleld by constructing windbreaks. At the regional level it is of locational importance only in the arid West and in the Great Plains. Elsewhere it is mainly a microclimatic phenomenon. It does limit the success of

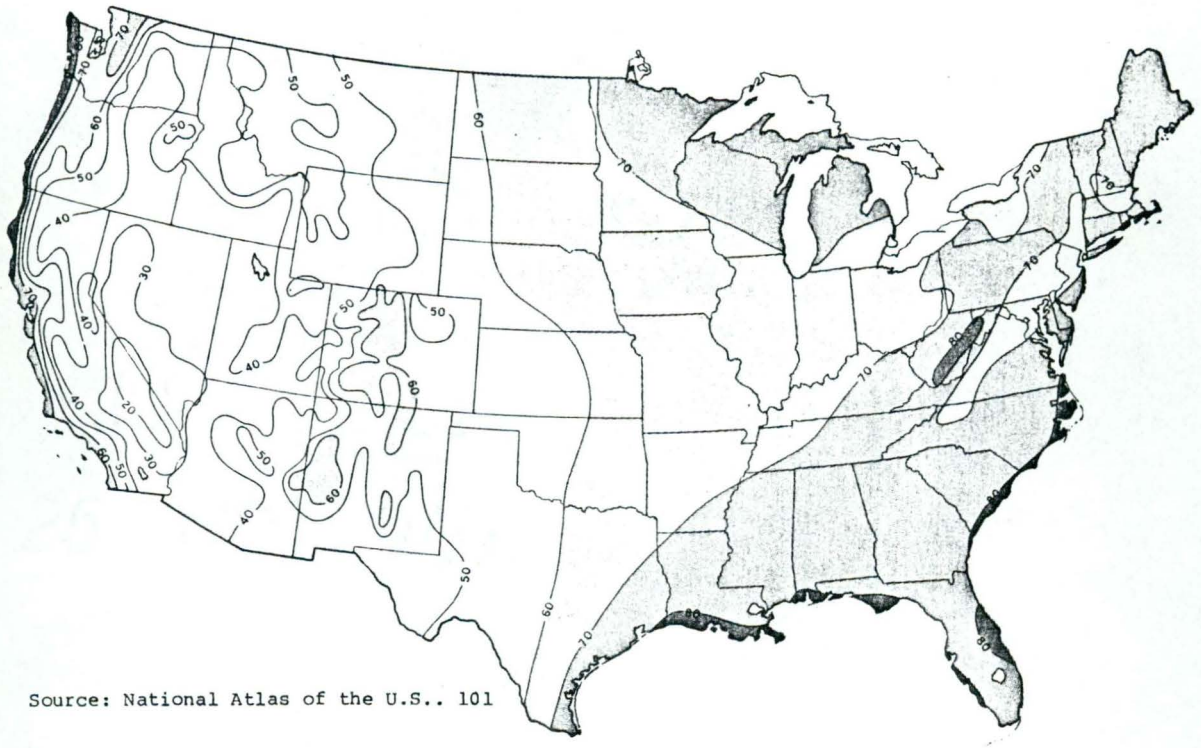


Figure 11-4. Mean Relative Humidity in July

container production of large trees, however, because they are susceptible to being blown over and damaged, Figure 11-5.

Severe storms can do major damage to nurseries but are rarely a limiting locational factor.[38] In the areas of greatest hail damage, in Illinois, Iowa, and Nebraska, areas of greatest tornado damage, in Kansas, Missouri and Oklahoma, or of hurricane danger along the Gulf and southeast coasts, nurseries generally carry insurance and the cost does not appear to be big enough to affect locational choices.

Semonin has proposed a climatic hardiness rating system modification of the standard zones based simply on average annual minimum temperature.[39] He urges consideration of the danger of severe weather phenomena, at least for the Midwest, to aid in judging performance of shade trees. The idea could be profitably extended to the rest of the country and to include other weather conditions. The climatic zones of Sunset could serve as a model for the kinds of factors to include. Their system of 24 zones for the western U. S. includes such factors as fog, cold air drainage, summer heat, humidity, winds, and performance of selected plants with critical climatic tolerances.[40]

Microclimates and Nursery Locations

The effects of all climatic factors are important only as they impinge on particular sites, and many sites have their own or local peculiarities which modify the regional climate. Microclimates are usually created from the regional climate by topographic conditions, usually through the alteration of the movement of air masses: frost pockets, wind venturis, localized orographic precipitation, humidity,

Figure 11-5. Red Maples in 15-gallon Containers Blown Over by Wind in California's Central Valley

etc. For nurseries the most important tend to be those which alter air and soil temperatures.

Cold air tends to sink, and during most heavy frosts it moves steadily downhill to the lowest areas locally available creating frost pockets. The difference in temperature between a frost pocket and a nearby area with good air drainage can be as much as 5°F. This can be a critical difference for many plants. Container nurseries are usually those most concerned about ensuring cold air drainage, to avoid root-injuring temperatures and unseasonable frosts in early fall or late spring. Typical locations are on rolling land above river valleys and along the upper edges of basins at the foot of hills, in both of which there is flat land but also good air drainage.

The largest container nurseries in southern California, for example, are all located on the lower slopes of hills at the edges of basins: Monrovia Nursery in Azusa, Hines and Bordiers Nurseries in Irvine, and Amfac Nursery in Fallbrook. The old nursery center at Montebello just east of Los Angeles lay at the foot of the Montebello Hills but above the lowlands of the Los Angeles basin. Monrovia Nursery uses its cold air drainage in two ways. On the upper levels of its site are grown the less hardy subtropicals like citrus, gardenias, and hibiscus. 150 ft. below on the flatter lower slopes, but still with air drainage off the site, are grown the hardier plants like junipers, hollies, camellias, and azaleas, many of which require the colder air to meet their dormance-breaking chilling requirements.[44]

Microclimates may provide opportunities for better growth of certain species of deciduous trees as well. J. Frank Schmidt & Son

Nursery in Oregon has eleven different sites among its 1700 acres, ten of them in the northern Willamette Valley, from Boring east of Portland to Independence southwest of Salem, some 50 miles away. The various sites have different soils and microclimates. At their farms in the Boring area, between 600' and 650' in elevation, the summers are relatively cool with a long spring and it is there that they grow most of their maples. At their Canby farm, 25 miles to the southwest and at an elevation of from 150' to 180' the spring and summers are an average of 2° to 3°F warmer. There the honeylocusts grow better, breaking their buds 7 to 10 days earlier in the spring and putting on more growth than they would in Boring.[42]

Many nurseries, especially container-growers, are small enough that they can afford to modify their microclimates rather extensively. Perhaps the most common method consists of a variety of covered and partly covered structures, from metal-frame glass-paned greenhouses to simple tunnels of plastic sheeting or shade screens hung on poles. At large container nurseries the shade houses can sometimes cover several acres, Figure 11-6, and are used to cut down temperatures as well as to reduce evapotranspiration and increase humidity. Monrovia Nursery, for example, has 70 acres covered in one form or another, including a 15 acre azalea and fern house and a 14 acre camellia lath house.[43]

Microclimates become especially important in areas where climatic gradients are steep, in areas where different macroclimates are only a short distance apart. This is especially the case in many coastal areas, particularly those near hills or mountains. The influence of terrain on the flow of air between water and land takes on critical

Figure 11-6. Part of 15 Acre Shade House at Oki Nursery, Sacramento, California

importance for a variety of climatic factors, from temperature to cloud cover. Areas where microclimates are important this way are along the entire Pacific coast, along the Atlantic coast north of New Jersey, and along the southern shores of Lakes Erie and Ontario.

