A Survey of the Alaska Greenhouse Industry and Related Enterprises

Results and Analysis

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TABLE OF CONTENTS

List of Tables

List of Figures

ABSTRACT

A list of commercial greenhouses, nurseries, interiorscape businesses, landscape contractors, florist businesses, and variety stores that sell plant products was developed in order to determine the scope of the horticulture industry in Alaska. The list identified 155 greenhouse, nursery, and interiorscape businesses along with 304 landscape contractors, 80 florist businesses, and 41 variety stores that sell plants. A questionnaire was used to determine the status of these types of enterprises including location, square footage of facilities, source of heating and lighting for greenhouses, number and type of employees, products purchased and/or produced, and total gross sales. The number of businesses responding to this survey totaled 135 and included 54 greenhouses and/or nurseries, 4 interiorscape businesses, 44 landscape contractors, 19 florists, and 14 variety stores.

More than half of the greenhouse, nursery, and interiorscape businesses were started after 1976, and 40.4 percent of the businesses began as a hobby that was expanded into a commercial enterprise. Nearly all of the greenhouse operations had Quonset or even-span gable greenhouses covered with corrugated fiberglass or double-layer polyethylene. Most greenhouses were heated with natural gas or heating oil. The businesses that responded had a total of 413,476 square feet (ft^2) of year-round heated greenhouse space, 266,900 ft^2 of seasonally heated space, and 18,369 ft^2 of nonheated space. The most commonly grown crops were flowering annual and vegetable bedding plants. The number of employees at the businesses with greenhouses was 678: 152 year-round, full-time employees; 85 year-round, part-time employees; and 441 seasonal employees, 150 of whom were hired only during the transplanting season. The estimated number of jobs available statewide in greenhouse, nursery, and interiorscape businesses totaled 1,559. Forty-four percent of the businesses with greenhouses reported gross sales of less than $25,000, while 5 businesses exceeded $1 million in gross sales. The estimated total gross sales for greenhouse, nursery, and interiorscape businesses in Alaska was $24,387,500.

INTRODUCTION

Horticultural crops have been grown in Alaska since the late eighteenth century. Early settlers produced such commodites as vegetables, fruits, and ornamentals to supplement an isolated and independent lifestyle. Greenhouses were used to extend the growing season and produce warm-season crops that could not be grown in traditional and sod-roof gardens.

Historical records indicate that greenhouses have been used for commercial crop production in Alaska since the early 1900s (i.e. Pathfinder of Alaska 1921, 1922; Franklin 1921; Georgeson 1910; Holm 1954; Kaiser 1938; Sheely 1934). The first attempt to document the scope of this commercial greenhouse industry was made by the USDA Agricultural Research Administration in 1946 (Magruder 1949). At that time, the two largest greenhouses were located in Fairbanks, and each contained 5000 to 6000 ft^2 principally devoted to the production of tomatoes and cucumbers. Several growers of truck crops had small greenhouses for growing vegetable transplants, while other owners of family-sized greenhouses produced a surplus that was sold to neighbors and local grocers. One commercial floriculture greenhouse was under construction in Fairbanks in 1946.

Anchorage had two commercial greenhouses in 1946 primarily used to produce flowers. Numerous small greenhouses were reported in the Matanuska Valley and at Homer, Kodiak, Miller House, and Circle Hot Springs. These greenhouses were used for production of vegetable transplants and/or sale of surplus greenhouse vegetable crops to roadhouses, mining camps, and military bases.

Wrangell had two small greenhouses from which surplus vegetables and flowers were sold. One greenhouse in Petersburg sold tomatoes and cucumbers, miscellaneous flowering plants, and perennial seedlings. Ketchikan greenhouses, measuring about 3000 ft^2 with supplementary cold frames, were devoted primarily to annual flower production. One greenhouse at Sitka contained two hydroponic beds with a gravel substrate, one of which was used for tomato production and the other for roses. The primary crop of commercial greenhouses in Juneau was flowers. Throughout the Territory of Alaska, none of the commercial greenhouses were used in winter because of low light intensity and high heating costs.

A second attempt to document the scope of a horticulture industry in Alaska occurred in 1975, nearly 30 years later. Hemphill (1976) surveyed 14 nursery

businesses to identify growers and retailers of woody and herbaceous perennial plant materials in southcentral Alaska. He found that retail sales of trees, shrubs, and herbaceous perennials approached $400,000 in 1975; 1 business in Anchorage accounted for slightly over $100,000 of these sales.

The Cooperative Extension Service conducted a survey in 1980 to determine the size of individual greenhouse businesses and a value for statewide retail sales (Vandre 1980). That study identified a total of 25 greenhouse businesses in Alaska in 1980, 15 of which responded to the survey. Using average retail sales per square foot from 10 of these businesses, it was estimated that the total retail sales for the Alaska greenhouse industry was $5,612,414.

In 1982, Agresources (Logsdon 1982) identified a total of 15 commercial greenhouses in the Matanuska-Susitna Borough, 10 of which were included in a survey. These 10 greenhouses had a total of 44,000 ft^2 and gross returns ranging from $1.25 to $8.00 per $ft.^2$ (Logsdon 1982). During this same year, the US Department of Commerce identified 66 operations in Alaska that sold "nursery and greenhouse products, mushrooms, and sod" for a total value of $3,033,000 (US Dept. of Commerce 1983). The Alaska Division of Agriculture, Department of Natural Resources, reported 44 greenhouse operations in Alaska in 1982. The total greenhouse space was 625,000 ft^2 with the total value of greenhouse plants produced exceeding $4 million (Eberhart and Wright 1984). The most recent survey was conducted in 1983 by the USDA. In this case, cash receipts for greenhouse and nursery businesses totaled $5,030,000 amounting to 27.1 percent of all agricultural commodities sold in Alaska (USDA 1984).

Our literature review revealed little comprehensive information on the scope of the horticulture industry despite its apparent importance in the agricultural economy of Alaska. Direct comparisons among studies were not always possible because of the inconsistency with which horticultural enterprises were defined and/or categorized. In addition, sample sizes in some studies did not appear to be representative of the population. Consequently, estimates of the value of the greenhouse industry in Alaska were questionable.

The purpose of the study reported here was to provide information on the current status of various horticultural enterprises in Alaska. Specifically, commercial greenhouses, nurseries, interiorscape businesses, landscape contractors, florists, and variety stores that sell horticultural products were inventoried. This information was used to determine the scope of the industry in terms of physical size and business characteristics, plant production, and total sales.

METHODS

Beginning in September 1984, an attempt was made to create a complete list of commercial greenhouses, nurseries, interiorscape businesses, landscape contractors, florists, and variety stores that sell plants in Alaska. This list was compiled from phone directories; business license registrations; available address lists from the Alaska Horticultural Association, the Cooperative Extension Service, and the Alaska Division of Agriculture; the authors' knowledge of the industry; and word of mouth. Verification of the accuracy of these names and addresses continued throughout the study.

Four questionnaires were used in this study (Appendix 1). The first questionnaire identified specific types of greenhouse, nursery, and interiorscape businesses in Alaska. Variables included the type of enterprise, physical size and characteristics of the facilities, employment data, history of the business, cropping season, description of commodities sold, and gross sales. The second questionnaire was designed to determine the use of plant materials by landscape contractors and provide information for the greenhouse industry regarding the potential demand for these plant materials. Variables included historical information on the business and descriptions, sources, and value of plant materials used. The remaining two questionnaires were designed to determine the current and potential use of Alaska-grown horticultural products by florists and variety stores. In addition, variety stores were asked to report gross sales of plant materials.

Shortly after the survey was begun, the need arose to reword certain questions to clarify their intent. For instance, in the original greenhouse questionnaire, question number seven referred to the type of glazing used on the greenhouse structures. Since respondents were not familiar with the term *glazing*, the term *covering* was substituted. In addition, two questions were inserted that asked respondents for their comments and if they would like to receive a copy of the survey results.

Attempts were made to contact all greenhouses, nurseries, and interiorscape operations by personal or telephone interviews. Businesses that were not accessible by these methods were mailed a questionnaire with a self-addressed, stamped envelope. Sixty percent of the landscape contractors were surveyed by telephone, while the remainder was interviewed personally or by mail. Because the primary emphasis of this study was the greenhouse industry and the use of plant materials by related

enterprises, no attempt was made to contact all florists and variety stores in Alaska. Consequently, interviews were limited to the Anchorage and Fairbanks areas. Florists were surveyed by telephone, and variety stores were surveyed by personal interview. The number of businesses surveyed totaled 135, including 54 greenhouses and/or nurseries, 4 interiorscape businesses, 44 landscape contractors, 19 florists, and 14 variety stores. In each interview the purpose of the survey and its confidentiality were explained. The respondents were encouraged to voice their concerns about the industry and to discuss problems associated with their business.

Data were analyzed using the Statistical Package for the Social Sciences, tenth edition (SPSSx). A frequency distribution program was used to obtain frequency, percent, valid percent, and cumulative percent for the descriptive information. Valid percent figures excluded missing cases. Crosstabs were used to make direct comparisons among and between sets of variables.

RESULTS

Greenhouse, Nursery, and Interiorscape Businesses

General Characteristics

The total number of Alaska greenhouse, nursery, and interiorscape businesses identified was 155 with 37.4 percent responding to this survey. Responses were received from the five most populated regions of Alaska (table 1) and included 54 greenhouses and/or nurseries and 4 interiorscape businesses, most of which were located in interior Alaska and Anchorage. Among these businesses, 36.2 percent were solely greenhouse operations, 37.9 percent were greenhouse/nursery/garden center operations, 6.8 percent were interiorscape businesses, and the remainder were combinations of the above (table 2).

One of the businesses responding to this survey began operation in 1956, and from 1957 through 1970, 13 more businesses were started (figs. 1 and 2). During the next decade 24 new businesses began operation, and, from 1981 to 1984, an additional 19 businesses were started. Sixty-five percent of all businesses surveyed were started within the last 9 years including 9 in interior Alaska, 10 in the Anchorage area, 4 in the Matanuska-Susitna Borough, 8 on the Kenai Peninsula, and 6 in southeastern Alaska.

Operators of 40.4 percent of the businesses began their commercial operation by expanding a hobby. Only 28.1 percent of owners actually planned for a career in a greenhouse, nursery, or interiorscape business. Another 8.8 percent of the respondents became interested in starting a business after taking college courses in horticulture or related disciplines, however few had completed degrees. Previous job experience in a horticulture-related enterprise motivated 7 percent of the owners to start their own business, while 5.3 percent inherited the family business. The remaining 10.5 percent of respondents proceeded into plant production and/or sales as a natural expansion of an original business such as landscaping.

Professional Affiliations

Thirty-one percent of the business owners responding to the survey belonged to national professional organizations such as Bedding Plants, Inc., the American

Table 1. Number of greenhouse, nursery, and interiorscape businesses responding to survey and estimated total businesses per region.

Region	Number of respondents	Estimated total*	Estimated percent response
Interior Alaska	13	25	52.0
Anchorage area	16	32	50.0
Matanuska Susitna Borough	8	41	19.5
Kenai Peninsula	14	37	37.8
Southeastern Alaska	6	13	46.2
Western Alaska	0	1	—
Kodiak & Valdez	1	6	16.7
Totals	58	155	

*Estimates based on address list compiled.

Table 2. Number and percent of each type of business responding to survey.

Type of business	Number	Percent of total
Greenhouse	21	36.2
Greenhouse/nursery*	2	3.4
Greenhouse/garden center	3	5.2
Greenhouse/nursery/garden center	22	37.9
Cold frame	1	1.7
Nursery	2	3.4
Nursery/greenhouse	2	3.4
Nursery & sod	1	1.7
Interiorscape	0	—
Interior & plant maintenance	2	3.4
Interiorscape & plant maintenance/greenhouse	2	3.4
Total	58	

*Business composed of several components; major components listed first.

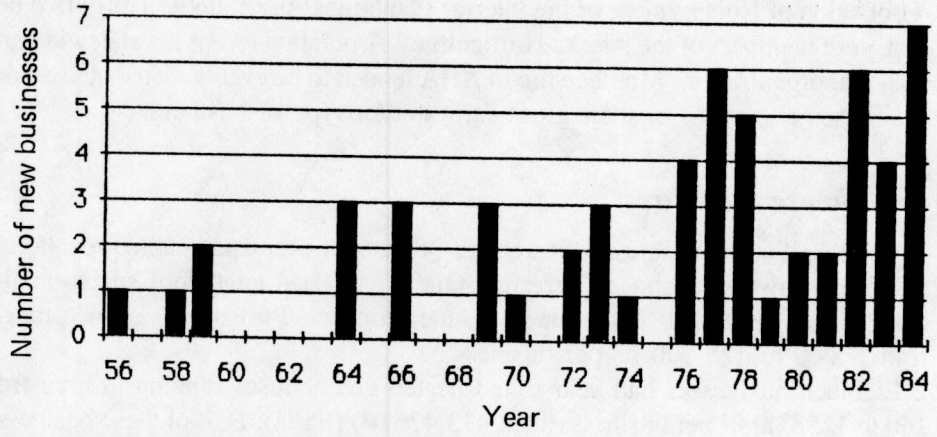

Figure 1. Number of new greenhouse, nursery, and interioscape businesses started by year (based on 57 valid responses).

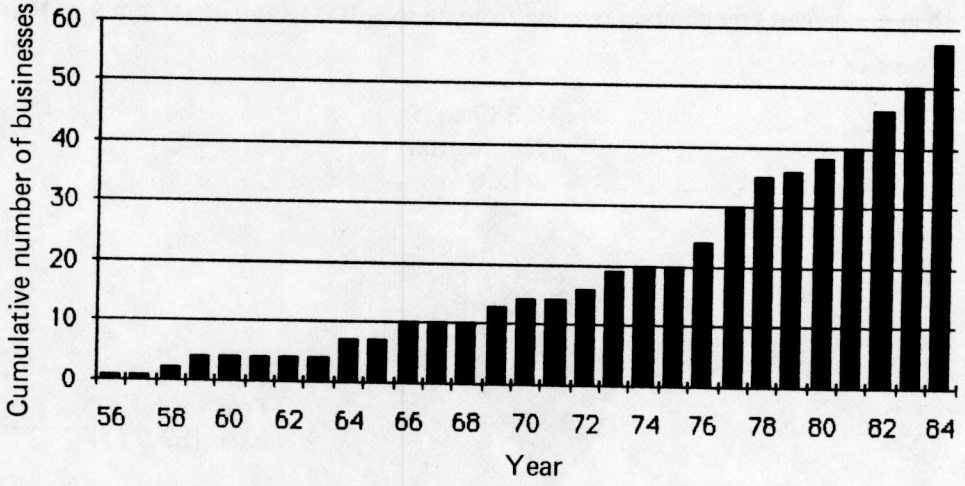

Figure 2. Cumulative number of new greenhouse, nursery, and interiorscape businesses (based on 57 valid responses).