Regional Macroclimates for Nursery Production

Looking at the distribution of the various climatic factors across the nation certain regions stand out with climates which for various resons favor nursery production of woody ornamentals. Most of these regions are now important centers of the nursery business although it is relatively recently arrived in some of them. Figure 11-7 shows the location of these areas and also of the leading counties in the sale of nursery products in 1978. Altogether one can speak of six major regions which enjoy climatic advantages:

1. Atlantic Northeast, including the Atlantic coastal portions of the nine states from Massachusetts to Virginia.

2. Great Lakes, including specifically the southern and eastern shores of Lakes Michigan and Ontario and all side of Lake Erie. (Much of the Canadian nursery business is concentrated in southern Ontario in this region).

3. Gulf and Atlantic Southeast, including the coastal portions of seven states from Texas to South Carolina, with the exception of central and south Florida which form their own region.

4. Florida, the central and southern portions.

5. California, including the coastal areas south of San Francisco and the Sacramento and San Joaquin Valleys.

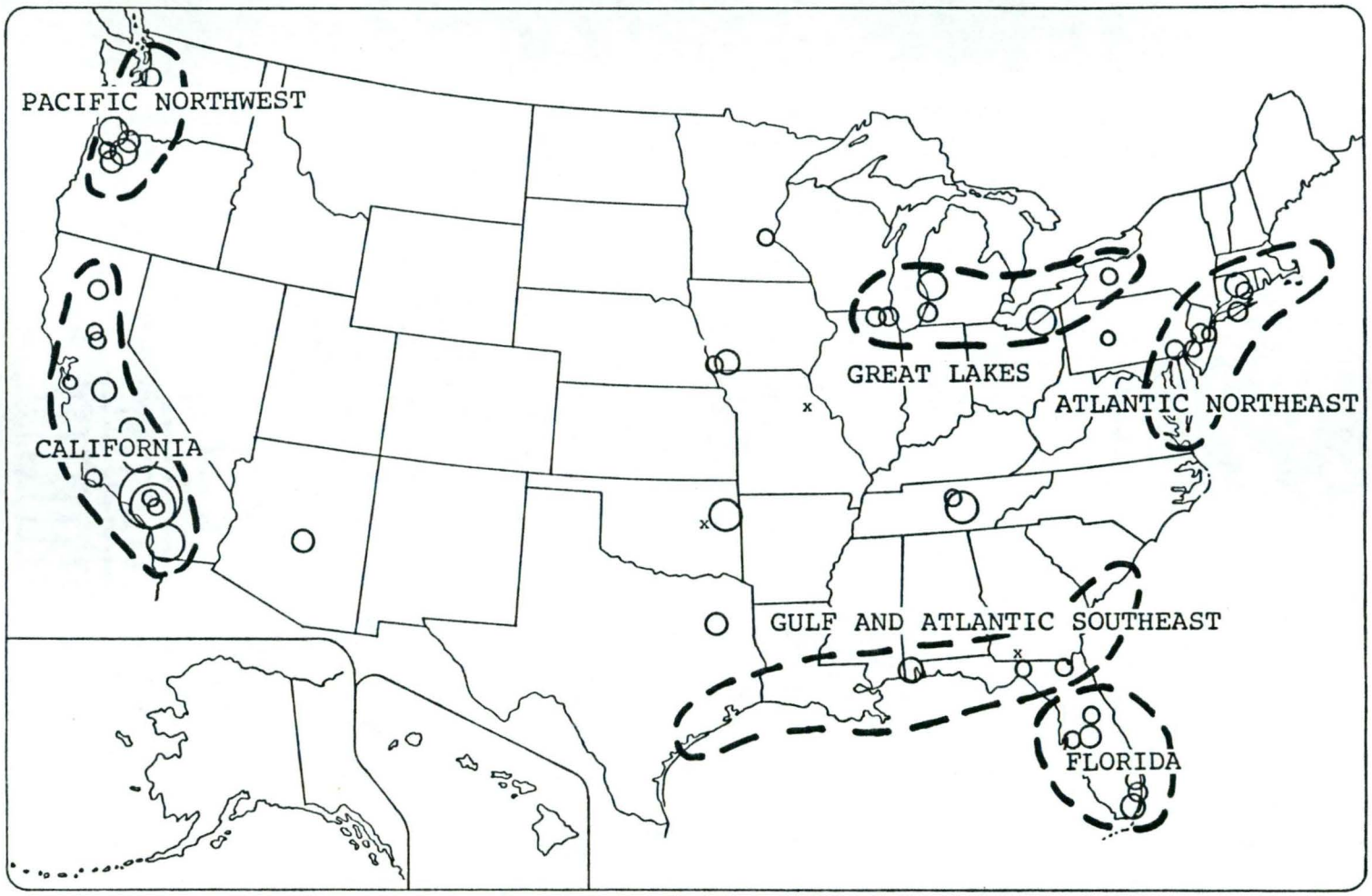


Figure 11-7. Climatically-favored Nursery Areas in the U.S.

6. Pacific Northwest, especially the interior valleys of western Oregon and Washington, but also part of eastern Washington. (This region extends climatically north into Canada, and much of the western Canadian nursery business is located in coastal British Columbia and in the interior Okanogan Valley.)

All of these nursery regions are located near large bodies of water, either oceans or large lakes, and their climatic advantages derive in large part from the moderating influences of these water bodies on temperature and precipitation. In addition there are several interior areas which are important nursery producers. These, in effect, are the "residuals" of this regional classification and as exceptions which test the rule they emphasize the importance of non-climatic factors in the location of all nurseries, including those in the six climatically-favored regions.

In the Atlantic Northeast the moderating effects of the ocean on winter temperatures are limited to a narrow area close to the shore. The prevailing eastward movement of the major air masses coming from the continental interior prevents the maritime effect from extending very far inland. Winter temperatures along the coast are warmer than they are inland to the west and, as Figure 11-8 shows, the isotherms for mean minima in January curve northward along the coast. Of more importance to the safety of ornamental plants, however, is the fact that the isotherms for average annual minimum temperatures curve even farther to the north than the monthly January mean minima (Figure 4-1). This means ornamentals are even more protected along the coast compared to inland areas to the west. In Suffolk County, New York, on Long Island the mean