Association of Nurserymen, or the Interior Plantscape Association. Thirty-five percent were members of the Alaska Horticultural Asociation (AHA), a statewide professional organization. Membership in AHA tended to be evenly distributed among businesses regardless of their gross sales and/or type of business.

Greenhouse Structures

Almost all of the businesses had either Quonset or even-span gable greenhouses (table 3). Most greenhouses were freestanding and had total floor space ranging from 160 to 38,000 ft² per business. Gutter-connected greenhouse space ranged from 2,000 to 125,000 ft² per business.

Eighteen businesses had year-round heated greenhouses ranging in area from 160 to 125,000 ft² per business (total: 413,476 ft²) (fig. 3). Half of these businesses were located in the Anchorage area (table 4). Forty-three businesses had seasonally heated greenhouses ranging from 60 to 38,000 ft² (total: 266,900 ft²). More than 60 percent of the businesses in interior Alaska, the Matanuska-Susitna Borough, and the Kenai Peninsula had seasonally heated greenhouses. Thirteen businesses had nonheated greenhouses ranging from 48 to 5,100 ft² (total: 18,369 ft²). Forty

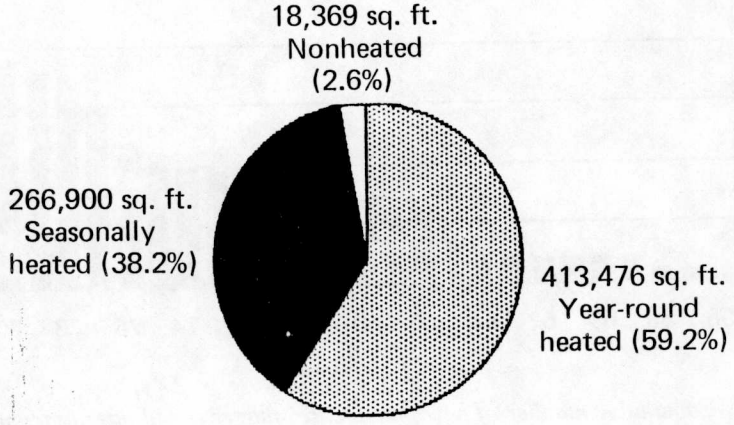

Figure 3. Square footage of year-round heated, seasonally heated, and nonheated greenhouses (based on 57 valid responses of which 51 had greenhouses).

Table 3. Types of greenhouse structures used by businesses surveyed.*

Greenhouse structural type	Number of businesses	
	Total	Subtotal
Free Standing	36	
Quonset/Gothic		10
Even-span gable		15
Uneven-span gable		1
Unspecified span gable		1
Quonset/Gothic & even-span gable		9
Gutter Connected	7	
Quonset/Gothic		5
Uneven-span gable		1
Quonset/Gothic & even-span gable		1
Freestanding & gutter-connected	2	
Quonset/Gothic		1
Quonset/Gothic & even-span gable		1
Lean-to	5	
Lean-to & freestanding Quonset/Gothic	1	

*Based on 57 valid responses of which 51 had greenhouses.

Table 4. Number and (percent) of businesses by region with year-round heated, seasonally heated, and nonheated greenhouses.*

Region	Nonheated	Seasonally heated	Year-round heated	Total
Interior Alaska	2 (13.3)	12 (80.0)	1 (6.7)	15 (100)
Anchorage area	4 (19.0)	8 (38.1)	9 (42.9)	21 (100)
Matanuska Susitna Borough	2 (16.7)	8 (66.6)	2 (16.7)	12 (100)
Kenai Peninsula	1 (6.3)	11 (68.7)	4 (25.0)	16 (100)
Southeastern Alaska	4 (40.0)	4 (40.0)	2 (20.0)	10 (100)

*Based on 58 valid responses of which 52 had greenhouses.

percent of the businesses in southeastern Alaska had nonheated greenhouse space. Twenty-two businesses had combinations of heated and nonheated greenhouse space. Five nurseries and 1 interiorscape business had no greenhouse space.

Greenhouses were covered most commonly with corrugated fiberglass or a double layer of polyethylene (table 5). Other glazing materials included single-layer polyethylene, glass, and acrylic. Nine businesses with year-round heated greenhouses used polyethylene as a covering, while 6 used corrugated fiberglass. The number of businesses using polyethylene and corrugated fiberglass for seasonally heated greenhouse space was 18 and 21, respectively. Four times as many businesses with nonheated greenhouses used polyethylene rather than corrugated fiberglass as a covering. Businesses in southeastern Alaska used polyethylene more often than fiberglass as a greenhouse covering, whereas businesses in other regions showed no apparent preference for either type of covering (table 6).

Greenhouse Heating and Lighting

Seventy-two percent of the businesses with year-round heated greenhouses used natural gas as a primary heating source (table 7). Natural gas was the preferred heating source regardless of the square footage of year-round heated space per business (table 7) and was the fuel used most often in the Anchorage and Kenai Peninsula areas (table 8). Businesses with seasonally heated greenhouses used natural gas or heating oil as the heating source most often (table 9). Businesses in the Anchorage area and the Kenai Peninsula used natural gas for seasonally heated greenhouses, while businesses in interior Alaska, where natural gas is not available, used heating oil (table 10).

Supplemental light for plant growth was used by 59.6 percent of the businesses, and fluorescent lighting was predominant (fig. 4). The types of businesses using supplemental light tended to be greenhouse only and greenhouse/nursery/garden center operations (table 11).

Hot Frames, Cold Frames, and Field Space

Hot frames were used by 2 of the 58 greenhouse, nursery, and interiorscape businesses. One business had 3,600 ft^2 of hot frame space that was heated with oil, while the other had 75 ft^2 of space heated by electricity. Both businesses covered the hot frames with a single layer of polyethylene.

Table 5. Number of businesses with year-round heated, seasonally heated, and nonheated greenhouses covered with different types of glazing.

Type of Glazing	Number of businesses				Percent of total
	Year-round heated	Seasonally heated	Nonheated	Total	
Single layer polyethylene	1	0	0	1	1.9
Double layer polyethylene	7	10	3	20	38.5
Polyethylene, unspecified number of layers	1	8	5	14	26.9
Corrugated fiberglass	6	21	2	29	55.8
Acrylic types	2	2	2	6	11.5
Glass	1	2	1	4	7.7

*Based on 58 valid responses of which 52 had greenhouses.

Table 6. Number of businesses in different regions with greenhouses covered with polyethylene and corrugated fiberglass.

Region	Polyethylene-covered greenhouses	Fiberglass-covered greenhouses
Interior Alaska	7	5
Anchorage area	10	10
Matanuska Susitna Borough	5	5
Kenai Peninsula	7	8
Southeastern Alaska	6	1

Table 7. Number of businesses with year-round heated greenhouse space by heat sources used.*

Square footage	Natural gas	Heating oil	Wood	Electricity
1-999	3	2	1	1
1,000-4,999	2	1	0	0
5,000-9,999	2	0	0	0
10,000-29,999	0	0	0	0
30,000-69,999	3	0	0	0
70,000-99,999	2	0	0	0
100,000-125,000	1	0	0	0

*Based on 58 valid responses.

Table 8. Number of businesses by region with year-round heated greenhouse space by heat source used.*

Region	Natural gas	Heating oil	Wood	Electricity
Interior Alaska	0	1	0	0
Anchorage area	9	0	0	0
Matanuska-Susitna Borough	1	1	0	0
Kenai Peninsula	3	0	0	1
Southeastern Alaska	0	1	1	0

*Based on 58 valid responses of which 18 had year-round, heated greenhouses.

Table 9. Number of businesses with seasonally heated greenhouse space by heat source used.*

Square footage	Natural gas	Heating oil	Oil/ wood	Oil/ coal	Propane	Wood	Electricity
1-999	2	2	1	1	1	1	2
1,000-4,999	6	5	2	0	2	3	1
5,000-9,999	2	1	0	0	0	1	0
10,000-29,999	3	4	0	1	0	0	0
30,000-69,999	1	1	0	0	0	0	0

*Based on 58 valid responses of which 43 had seasonally heated greenhouses.

Table 10. Number of businesses in different regions with seasonally heated greenhouses by heat source used.*

Region	Natural gas	Heating oil	Oil/ wood	Oil/ coal	Propane	Wood	Electricity
Interior Alaska	0	7	1	1	0	2	1
Anchorage area	6	0	0	0	1	0	1
Matanuska-Susitna Borough	1	3	1	0	2	1	0
Kenai Peninsula	6	1	1	1	0	2	0
Southeastern Alaska	1**	2	0	0	0	0	1

*Based on 58 valid responses of which 43 had seasonally heated greenhouses.
**This response may have actually been "propane".

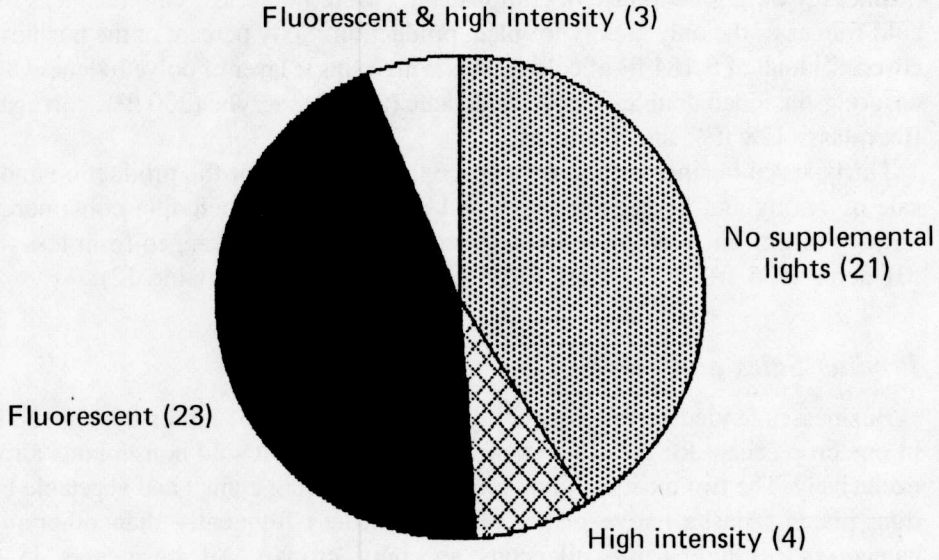

Figure 4. Number of greenhouse, nursery, and interiorscape businesses with different types of supplemental light (based on 57 valid responses of which 51 businesses were applicable).

Table 11. Number of each type of business with greenhouses by supplemental light sources used.*

Type of business	Fluorescent	High intensity	Fluorescent/ high intensity	No lights
Greenhouse	8	2	1	10
Greenhouse/nursery	1	0	0	1
Greenhouse/garden center	1	0	0	1
Greenhouse/nursery/ garden center	9	2	2	9
Nursery/greenhouse	2	0	0	0
Interiorscape & plant maintenance greenhouse	2	0	0	0

*Based on 57 valid responses.

Fifteen businesses had a total of 6,343 ft^2 of cold frame space. Twelve of these businesses were greenhouse operations and 2 were nurseries. One business used cold frames as the only facility for plant production. Sixty percent of the businesses covered a total of 5,184 ft^2 of cold frames with a single layer of polyethylene. Other coverings included double-layer polyethylene (800 ft^2), acrylic (200 ft^2), corrugated fiberglass (128 ft^2), and glass (31 ft^2).

Thirty-seven businesses had field space that was used for the production and/or sale of woody and herbaceous perennial plant materials including containerized nursery stock. The amount of field space for each business ranged from less than .01 acres (435 ft^2) to 50 acres for a total of 156.33 acres (table 12).

Product Sales and Services

Businesses tended to sell a diversity of plants (table 13) rather than specialize in one crop except for the 4 interiorscape businesses that sold houseplants almost exclusively. The two most common crops were flowering annual and vegetable bedding plants. Alaska native plants were grown less frequently than other plant categories (excluding miscellaneous specialty crops). All businesses in the Matanuska-Susitna Borough sold flowering annuals; vegetable transplants; and geranium, fuchsia, and/or begonia baskets (table 14). In interior Alaska the most common crops were flowering annual and vegetable bedding plants while trees and shrubs were sold less frequently. Businesses in the Anchorage area tended to be more specialized in the types of crops sold when compared with businesses in other regions as shown by the generally lower percentage of businesses selling each crop. With the exception of native plants in southeastern Alaska, crops in all other categories were sold within each region.

Approximately one-half of the businesses purchased nursery stock, rooted cuttings, and/or potted plants from other sources for resale (table 15). More than half of the businesses that sold nursery stock and plants from rooted cuttings (fuchsia, geranium, poinsettia, etc.) purchased 100 percent of the nursery stock and cuttings from other sources (table 16). Seven businesses that sold potted plants produced at least 80 percent of their own plants, while 10 businesses purchased all of the potted plants that they sold.

Most businesses offered services other than plant sales. Thirty-seven percent of the businesses had garden centers that provided a variety of services such as the sale of garden tools, fertilizer, soil, pesticides, and seeds (table 17). Twelve businesses

Table 12. Number of businesses with various acreages of field space.*

Acres of field space	Number of businesses
0.00	22
.01	2
.01 to .49	10
.50 to .99	2
1.00 to 1.99	8
2.00 to 2.99	5
3.00	3
4.00	1
5.00	1
7.00	1
10.00	2
40.00	1
50.00	1

*Based on 59 valid responses.

Table 13. Number of businesses by percent of total plant sales for different plant categories.*

Crop Category	0	1-20%	21-40%	41-60%	61-80%	81-100%
Houseplants	27	22	4	0	0	4
Flowering annuals	11	19	16	9	2	0
Vegetable transplants	13	23	14	5	1	1
Herbaceous perennial	20	33	1	2	0	1
Fuchsia, geranium, & begonia baskets	20	32	5	0	0	0
Planters with annuals	23	33	1	0	0	0
Containerized roses	36	20	1	0	0	0
Alaska native plants	39	18	0	0	0	0
Shrubs	25	24	8	0	0	0
Trees	28	23	5	1	0	0
Miscellaneous**	42	7	2	4	2	0

* Based on 57 valid responses.