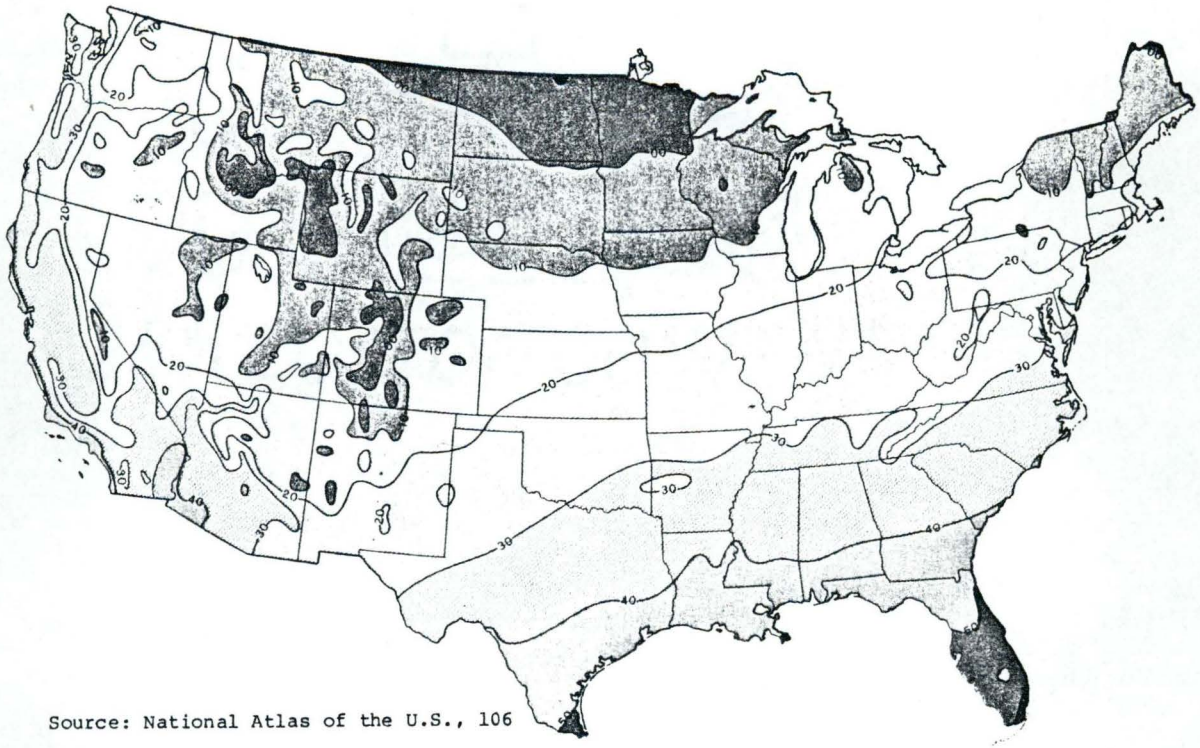


Figure 11-8. Mean Minimum Temperature in January

January minima are 2°F warmer than in Wayne County, Ohio just south of Cleveland. Yet the annual average minima in Suffolk County are 10° to 15°F warmer than in Wayne County.

In addition, the risk of winter injury to plants along the northern Atlantic coast is also reduced by the fact that the relative humidity in winter is higher, thus reducing risk of injury from dessication during freezes. Areas in similar hardiness zones farther west are also much farther south. This means the Atlantic Northeast had comparatively longer photoperiods in the growing season which also increases the growth of many plants. And finally, the region is in the midst of the major markets for ornamental plants in the nation, the urbanized Northeast. This puts transportation costs at a minimum and gives the nursery business there a large advantage over other areas. Few of its plants are shipped out of the region, and the region is in fact a net importer of nursery stock. But the production and transportation costs there in effect set a standard against which nurseries in other regions must compete.

The Great Lakes region enjoys some of the same advantages as the Atlantic Northeast. It is near major markets in the large metropolitan areas of the Midwest, and the lakes moderate temperatures somewhat like the Atlantic Northeast. The lakes retain heat and temper the threat of hard freezes in winter, putting the south and east sides of the lower lakes in U.S.D.A. zones 6a and 6b. In addition they add humidity to the winter winds and protect plants from dessication. By being farther north than most other areas in zone 6 (Cleveland is some 3° north of Cincinnati, for example) they also enjoy longer photoperiods in spring.

One of the climatic advantages of the Great Lakes region is relatively unique, however. The lake waters warm only slowly in the spring when the first warm weather arrives. The air moving over the lakes is cooled, reducing spring temperatures on land nearby. This in turn delays bud-break on most deciduous plants and lets them open only after all danger of frost is gone.[44] They are thus more protected from the danger of late spring frosts than nearby areas where early spring warm periods can set up disaster later. This is a form of insurance for nursery growers and orchardists whose entire crop could be damaged by one late frost.

These two regions in the Northeast and Midwest enjoy the proximity of major markets and are both net importers of plants in addition. Other nursery regions of national importance are generally net exporters of plants and being farther from these major markets must enjoy enough advantage from their locations to compensate for the additional costs of transporting their plants long distances to market.

A prime example of this is the Gulf and Atlantic Southeast region. As recently as 1930 there was very little nursery production in the region. Only in Baker County, Florida, Orleans Parish, Louisiana, and Galveston County, Texas did nursery sales exceed $10,000 in the 1900 census, and the latter two were primarily supplying local markets. The real boom along this coastal strip came with the introduction of container-growing and motor truck transportation in the years just before and after the second world war.

Climatic advantages of the region are particularly well suited to container production, especially of evergreen shrubs. Average annual

minimum temperatures are so warm, from 20° to 25°F in most of the region (U.S.D.A. zone 9) that only minimal winter protection is usually needed, although, as the winter of 1983-84 demonstrated, growers need to be prepared to do more if necessary. The immediate coastal portions of the region also benefit from both cooler and more humid summers than areas only a few miles inland. This reduces moisture stress and/or watering requirements and makes propagation of new plants easier. The region's long frost-free period, from 250 to 300 days, also means that many plants can grow longer and that growers can use more flexibility in their growing schedules.

Central and southern Florida constitutes a climatic nursery region of its own separate from the Gulf and Atlantic Southeast including north Florida. This region enjoys warmer winters with much less danger of killing frosts due to the presence of ocean water on both sides of the peninsula and close proximity to the Gulf Stream, a major warm ocean current. It also has a much longer growing season, from 300 days per year in central Florida up to a year round season in the extreme south. The near-tropical climate is not, however, suitable for many species of temperate plants, which require cooler winters for their dormant period. The climate does favor production of foliage plants (tropicals used indoors in the rest of the country) and of a variety of subtropical species used mostly in the local Florida market for ornamentals. The nursery business of this region, then, has a different mix of plants grown there than does the Gulf and Atlantic Southeast.

Both the Gulf and Atlantic Southeast region and the Florida region are relatively far south, mostly below latitude 31°N. This gives them

relatively short summer photoperiods compared to the northern regions. At 30°N the maximum photoperiod at the summer solstice is approximately 14 hours. At 40°N it is approximately 15 hours and there is a period of some 2 1/2 months with a photoperiod in excess of 14 hours daily. This limits the growth of most temperate deciduous trees in the two southern nursery regions to rates which are not competitive with growers in the North. In addition, much of these two regions lacks enough cold weather to meet minimum winter chilling requirements for most deciduous and many narrowleaf evergreen species. The concentration on broadleaf evergreen shrubs thus is not only aided by the climatic opportunites of the region but almost required by the unsuitability of the region for production of many deciduous species.

California and the Pacific Northwest both benefit from maritime climates under the influence of air masses moving in off the Pacific Ocean. Both regions have variations on the Mediterranean climatic type in part, with cool wet winters and warm dry summers. Both winters and summers are cooler and wetter in the north and are warmer and dryer in the south. Climatic gradients, however, generally run north-south along the west coast, and a series of mountain ranges creates distinct climatic subregions which also trend north-south in much of both regions. Generally, temperature regimes go from moderate year round near the coast to more seasonally extreme at inland locations. Hardiness zones are also aligned north-south rather than east-west as elsewhere, and many parts of these two regions are far north of comparable hardiness zones to the east, even those along the Atlantic coast.

In California there are large markets for ornamentals, but even so there is a net export of plants from the region, mostly to areas east of the Rockies in both north and south. There are two distinct climatic subregions in the nursery growing areas in California - the coast and the central valley. For the most part, coastal areas enjoy warmer winters and cooler summers while the central valley has cooler winters and hot summers. (January mean maxima and minima are 53° and 37°F at Sacramento in the Central Valley and are 64° and 42°F at Pasadena in the southern coastal zone; July means are 93° and 57° at Sacramento and 86° and 60° at Pasadena.) Most of the state receives enough cool weather in the winter to break the dormany of many temperate species, especially in the central valley where cold fogs are common in winter.