** Miscellaneous=berries, berry plants, tomatoes and cucumber, sod, or miscellaneous vegetables.

Table 14. Percent of businesses by region selling various crops.*

Crop category	Interior Alaska	Anchorage Area	Matanuska-Susitna Borough	Kenai Peninsula	Southeast Alaska
Houseplants	61.5	62.5	62.5	30.8	42.9
Flowering annuals	92.3	56.3	100.0	84.6	57.1
Vegetable transplants	92.3	56.3	100.0	92.3	42.9
Herbaceous perennials	69.2	62.5	75.0	61.5	42.9
Fucshia, geranium, begonia baskets	69.2	62.5	100.0	53.8	42.9
Planters with annuals	61.5	56.3	75.0	53.8	57.1
Containerized roses	38.5	43.8	50.0	15.4	42.9
Alaska native plants	15.4	43.8	50.0	38.5	0.0
Shrubs	38.5	75.0	62.5	38.5	57.1
Trees	32.1	75.0	62.5	46.2	42.9

*Based on 57 valid responses.

Table 15. Number of businesses purchasing various plant materials.*

Plant Material	Purchasing	Not Purchasing
Rooted cuttings	30	26
Potted plants	33	23
Bareroot nursery stock	34	22
Balled & burlapped and containerized nursery stock	28	28

*Based on 56 valid responses.

Table 16. Number of businesses by percent of sales that purchased plant materials from other sources.

Plant material	Number of businesses by percent sales						Number of valid responses
	1-20	21-40	41-60	61-80	81-99	100	
Rooted cuttings*	3	1	1	1	2	12	20
Potted plants**	7	1	2	1	1	10	22
Bareroot nursery stock	0	1	0	2	0	23	26
Balled & burlapped and containerized nursery stock	0	1	1	0	2	13	17

*Fuchsia, geranium, poinsettia, etc.

**Foliage plants, poinsettias, and other flowering pot plants.

Table 17. Number of businesses offering services other than plant sales.*

Services	Number
None	9
Tools & fertilizer sales	3
Fertilizer sales	2
Soil sales	2
Vegetable sales	4
Garden center	14
Garden center offering classes	2
Garden center & landscaping	2
Landscaping and/or yard maintenance	7
Interiorscape plant maintenance	4
Consulting	3
All of the above	5

*Based on 57 valid responses.

provided a price list of their products and services for their customers. Two businesses conducted surveys to solicit consumer opinion regarding their products and services.

Four of the 55 businesses sold products only by wholesale, 25 were retail only, and 26 were both wholesale and retail. Nine businesses sold products by mail order; in no instance did this sales activity exceed 10 percent of total sales.

Employees

The number of employees (including working owners) at the 58 greenhouse, nursery, and interiorscape operations was 678: 152 year-round, full-time employees; 85 year-round, part-time employees; 291 seasonal employees; and 150 employees hired only during the transplanting season in spring. Four businesses hired 95 of the 152 year-round, full-time employees, while 27 businesses hired none. One business hired 37 of the 85 year-round, part time employees, while 36 businesses hired none. Three businesses hired 141 of the 291 seasonal employees, and two businesses hired one-third of the employees used only during the transplanting season.

Gross Sales

Twenty-four of the 55 businesses, including the majority of businesses in southeastern Alaska, interior Alaska, and the Kenai Peninsula, reported gross sales of less than $25,000 (tables 18 and 19). Half of these businesses were started after 1982. Five businesses reported gross sales exceeding $1 million with 1 business specifying $2.7 million. All of these larger businesses were started prior to 1978. Businesses with 1000 ft² or less of greenhouse space tended to report low gross sales of less than $25,000; however businesses with 1000 to 5000 ft² of greenhouse space reported gross sales from the lowest range given to $1 million or more (table 20).

Table 18. Number of greenhouse, nursery, and interiorscape businesses by year started and range of gross sales.*

	Range of Gross Sales ($)					
Year	0-24,999	25,000-49,999	50,000-99,999	100,000-499,999	500,000-999,999	1,000,000+
1956				1		
1958			1			
1959				1		1
1964		1		2		
1966	1		1	1		
1969		1	1			1
1970						
1972	1					1
1973	1		2			
1974				1		
1976		1		1	1	1
1977	3		1		1	1
1978	2	1	2			
1979	1					
1980	1			1		
1981	2					
1982	4	1				
1983	3			1		
1984	5		1	1		
Total	24	5	9	10	2	5

*Based on 55 valid responses.

Table 19. Number of greenhouse, nursery, and interiorscape businesses by region and range of gross sales.*

Region	Range of gross sales ($)**				
	0-24,999	25,000-49,999	50,000-99,999	500,000-499,999	500,000-1,000,000
Interior Alaska	7	1	2	2	0
Anchorage area	2	0	3	4	2
Matanuska-Susitna Borough	1	3	3	1	0
Kenai Peninsula	9	0	0	3	0
Southeastern Alaska	6	1	1	0	0

*Based on 51 valid responses.
**To protect confidentiality, the $1,000,000+ category was omitted.

Table 20. Number of greenhouse, nursery, and interiorscape businesses with greenhouses by gross sales and greenhouse square footage.*

ft^2	Range of gross sales ($)					
	0[1] 24,999	25,000-49,999	50,000-99,999	100,000-499,999	500,000-999,999	1,000,000 +
0-1000	9	1	1	1	0	0
1001-5000	9	3	3	2	1	1
5001-10,000	0	1	1	0	1	0
10,000-50,000	0	0	4	5	0	1
50,001-100,000	0	0	0	0	0	2
100,001-200,000	0	0	0	0	0	1

*Based on 55 valid responses of which 47 had greenhouses.

Landscape Contracting Businesses

General Characteristics

The estimated total number of landscape contracting businesses in Alaska was 304 (table 21). Seventy-seven businesses were contacted for this survey, and 57.1 percent responded. Most responses were received from the Anchorage region.

One of the businesses responding to this survey began operation in 1959, and 3 more businesses were started from 1960 through 1970 (figs. 5 and 6). During

Table 21. Number of landscape contractors responding to the survey and estimated total per region.

Region	Number of respondents	Estimated total per region*	Estimated percent responses per region
Interior Alaska	6	44	13.6
Anchorage area	22	174	12.6
Matanuska-Susitna Borough	3	23	13.0
Kenai Peninsula	5	26	19.2
Southeastern Alaska	7	27	25.9
Western Alaska	1	4	25.0
Kodiak & Valdez	0	6	—

*Estimation based on address list compiled.

the next decade, 21 new businesses began operation, and 19 additional businesses were started since 1980. In 1983 alone, 10 new businesses were started. Eighty percent of all businesses surveyed began within the last 9 years including 4 in interior Alaska, 17 in the Anchorage area, 3 in the Matanuska-Susitna Borough, 4 on the Kenai Peninsula, 6 in southeastern Alaska, and 1 in western Alaska.

Sources of Plant Materials

One-third of the landscape contracting businesses grew a portion of the plants that they used on landscape jobs. The plant materials most commonly grown by the contractors were flowering annuals and herbaceous perennials. Only 12.5 percent of the businesses grew all or a portion of their own trees and shrubs.