The southern part of the state produces mostly container plants while the central valley produces both bare-root field-grown plants and containers. Most of the central valley is far enough north to have photoperiods adequate for the growth of most deciduous trees and shrubs, but it also gets hot very early in the summer. Fruit trees and rose plants are the main bare root products. Evergreen shrubs are the main container plants. All nurseries in the state rely almost completely on irrigation water since summer rain is negligible in most years. Water supply is limited, however, and will be even more so in the South after the state's share of Colorado River water is cut with the completion of the Central Arizona Project later in this decade. Aside from that California enjoys many of the same advantages of the Gulf Coast and Florida for the production of evergreen shrubs and subtropicals, in addition to which its winter chilling and longer summer photoperiods

allow for production of many temperate deciduous species.

The Pacific Northwest is also characterized by two climatically different subregions. In western Oregon and Washington between the Coast Ranges and the Cascades is the lowland of the Willamette and Puget Sound where winters are mild while summers are generally warm and sunny. Most of this area is in U.S.D.A. zones 7 and 8. The main nursery area here is in the northern Willamette Valley. East of the Cascades the climate is more extreme with colder winters and dryer, hotter summers, but even so it is generally milder at both times of the year than other parts of the country in U.S.D.A. zone 6. The main nursery area here is the Yakima Valley of Washington.

Like California, the Pacific Northwest is far north of other areas in comparable hardiness zones. This give it significantly longer photoperiods in summer. At latitude 46°N, just north of Portland, there are 16 hours of sunlight at the summer solstice, a full hour more than the maximum available on the solstice at latitude 40°N, that of most nursery growing in the Great Lakes and Atlantic Northeast. The region also has enough cold winter weather to satisfy chilling requirements for all temperate species.

The Pacific Ocean acts in the Northwest much like the Great Lakes in the Midwest by cooling spring temperatures and thus delaying bud break in most years until after the danger of killing frosts has passed. Yet both of these occur much earlier here than in the Midwest. The ocean also helps keep summer temperatures lower than in other areas in zones 6 to 8 at the same time that the region receives more sunlight, with longer photoperiods and fewer cloudy days in the summer. This is

apparently good for the growth of many deciduous trees and both broadleaf and needleleaf evergreens as well. Oregon, for instance, sells roughly equal numbers of deciduous trees, broadleaf evergreens, and needleleaf evergreens.

Like California, the Pacific Northwest is far from its major markets, but unlike California it has only small local markets. To make its plants sell in the Midwest and Northeast they must be significantly cheaper or better than others in the country. It is all the more surprising then that the region produces large numbers of all types of woody ornamentals, with the exception of rose plants.

Chapter Eleven - Notes

[1]Badenhop, "Marketing Woody Ornamental Plants by Tennessee Nursery Wholesalers."

[2]J. Robert Strain and Richard Beilock, "Truck Shipments of Florida Ornamentals to the U.S. and Canada," Proceedings of the Florida State Horticultural Society 95(1982), 181-184; Elmer Jarvesoo, Procurement and Sales Practices of Retail Outlets for Ornamental Nursery Products, Northeast Regional Research Publication, Bulletin 824 (New Brunswick, NJ: Rutgers University, Agricultural Experiment Station, 1969); Technical Committee SM-33, Marketing Ornamentals: Practices and Trends of Nurseries in the South, Southern Cooperative Series Bulletin 143 (Auburn, Alabama: Auburn University Agricultural Experiment Station, 1969).

[3]Francis R. Gouin, "Winter Injury to Container-Grown Plants," in Better Trees for Metropolitan Landscapes edited by Frank S. Santamour, Henry D. Gerhold, and Silas Little, U. S. Dept. of Agricultural Forest Service General Technical Report NE-22 (Upper Darby, Pennsylvania: U.S. Dept. of Agriculture Forest Service, Northeastern Forest Experiment Station, 1976), 179-184.

[4]John R. Havis, "Root Hardiness of Woody Ornamentals," HortScience 11 (1976), 385-386.

[5]Above-ground hardiness based on Arnold Arboretum hardiness zones reported in Donald Wyman, Wyman's Gardening Encyclopedia (New York: Macmillan, 1971).

[6]See, for instance, Calvin Chong and R. L. Desjardins, "Comparing Methods for Overwintering Container Stock," American Nurseryman 153 (Jan. 1, 1981), 8-9, 131-135; and F. Wallace Patch, "Growers Cover Their Plants to Get Through Winter," American Nurseryman 157 (1 Jan. 1983), 113-117.

[7]Harold Pellet, "The Minnesota System - A New Approach to Tree Production," American Nurseryman 153 (1 May 1981), 14; and Pellet "An Update on the Minnesota System of Container Production," American Nurseryman 157 (1 Jan. 1983), 95-99. The Minnesota System also includes root control through interior ribs on pots and use of waterlogged gravel substrate to prune roots at a limited depth.

[8]U.S. Bureau of the Census, Census of Horticultural Specialties, 1979, Table 34.

[9]Badenhop, "Marketing Woody Ornamental Plants by Tennessee Nursery Wholesalers."

[10]Ibid.

[11]Brent Marchant, "Opening an Established Container Nursery; Greenleaf's Nursery's Texas Div.," American Nurseryman 155 (15 Jan. 1982), 54-69.

[12]Dick Morey and Walter A. Gammel, "Nursery Business Wholesale 100," Nursery Business 28 (Sept. 1983).

[13]Ibid.

[14]"Freezes Devastate Stock of Southern Growers," American Nurseryman 159 (1 May 1984), 6-8.

[15]Furuta, Environmental Plant Production and Marketing, 90.

[16]If permanently planted in large landscape containers as is increasingly popular, however, trees are subject to cold injury to their roots. See, William Flemer III, "Container Trees for Use in Landscaping," in Better Trees for Metropolitan Landscapes, Santamour, Gerhold, and Little, eds., 185-193.

[17]U.S. Bureau of the Census, Census of Horticultural Specialties, 1979; and Donald Wyman, Wyman's Gardening Encyclopedia. Acer platanoides, A. rubrum, A. saccharum, and A. saccharinum are all hardy to Arnold Arboretum Zone 3 (-35°F); Quercus rubra to Zone 3, Q. palustris and Q. coccinea to Zone 4 (-20°); Fraxinus pennsylvanica to Zone 2 (-50°), F. americana and F. excelsior to Zone 3.

[18]T. T. Kozlowski, Growth and Development of Trees, Vol. I, Seed Germination, Ontogeny, and Shoot Growth (New York: Academic Press, 1971), 164-206.

[19]See, for example, R. J. Downs and H. A. Borthwick, "Effects of Photoperiod on Growth of Trees," Botanical Gazette 117 (1956), 310-326; and Scott S. Pauley and Thomas O. Perry, "Ecotypic Variation of the Photoperiodic Response in Populus," Journal of the Arnold Arboretum 35 (1954), 167-188.

[20]C. E. Ahlgren, "Phenological Observations of Nineteen Native Tree Species," Ecology 38 (1957), 622-628.

[21]Kozlowski, Growth and Development of Trees, Vol. I, 277, and Thomas O. Perry, "Racial Variation in the Day and Night Temperature Requirements of Red Maple and Loblolly Pine," Forest Science 8 (1962), 336-344.