Depending upon the crop category, up to 20 percent of the landscaping businesses purchased trees, shrubs, annuals, ground covers, and/or herbaceous perennials exclusively from sources outside Alaska (table 22). With the exception of ground covers, more than half of the businesses purchased their plant materials from sources within Alaska. Landscape businesses using the most trees and shrubs by retail value ($50,000 or more) tended to purchase those plant materials from sources outside Alaska, while annuals, herbaceous perennials, and ground covers were obtained from sources within Alaska (table 23).

Forty-two percent of the businesses preferred to purchase annuals and herbaceous perennials that were grown in 4-inch pots. Five percent of the businesses preferred

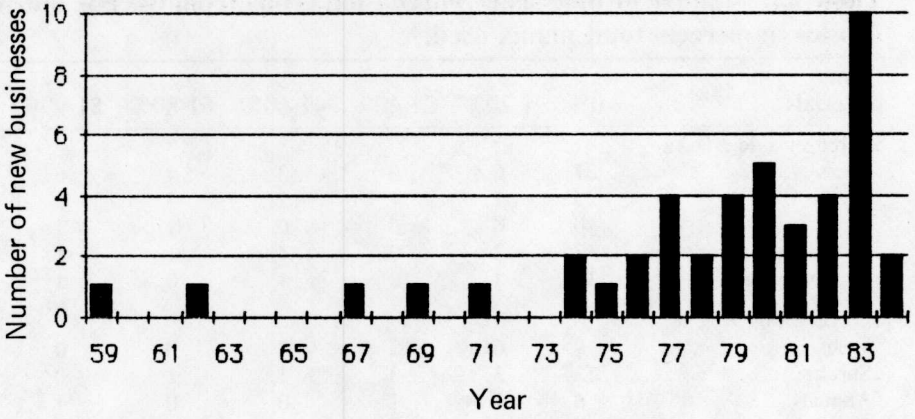

Figure 5. Number of new landscape contracting businesses started by year (based on 44 valid responses).

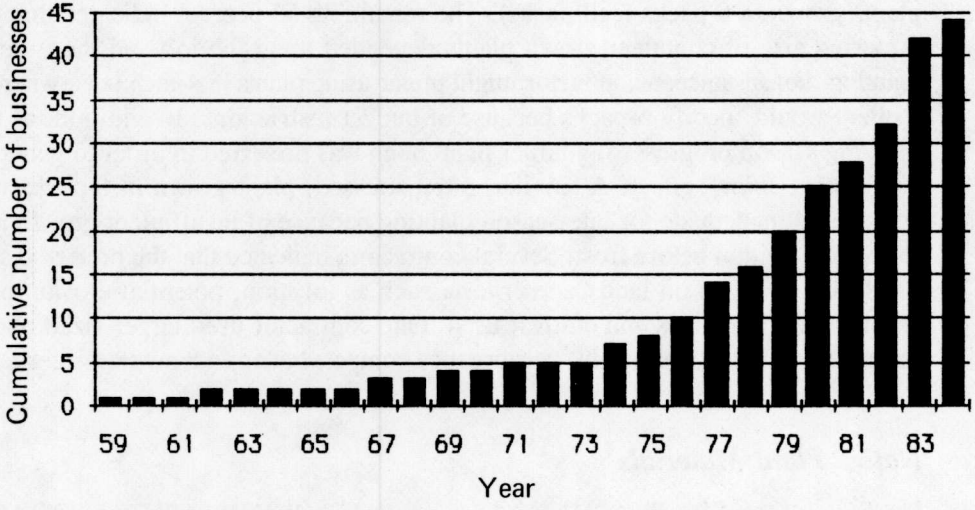

Figure 6. Cumulative number of new landscape contracting businesses (based on 44 valid responses).

Table 22. Number of businesses purchasing crops from outside and within Alaska by percent total plants used.*

Plant materials	0%	1-20%	21-40%	41-60%	61-80%	81-99%	100%
Source outside Alaska							
Trees	27	0	0	3	4	6	4
Shrubs	25	1	1	2	3	3	9
Annuals	40	0	0	0	1	1	2
Herbaceous perennials	32	2	0	4	1	1	4
Ground covers	37	1	0	1	0	1	4
Source within Alaska							
Trees	9	6	2	2	0	0	25
Shrubs	13	3	3	1	1	0	23
Annuals	6	1	1	0	0	1	35
Herbaceous perennials	7	2	0	4	1	1	29
Ground Covers	37	0	0	1	1	2	3

*Based on 44 valid responses.

plants grown in 6-packs (cell packs). The remaining 53 percent indicated that the preferred size of container-grown plants depended upon the job and the time of planting. For instance, a contractor might prefer using plants in 4-inch pots, whereas a client would specify 6-packs because of budget restrictions. In addition, as the growing season progressed, a larger plant often was preferred in order to generate an "instant color" effect. A smaller, often stressed, plant grown in 6-packs was considered inadequate for late-season planting because of insufficient growth and flower production before frost. Several contractors indicated that the preferred size of plants depended on landscape criteria such as location, potential erosion problems, and the species and cultivar used. One contractor used larger-sized plants (more than 12 inches in height) because they compete better with natural vegetation.

Native Plant Materials

Ninety-one percent of the businesses used native birch and spruce in their landscape projects. Fifty-seven percent of the businesses used other indigenous plants including iris, ferns, highbush cranberry, kinnikinnick (bearberry) and dwarf dogwood. One contractor in southeastern Alaska used native plants in landscape

Table 23. Number of businesses by the retail value of plant materials used, purchasing various amounts from sources outside Alaska.*

Plant materials by amount purchased	(%)	Retail value of plant materials ($)					
		0-499	500-1,999	2,000-9,999	10,000-19,999	20,000-49,999	50,000-+
Trees	0	4	4	8	5	5	1
	1-20	0	0	0	0	0	0
	21-40	0	0	0	0	0	0
	41-60	0	0	2	1	0	0
	61-80	0	0	2	0	1	1
	81-99	0	0	0	1	3	2
	100	0	0	0	0	2	2
Shrubs	0	4	3	8	5	5	0
	1-20	0	0	0	0	0	1
	21-40	0	1	0	0	0	0
	41-60	0	0	1	1	0	0
	61-80	0	0	2	0	1	0
	81-99	0	0	0	1	1	1
	100	0	0	1	0	4	4
Annuals	0	4	4	11	6	9	6
	1-20	0	0	0	0	0	0
	21-40	0	0	0	0	0	0
	41-60	0	0	0	0	0	0
	61-80	0	0	1	0	0	0
	81-99	0	0	0	1	0	0
	100	0	0	0	0	2	0
Herbaceous perennial	0	3	3	9	6	8	3
	1-20	0	1	0	0	0	1
	21-40	0	0	0	0	0	0
	41-60	0	0	1	0	1	2
	61-80	1	0	0	0	0	0
	81-99	0	0	0	1	0	0
	100	0	0	2	0	2	0
Ground covers	0	4	3	10	6	9	5
	1-20	0	1	0	0	0	0
	21-40	0	0	0	0	0	0
	41-60	0	0	1	0	0	0
	61-80	0	0	0	0	0	0
	81-99	0	0	0	0	1	1
	100	0	0	1	1	1	1

*Based on 44 valid responses.

projects, but the plant materials were not from Alaska sources. One contractor in the Interior indicated that most Alaska native plants used in landscaping, particularly spruce and birch, were not purchased from or grown in nurseries, but were dug from wild stands.

Plant Material Needs

Twenty contractors listed plant materials that would be used if they were available locally or statewide. Categories of plant materials most frequently listed were species of Alaska native plants and any type of hardy ground cover, followed by locally grown lawn seed and sod, different types and larger-caliper shade trees, and deciduous shrubs. Specific plant materials requested by contractors are listed in Table 24. Seventeen contractors did not list additional plant materials, and many of these contractors responded that all of the plant materials currently used were readily available from local commercial sources or from wild stands.

Plant Materials Lists

Thirty percent of the businesses had a list of preferred plant materials that they used as an aid in developing landscape design specifications. One contractor did not have his own list, but used one developed by the Alaska Horticultural Association for the Anchorage region. The remaining contractors relied on local plant availability to determine the types of plants used on different jobs. One contractor stated that each landscape job required different types of plant materials, thus a list of preferred materials was impractical.

Florists

Sources of Plant Products

The estimated total number of florist businesses in Alaska was 80. Twenty-one businesses were contacted, and 19 interviews were granted. One business was located on the Kenai Peninsula, 10 were in Anchorage, and 8 were in Fairbanks. Three of the 19 businesses indicated that they currently buy Alaska products, including

Table 24. Plant materials that landscape contractors would use if available locally or statewide (listed in order of most to least frequently requested).

Common name	Scientific name
*Kinnikinnick (bearberry)	*Arctostaphylos uva-ursi*
*Junipers (native species and different cultivars of introduced species	*Juniperus* sp.
*Common mountain juniper	*Juniperus communis* ssp. *nana*
*Creeping juniper	*Juniperus horizontalis*
*Potentilla (bushy, well-formed selections of the native plant)	*Potentilla fruticosa*
*Highbush cranberry	*Viburnum edule*
*Western hemlock	*Tsuga heterophylla*
*Bunchberry (dwarf dogwood)	*Cornus canadensis*
*Redosier dogwood	*Cornus sericea (C. stolonifera)*
*Lodgepole pine	*Pinus contorta*
*Mountain ash	*Sorbus scopulina*
*Lingonberry (lowbush cranberry)	*Vaccinium vitis-idaea* ssp. *minus*
*Saskatoon (juneberry)	*Amelanchier alnifolia*
*Alaska spiraea	*Spiraea Beauverdiana*
*Ferns	several species
*Wild iris	*Iris setosa*
*Shooting star	*Dodecatheon* sp.
*Chocolate lily	*Fritillaria camschatcensis*
*Lupines	*Lupinus* sp.
*White spruce (different cultivars and strains)	*Picea glauca*
*Sitka spruce	*Picea sitchensis*
*Mountain hemlock	*Tsuga Mertensiana*
Arborvitae	*Thuja plicata*
Periwinkle	*Vinca minor*
St.-John's-wort	*Hypericum* sp.
Siberian elm	*Ulmus pumila*
'Thompson' blue spruce	*Picea pungens* 'Thompsonii'
Heaths	*Erica* sp.
Heathers	*Calluna* sp.
European mountain ash (more and different cultivars	*Sorbus Aucuparia*
'Wien' crabapple	*Malus baccata* 'Wien'
Honeysuckle	*Lonicera caerulea*
'Chief raspberry	*Rubus idaeus* 'Chief'
'Boyne' raspberry	*Rubus idaeus* 'Boyne'
*Nagoonberry	*Rubus arcticus*
*Salmonberry	*Rubus spectabilis*
Icelandic poppy	*Papaver nudicaule*
*Larch (tamarack)	*Larix laricina*
Shrub roses (more hardy species and cultivars	*Rosa* sp.
*Blueberries	*Vaccinium* sp.
*Alder	*Alnus* sp.
Crabapple (a hardy rootstock for apple and crabapple species and cultivars)	*Malus* sp.

*Native plant materials.

potted flowering plants (especially chrysanthemums), foliage plants, strawflowers, statice, calendula, and snapdragons. All businesses were willing to buy flowers, foliage plants, or other plant products from Alaska sources. One business would like to buy from local sources in order to have the convenience of delivery within one or two days. Specific plants requested by florists owners are listed in Table 25.

Product Characteristics

Eighteen of the 19 businesses indicated that small quantities of plants and seasonal availability would not adversely affect their willingness to purchase from local sources, particularly if a certain quantity could be guaranteed for a given time. Four businesses mentioned that product quality (particularly product freshness and freedom from insect pests and diseases) was paramount, and 1 business specified a willingness to pay more for plants of higher quality. Two businesses would purchase local products only if the product was competitively priced with outside markets. One business would not consider purchasing from local sources because seasonal purchases of local products would jeopardize year-round purchasing power with outside sources, particularly during holiday seasons.

Table 25. Plant products that florists would be interested in obtaining from local (Alaska) sources (listed in order of most to least frequently requested).

Potted flowering plants (any kind, more variety)
bulbs
chrysanthemums
Foliage plants (more variety)
Cut-flower crops (any kind, more variety)
bulbs (especially tulips, daffodils, lilies)
chrysanthemums (more variety)
snapdragons
miniature carnations
gerbera daisies
roses (less expensive)
gardenias
orchids
baby's breath
Greenery (unfrozen)
ferns (any kind)
huckleberry
scotch broom

Variety Stores

General Characteristics

An estimated 41 variety stores in Alaska sell plants to the extent that they have a plant sales department. Twelve of these stores were surveyed; 7 were located in Fairbanks, and 5 were in Anchorage. One of the variety stores began selling plants and related products in 1960, another store began in 1972, and 2 began in 1975. During the last 9 years, 7 stores included plant departments in their operation.

Employees

Seven of the 11 variety stores hired one employee to work in the plant department, while 4 stores hired two employees. Seven stores made an effort to hire individuals with knowledge of plant care.

Sources of Plant Products

All commodities included in this survey, except garden equipment, were purchased by the variety stores from sources both outside and within Alaska (table 26). Five of the variety stores purchased bedding plants exclusively from Alaska sources. All 12 respondents indicated a willingness to purchase from Alaska sources if high quality, competitively priced products were available. Quality was most often the primary consideration. Two plant department managers were willing to purchase Alaska-grown cut flowers and containerized foliage and flower crops only if a certain quantity could be guaranteed year-round. One manager was willing to purchase any quantity of locally grown cut flower crops especially during Christmas because personal gift packages have shipping priority over business parcels (including perishable cut flowers).

Gross Sales

In most stores, sales of bedding plants, bulbs, and seeds had a retail value up to $20,000 (table 27). One store sold garden supplies and equipment valued at $200,000 or more. There was a wide range of gross sales reported in the category of houseplants and cut, arranged, and potted flowers.

Table 26. Number of businesses purchasing different commodities from various sources.*

Commodity	Outside Alaska	Within Alaska	Outside & within Alaska	Neither source
Cut flowers	2	1	5	4
Houseplants	3	1	7	1
Bedding plants	2	5	4	1
Potted flowers	3	0	8	1
Shrubs	4	2	1	5
Trees	2	1	1	8
Seeds	1	2	6	3
Bulbs	7	1	1	3
Garden supplies	4	1	4	3
Garden equipment	6	2	0	4
Other	1	1	0	10

*Based on 12 valid responses.

Table 27. Number of variety stores by gross sales in various commodity groups.*

	Commodity Group		
Gross sales($)	Houseplants & cut, arranged, & potted flowers	Bedding plants bulbs & seed	Garden supplies & equipment
0	0	0	1
1-19,999	3	7	1
20,000-49,999	3	3	6
50,000-99,999	2	0	1
100,000-199,999	2	0	0
2,000,000+	0	0	1

*Based on 10 valid responses.