[22]Raymond R. Chapin and Philip C. Kozel, Shade Tree Evaluation Studies, Research Bulletin 1074 (Wooster, Ohio: Ohio Agricultural Research and Development Center, 1975).

[23]"Growth of Trees in Landscape Tree Evaluation Program - 1982." and "Average Height and Width of Trees After 5 and 10 Years in the Landscape Tree Trial," both mimeo reports of the North Willamette Experiment Station, Aurora, Oregon, n.d., c. 1981.

[24]Hendrik van de Werken and James T. Beavers, "The Effect of Nitrogen on Shade Trees for Lawns," Tennessee Farm and Home Science 54 (1965), 19-20; Hendrick van de Werken and James G. Warmbrod, "Response of Shade Trees to Fertilization," Tennessee Farm and Home Science 72 (1969), 2-4; H. van de Werken, "Response of Shade Tree Species Planted in Groves to Spacing, Gravel on Plastic Mulch, and Turf," Tennessee Farm and Home Science 107 (1978), 2-5; and Hendrik van de Werken, "Fertilization Practices as They Influence the Growth Rate of Young Shade Trees," Journal of Environmental Horticulture 2 (1984), 64-69.

[25]The lack of control available makes these comparisons tenuous at best. As pointed out by Dr. van de Werken in a personal communication (1984), "Only for non-fertilized forest trees growing on soils of comparable fertility and with comparable moisture supply could one separate geographic climatic factors as an influence on growth rate." Nevertheless, the clear differences in growth shown for several of the species and varieties reported here indicate a strong climatic influence.

[26]Interview with John Frye, General Manager, Northwest Division Mt. Arbor Nurseries, Hopewell, Oregon, May 1984.

[27]Kozlowski, Growth and Development of Trees, Vol. I, 258.

[28]Howard B. Kriebel, Patterns of Genetic Variation in Sugar Maple, Research Bulletin 791 (Wooster, Ohio: Ohio Agricultural Experiment Station, 1957).

[29]Ibid.

[30]Ahlgren, "Phenological Observations of Nineteen Native Tree Species."

[31]Downs and Borthwick, "Effects of Photoperiod on Growth of Trees," and O. Vaartaja, "Evidence of Photoperiodic Ecotypes in Trees," Ecological Monographs 29 (1959), 91-111.

[32]Perry, "Racial Variation in the Day and Night Temperature Requirements of Red Maple and Loblolly Pine."

[33]Flemer, "Container Trees for Use in Landscaping."

[34]Manifred J. Muller, Selected Climatic Data for a Global Set of Standarad Stations for Vegetation Science (The Hague: Dr. W. Junk, 1984). Portland, Oregon, at 45° 31' N has mean July minima and maxima of 14.6° and 28.0°C; Lyon, France, at 45° 44' N has July means of 14.4° and 26.6°. Cleveland, Ohio, at 41° 30' N has July means of 17.0° and 29.2°C; Madrid, Spain, at 40° 26' N has July means of 17.4° and 30.8°C.

[35]Harrison L. Flint, "Phenology and Genecology of Woody Plants," in Phenology and Seasonality Modeling edited by Helmut Lieth (New York: Springer-Verlag, 1974), 83-97.

[36]Fritz E. Schnelle and Erik Volkert, "International Phenological Gardens in Europe: The Basic Network for International Phenological Observations," in Lieth, Phenology and Seasonality Modeling, 383-387.

[37]Technical Committee S-103, Factors Affecting Southern Regional Production Advantages for Kurume Azaleas, Southern Cooperative Series Bulletin 241 (Knoxville, Tennessee: University of Tennessee, Agricultural Experiment Station, 1979), 19.

[38]Waltrand, A. R. Brinkmann, Severe Local Storm Hazard in the United States: A Research Assessment (Boulder, Colorado: Institute of Behavioral Science, University of Colorado, 1975).

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[40]Sunset Western Garden Book (Menlo Park, California: Lane Magazine and Book Co., 1973).

[41]Monrovia Nursery Company, "Information Sheet."

[42]Interview with Keith Warren, Horticulturist, J. Frank Schmidt & Son Co., Boring, Oregon, October, 1983.

[43]Monrovia Nursery Company, "Information Sheet."

[44]National Oceanic and Atmospheric Administration, Climates of the States, 2nd ed., new material by James A. Ruffner (Detroit, Michigan: Gale Research Co., 1980).

CHAPTER TWELVE

THE CHANGING DEMAND FOR PLANTS: SUMMARY

In the years since the second world war some of the biggest changes in the nursery industry have been the result of changes in the demand for plants. As discussed earlier in the history of the U.S. nursery industry (Chapter 5 through 8) and in the study of recent changes in production locations and regional specialization (Chapter 9), these changes have important locational implications. Locational advantages vary with plant type and market location, and the propsects for the future of the industry hinge in large part on the development of new markets formed by the future demand for ornamental plants.

Among the forces active in changing the demand for plants are the demographics of the U. S. population, gardening taste and planting practices, changing concepts of the role of ornamental plants in the landscape, and the development of new varieties and hybrids whose introduction to the market may have importance for the location of future production. This chapter will examine these forces and how they may be influential in changing the locational structure of the U. S. nursery industry in the future.

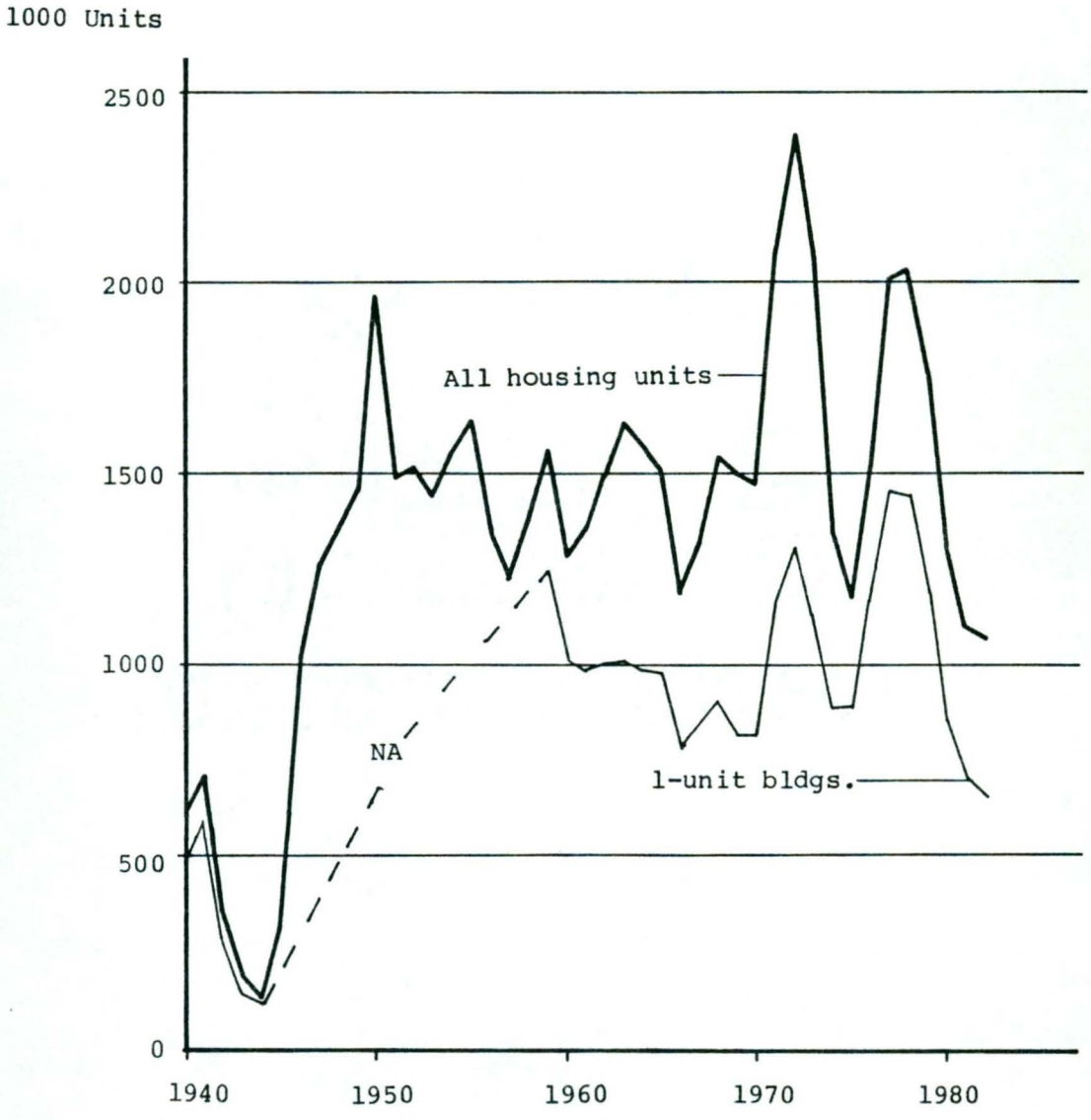
Demographic Change

Demographic change in the U. S. has two principal components that affect the demand for ornamental plants, intra-metropolitan migration and inter-regional migration. Both are having important impacts on the

market for nursery products independent of contemporary shifts in demand due to changes in gardening taste or changes in the way plants are used in the landscape.

Since the end of the second world war there has been a major shift in the location of residences in the U. S., away from central cities and into newer suburbs. In the three decades since the end of the war, all across the country new houses were built that required landscape planting and provided a major boost to the nursery industry. As seen in Figure 12-1 the boom in residential construction that accompanied the migration to the suburbs has been large and sustained, although in the most recent decade it has shown distinct signs of instability. Approximately two-thirds of the new housing built has been in single-unit structures and these have been the greatest market for ornamental plants. While many of the new single-unit houses have been on small lots with room enough for no more plants than earlier lots, many of them have been significantly larger. By one estimate, for example, the average size of new residential lots on the expanding fringe of the New York City metropolitan area in the late 1960s was two-thirds of an acre, whereas in 1950 the average size lot was only one-quarter acre.[1]

While it is difficult to gauge the precise impact of lot sizes on plant use or of housing construction on nursery sales, it is fair to say that the increased construction since 1945 has provided a major market for ornamentals for residential use. That market may be changing, however, as construction of new housing fails to keep up with population increases and as more housing is built in multiple units and on smaller lots than in the past. Many nursery growers are already experiencing an



Source: Statistical Abstract of the U.S. 1984, Table 1329;
Historical Statistics, Colonial Times to 1970, Series N 156, 159

Figure 12-1. Housing Starts per Year, 1940 to 1982

increase in demand for smaller flowering deciduous trees and a slackening demand for large shade trees, which they attribute to smaller residential lot sizes.[2]

Inter-regional migration has had a major impact on the nursery industry by shifting the location of major portions of the market to the South and West. While the population of the states in the Northeast and North Central regions of the U. S. has grown 30% from 1950 to 1980, that of the states in the South and West has grown by 76% over the same period. The 51 million new residents of the South and West are more than twice the number of new residents, 25 million, in the Northeast and North Central regions.[3] The large increases in the South and West have not been distributed uniformly, though. Just three states, California, Texas, and Florida, have become home to 56% of the increase in the South and West, over one-third of the entire national population growth.

This has created a large new demand for ornamental plants in U.S.D.A. Hardiness Zones 8, 9 and 10. The nurseries supplying that demand have been mainly in those zones, although as seen earlier a major share of the deciduous trees used in these zones are probably grown in Zone 7. Much of the shift in production by plant type seen in Figure 9-5, away from roses and other deciduous shrubs and toward broadleaf and narrowleaf evergreens, has been a response to the expansion of regional markets in the South and West. But much of the change in market demand in the South and West has been for different genera or species within plant type rather than for a different type altogether. Pittosporums hardy in Zone 8 and hollies hardy in Zone 6 are both broadleaf

evergreens, for example. Data on production by genus only begins with the 1979 Census of Horticultural Specialites, and we will have to wait for the next special census at the end of this decade to see trends in production by genera.

By the year 2000 the South and West are projected to gain 31% and 45% respectively, over their 1980 populations while the Northeast and North Central are projected to lose 6% and gain 1%, respectively.[4] If these projections are even partially correct the nurseries of the South and West will enjoy continued market growth in the next few decades while those in the rest of the nation will see stagnation unless the use of plants per person increases.

Changing Preferences and Practices

The market for ornamental plants has been strongly influenced by changes in landscape taste, garden styles, and the role of ornamental plants in the landscape outside residential settings. The trend away from roses and other deciduous shrubs toward evergreens and deciduous trees in the years from 1949 to 1978 has been perhaps the greatest change in market demand since the mid-nineteenth century when conifers became popular for the first time. Two over-riding concerns seem to have motivated the change in plant preference: a desire to lessen the maintenance required, and a desire for greater and longer-lasting visual effect. Most narrowleaf evergreens answer the first concern, and most broadleaf evergreens and deciduous flowering trees answer both of them.

Maintenance takes many forms: raking leaves, pruning, weeding,

controlling pests and diseases, and periodically replanting, among othes. The gardening public has decided to place more importance on efficiency and ease of operation in its plant preferences and practices, just as Americans have done elsewhere in many areas, from dining out to clothing. Plants such as roses which require regular maintenance have lost favor and those with lower maintenance requirements have gained. As but one example, the March, 1975 issue of Horticulture magazine listed a suggested regular "spray schedule for roses" (pp. 74-75), that was meant to control seven different animal pests and two diseases, beginning in late April and continuing at weekly intervals through September. By contrast, the May, 1975 issue's "spray schedule for broad-leaved evergreens" (p. 35) listed only four pests of rhododendrons, three of holly, and one of mountain laurel, with spraying at much longer intervals than for roses.

Many narrowleaf evergreens are equally tractable, if not more so. Pfitzer junipers (Juniperus chinensis 'Pfitzeriana'), for example, are tolerant of an amazingly wide range of soil conditions, drought, physical abuse and general neglect. These strengths have endeared them to business owners and home owners looking for a small mass of shrubbery demanding almost no care, Figure 12-2.

The desire for greater and longer-lasting visual effect is responsible for the increasing popularity of broadleaf evergreens, especially those with variegated or colored foliage, and of deciduous flowering trees. Many nurseries have recently experienced a demand for "color" plants, those trees, shrubs, and herbaceous plants with long-lasting flowers or colored foliage.[5] By combining easier maintenance with

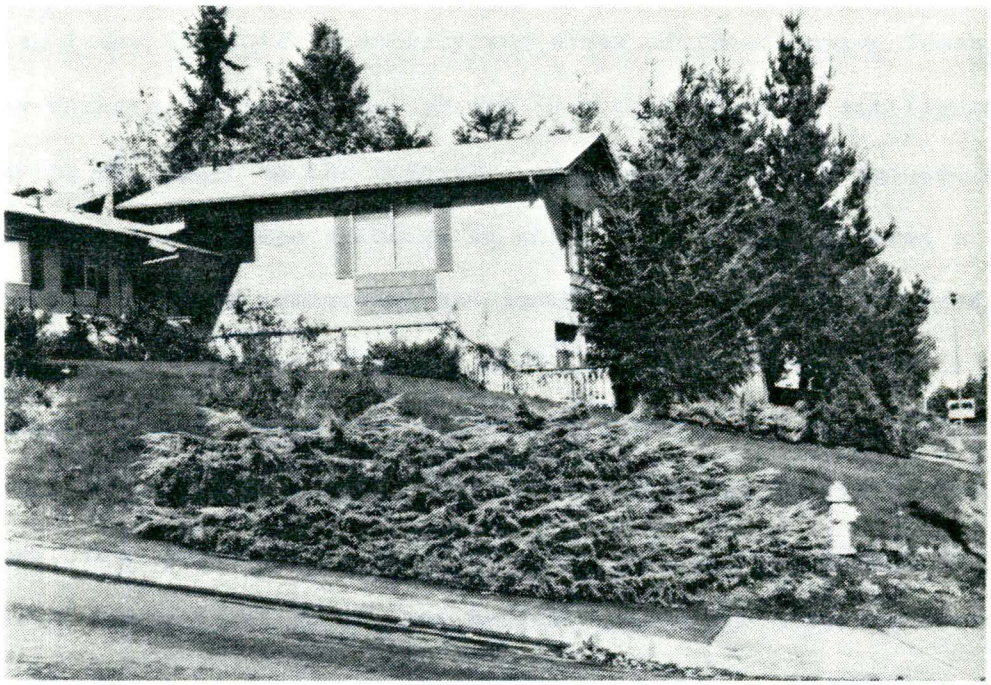


Figure 12-2. Gold-tip Pfitzer Juniper Provides Year-round Color and Foliage with Low Maintenance Requirements.

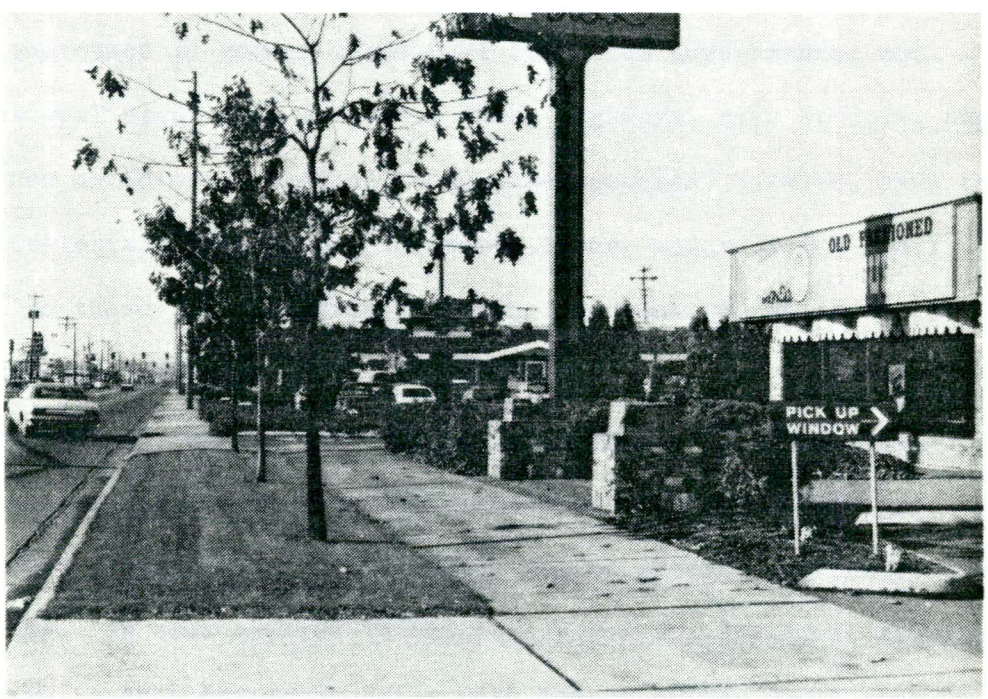


Figure 12-3. Commercial Landscape Plantings are Increasingly Popular, Even at Fast Food Franchises on the Highway Strip.

increased visual impact many broadleaf evergreens and deciduous flowering trees are able to satisfy two sides of the changing demand.

New markets for ornamental plants in non-residential settings are also having an impact on the industry. Ornamentals are being used more in a variety of landscape settings in which they rarely appeared a generation ago. Many commercial and industrial sites now have landscape plantings, as illustrated in Figure 12-3, and the use of plants is increasingly common around new buildings even in the heart of large cities or in industrial areas, often named industrial "parks." Many of these new urban commercial-industrial plantings call for plants very tolerant of neglect and abuse, and several genera are used repeatedly across the nation in standardized settings, junipers, arborvitaes, hollies, and barberries, in particular. Deciduous shade trees continue to be used in large numbers in residential plantings, but the largest market increases in recent years have come from governmental and institutional plantings, in parks, along highways, city streets, and around new buildings. Many of these same agencies, however, have rather strict criteria that they use to select trees, and restrict their choices to those few varieties requiring the least maintenance and susceptible to the fewest pests and diseases.[6]

The implications for the locational structure of the nursery industry of these shifts in market demand are not easy to assess. Many of the changes will have no direct bearing on production locations while others may. As seen earlier in Chapters 9 and 11, deciduous flowering trees seem to grow better in areas with longer photoperiods than do many species of deciduous shade trees. If there is a shift in demand away

from large shade trees to smaller flowering trees, the nurseries of California, Florida, and the Gulf and Atlantic Southeast may lose some business to those in the Pacific Northwest, Mid-South and Great Lakes states. On the other hand, the growing demand for colorful broadleaf evergreen shrubs may have just the opposite effect since many of these plants appear to grow best in nurseries in the Southeast and California.

Introduction of New Varieties

One area in which the locational implications of changing demand for plants are a little more clear is with those new varieties that are being sought and introduced based on their climatic tolerances. There is a large effort underway to develop varieties of shade and flowering trees which will better withstand the peculiar environmental conditions of cities. The stresses created by shallow compacted soils, reflected heat from pavements, salinity buildup from road de-icing salts, and the need for narrower trees whose branches do not obstruct traffic or scrape buildings all call for a special breed of new trees tailored to city conditions.[7] Several organizations including the U. S. National Arboretum and the Metropolitan Tree Improvement Alliance are seeking new cultivars of existing species or new species altogether for urban planting.[8] In addition there is a search underway to identify and propagate regional cultivars better adapted to the peculiarities of various regional climates, particularly in areas with very cold winters and/or very dry hot summers.[9]

The initial results of these efforts have yielded several new

varieties that now have a greater climatically suitable planting range. They also may have a greater range of profitable nursery production. Among deciduous shrubs forsythias are popular for their bright yellow flowers in early spring. While many varieties of the most popular species, the hybrid Forsythia x intermedia, are hardy up through Zone 4 they often fail to flower following harsh winters in Zones 4 and 5. Five recently introduced varieties do flower reliably in Zone 4.[10] They are hybrids of several Asian and one European species including F. ovata (Korean forsythia), F. europea (European forsythia), and F. x intermedia, itself a hybrid of F. suspensa and F. viridissima, both Asian natives. The new hybrids have been tested in Ontario, Minnesota, Iowa, and New Hampshire and they extend the useful range of forsythias some 200 miles inland in the Midwest and Northeast. The implications for the nursery industry are that these new hybrids will 1) create a market for these new hybrids in these areas, and 2) perhaps grow better in nurseries in colder areas than the nurseries currently producing most of the forsythias.

The search for shade trees better adapted to regional and/or urban climates has yielded some promising results as well. One of the most notable is the Green Mountain sugar maple (Acer saccharum 'Green Mountain'). This cultivar is tolerant of hotter and drier summers than the species and has found a ready market in cities of the Midwest where other sugar maples suffer from a malady known as sun-scorch, losing their leves prematurely after browning and curling in from the edges.[11] As seen in the data on growth rates, Figure 11-5, this is one of the few maple varieties that grows as fast in Ohio as it does in

Oregon. The climatic production advantages enjoyed by growers in the Willamette Valley might not apply to Green Mountain sugar maple as they do to other maple species and varieties. It may be that nurseries in the Midwest will be able to produce them as quickly and, being closer to the markets, sell them more cheaply than Oregon growers.

These examples are meant only to be suggestive of the possibilities for change in production locations inherent in the development of new varieties. They indicate the importance of climate to production advantages and to regional markets. The efforts now underway to develop plants better adapted to regional and urban environmental conditions must in the long run have some such impact on the location of nursery production. The net result may well be a redispersal of production of some plants, with more regional growers supplying their own regional markets and less concentration of national production in just a few states. It is still far too early to assess this, however, and it may be equally possible that other locational production advantages will more than offset the loss of competitive advantage in growth rates alone. As seen earlier in Chapter 11 in the discussion of climatic factors involved in container-growing in the Southeast, much of the locational advantage there is due to a greater flexibility in production rather than to faster growth per se.

The future of the nursery industry is no more likely to repeat its history than is that of any other industry. But anticipation of its prospects must necessarily be based on projecting from current trends and extrapolating data from the recent past. This chapter has attempted to do this, with the tentative conclusion that the growth of regional

markets holds the greatest potential to influence the locational structure of the industry in the future.

The expected population growth in the South and West should provide a continuing stimulus to production there, especially for residential planting. Elsewhere development of new markets based on regionally adapted varieties holds the greatest promise for production growth. Residential markets in the Northeast and North Central regions will probably increase only slowly in the near future, but there is still a large potential market there, as well as in the South and West, for civic, institutional, commercial, and industrial planting. The potential of regional cultivars in these new markets will probably be even more important, since many of these customers will be purchasing plants on the advice of professional designers and planners who will, presumably, be familiar with the latest developmens in breeding and varietal selection programs.

Summary

This dissertation has examined changes in the locational structure of the U. S. nursery industry in the context of regional specialization of production. It has attempted to isolate the role of the most important locational factors by studying available data through comparative map analysis of the location of production by plant types. It has underscored the importance of climate to production locations and has suggested some of the climatic factors that may be responsible for competitive production advantages, emphasizing the possible role of photoperiod and summer temperature regime to the growth of deciduous

shade trees. It has also studied the importance of the form of the product in relation to soils and water supply as well as climate, emphasizing the special ways in which these factors influence the location of container nurseries.

The special role of nurseries in the agriculture of metropolitan areas is a critical one. This study has begun to question some of the assumptions of the geography of metropolitan agriculture as it looked at changes in production of various commodities in several metropolitan areas in the U. S. Much more needs to be done to explain the workings of the special locational factors involved in metropolitan agriculture, but the work here suggests a historical model and raises questions about the factors involved with specialized horticulture which may have a bearing on other commodity types as well.

It has done all of this in the historical context of the development of the nursery industry in the U. S., examining the role of changes in demand as influenced by taste and fashion in gardening. These continue to play a major role in shaping the demand for ornamental plants and may well be among the most important locational factors in the future.

This dissertation has tried to explain in broad outline the workings of only the most important locational factors. Above all it has tried to define issues and to form questions as much as it has tried to answer them. This is especially the case with the role of climatic factors, whose study needs an integrated phenological and genecological approach. It is my hope that others will extend and correct my work by examining these factors in more detail in a more systematic way in the future.

What I have done here is to open the door to the study of a fascinating branch of agriculture, one of the most interesting areas for the integrative approaches of geographic inquiry.

Chapter Twelve - Notes

[1]Peter Hall, The World Cities, 1st ed., (New York: McGraw Hill, 1966), 198. Hall refers to a study done for the Regional Plan Association.

[2]The trend was visible over 20 years ago in Maplewood, New Jersey where homeowners asked the city to replace dying oak and maple street trees with smaller flowering crabapples, pears, etc.; Richard Walter, "Street Trees," Horticulture 42 (July, 1964). The large increases in sales of deciduous trees in Michigan and Tennessee shown in Figures 9-19 and 9-20 are due mainly to increased production of flowering trees, principally crabapples and dogwoods, Figures 9-23 and 2-23 respectively. J. Frank Schmidt & Son Nursery in Oregon has recently seen declining sales of birches, red maples, and plane trees in its markets in the Midwest and Northeast, steady sales of oaks and Norway maples, and much increased sales of crabapples; interview with Keith Warren, Horticulturist, J. Frank Schmidt & Son, Boring, Oregon, October, 1983.

[3]U. S. Bureau of the Census, Statistical Abstract of the United States 1984 (Washington: U. S. Dept. of Commerce), 14, Table 10.

[4]Ibid., 15, Table 14.

[5]This is especially true of nurseries in Zones 8-10. See for example the recent catalogs of Monrovia Nursery, Azusa, California, and Hines Wholesale Nursery, Irvine, California.

[6]International City Management Association, "Municipal tree Management," Urban Data Service Report 14 (1982), reports on a 1979 survey by the Dept. of Forestry, Michigan State University, which found that 61% of the 1534 responding municipalities in the U. S. had a municipal tree ordinance. 66% of those had statutory restrictions on the species which could be planted in city-owned rights-of-way. The City of Seattle, for instance, bans planting anywhere in the city of bigleaf maple (Acer macrophyllum) and Lombardy poplar (Populus nigra var. Italica) among others, and requires a permit for planting others (Seattle Ordinance No. 90047).

[7]See, for instance, Hopkins, Proceedings of the National Urban Forestry Conference; Gangloff and Moeller, Proceedings of the Second National Urban Forestry Conference; and Santamour, et. al., Better Trees for Metropolitan Landscapes.

[8]Frank S. Santamour, Jr., "Developing Improved Cultivars for Urban Forests," in Hopkins (491-499), Proceedings of the Urban Forestry Conference, 1980; Henry D. Gerhold, "History and Goals of METRIA, the Metropolitan Tree Improvement Alliance," Journal of Arboriculture 4 (1978), 62-66.

[9]Douglas J. Chapman, "Cutting Propagation for Shade Tree Cultivars Encourages Development of Regional Plants," American Nurseryman 158 (15 Aug. 1983), 39-44; Harold Pellet, "Coordinated Effort to Enhance Development of Cold Hardy Landscape Plants," HortScience 18 (1983), 641-642.

[10]Carol Howe, "Five 1984 Forsythia Introductions,": American Nurseryman 159 (15 May 1984), 167-172.

[11]Chapin and Kozel, Shade Tree Evaluation Studies, 18; see also Kriebel, Patterns of Genetic Variation in Sugar Maple.

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