DISCUSSION

Industry Size

An estimated 580 businesses are involved in the greenhouse industry and related enterprises in Alaska, and 148 of these are greenhouse and/or nursery businesses. The number of businesses differs substantially from previous reports, indicating that the size of the greenhouse/nursery industry may have been underestimated in the past. For instance, Vandre (1980) estimated that there were 25 Alaska greenhouse businesses operating in 1980. This study identified 35 greenhouse businesses operating in 1980 based upon a survey of only 37.4 percent of the total (fig. 2). In addition, previous studies surveyed small segments of the horticulture industry, such as only nursery or only greenhouse businesses. None of these studies included landscape contracting businesses that comprise more than half the total number of businesses surveyed in this study.

Horticultural enterprises in Alaska tend to be diversified rather than solely greenhouse or nursery businesses. Nearly two-thirds of the businesses were combinations of greenhouses, nurseries, garden centers, etc. (table 2). Previous studies that surveyed only one component, such as nurseries, may have underestimated the size of the nursery industry by failing to include horticultural enterprises whose major component was not a nursery. Many owners also indicated it was impossible for them to separate their diversified businesses to estimate size, gross sales, and facilities for each component. In the past, this problem may have led to misinterpretation of business characteristics.

The number of greenhouse, nursery, interiorscape, and landscape contracting businesses increased slowly until the 1970s but more than tripled by 1984 (figs. 2 and 6). This increase paralleled the growth in Alaska's economy and population that was due largely to pipeline construction and oil revenue. The sudden wealth of the state, increases in personal income, and the growth of the population facilitated the creation and support of new businesses as well as expansion of existing businesses. Thus, greater demands were placed on the horticulture industry to supply products and services commensurate with lifestyles imported from the "lower 48."

In a 1975 survey, Hemphill (1976) reported that growth in the nursery industry in southcentral Alaska was strong due to the construction boom in the Anchorage area. Nursery owners also predicted a 5-10 percent per year growth in the nursery

industry over the next 10 years because of increasing population, continued construction, and a decrease in the amount of land surrounding Anchorage where homeowners and landscape contractors could freely dig native plant materials. Growth in the greenhouse, nursery, and interiorscape industry was similar to that predicted for the nursery industry. Since 1975, the number of greenhouse, nursery and interiorscape businesses operating in Alaska has grown by an average 7.2 percent per year, and the number of landscape contracting businesses has grown by 9.1 percent per year.

Greenhouse Structures

Quonset and even-span gable greenhouses are the most common structures used in commercial operations in Alaska (table 3). These structures are readily available commercially, often as relatively inexpensive prefabricated units, but many Alaska greenhouses are self-designed and constructed using locally available materials. These greenhouse structures also may be reinforced, or the polyethylene-on-Quonset types may be dismantled in order to avoid damage by snow load, a consideration in some regions of Alaska. Availability, price, and ease of construction are important considerations, especially for the novice just starting a business, since many new business owners have little previous experience and/or in-depth knowledge of greenhouses prior to starting their business.

Ten percent of the businesses have either seasonally heated or nonheated lean-to structures attached to a house or garage. Many lean-to structures are used for spring starting of bedding plants to avoid or delay heating larger greenhouse structures. Uneven span, freestanding structures are seldom used for commercial greenhouses in Alaska, possibly because they are not as readily available commercially as the even-span or Quonset types, and they are less adaptable to automation (Nelson 1981). Gutter-connected greenhouse structures are used by the larger-sized, year-round operations in Alaska (table 3), possibly because they are more economical to heat and more efficient to manage than freestanding greenhouses. They also must be heated year-round to avoid damage from heavy snow loads. In contrast, properly spaced, freestanding greenhouses allow for easy snow removal without damaging the structure. They are less efficient to heat than gutter-connected greenhouses, although they allow more flexibility in the management of heating individual areas of greenhouse space (Boodley 1981).

Greenhouse Heating and Lighting

Half of the businesses with year-round heated greenhouses are located in the Anchorage area (table 4). In addition, these businesses tend to be larger (based on square footage) than greenhouses in other regions. These results are not surprising since the Anchorage area has a population more capable of supporting large, year-round operations than other regions. The availability of reasonably priced heating fuel is an added advantage. Thirty-eight years ago the largest greenhouses in Alaska also were located in a population center (Fairbanks), but none of the greenhouses were heated year-round because of high heating costs and low light intensity (Magruder 1949).

Today, wherever natural gas is available, it is the preferred heating fuel (table 7). Currently, natural gas lines are being installed in portions the Matanuska-Susitna Borough, and several growers have converted or plan to convert to this fuel source to reduce operating costs. Since heating a greenhouse is a major operating expense, the extent to which a reliable and relatively inexpensive heating source is available in any given area will have a major impact on the future growth of the greenhouse industry in Alaska. The economics of waste heat utilization from power plants, pump stations, and oil refineries as well as geothermal heat sources should be studied to determine their feasibility as heating sources for Alaska's greenhouses.

Most greenhouses in Alaska are covered with corrugated fiberglass or polyethylene (table 5). Corrugated fiberglass is stronger, more durable, and longer lived than polyethylene which may account, at least in part, for its popularity in Alaska, particularly in windy areas or those prone to hail storms (tables 5 and 6). Logsdon (1982) reported that half of the commercial greenhouses in the Matanuska-Susitna Borough were covered with double layers of polyethylene because this covering was cheaper and provided better insulation than fiberglass. In addition, the double layers provided greater protection from wind damage and heavy snow loads than single layers of polyethylene. Greenhouses covered with polyethylene constitute the largest portion of new greenhouse construction in the US today (Nelson 1981, Greenhouse Manager 1985). Polyethylene, particularly double layers, probably will be the covering used most frequently on new commercial structures in Alaska because of greater commercial availability, relatively low construction costs, and potential heating efficiency.

More than half of the greenhouse, nursery, and interiorscape businesses used supplemental light to extend the growing season, to maintain plant quality prior

to sale, or to start bedding plants in spring. Frequently, supplemental lighting was used in facilities other than the greenhouse, such as plant-display areas in garden centers, holding warehouses for interiorscape plants, or in propagation rooms for germination of bedding-plant seed. The lighted propagation rooms were used to delay and/or avoid heating large areas of greenhouse space in early spring. This example and those of greenhouse structures, coverings, and heating sources used in commercial greenhouse operations emphasize the importance of energy conservation in locating and operating commercial greenhouses in Alaska.

Hot Frames, Cold Frames, and Field Space

Relatively inexpensive hot and cold frames may be used to conserve energy by replacing or supplementing greenhouse space, particularly during the high-volume portion of the cropping season. One business used hot frames as the only facility for production of bedding plants, but most businesses use them to supplement existing greenhouse space. Growers use cold frames to develop compact growth on greenhouse-grown plants and to harden bedding plants prior to sale. Nurseries use the unheated, uncovered structures for wind and midwinter thaw protection of woody plant materials, while closed frames may be used to green up shrubs early in spring. Despite the versatility of these structures, fewer than half the businesses in Alaska used hot or cold frames, perhaps because of their seasonality. Extremely cold winter temperatures prevent the year-round use of these frames as feasible growing structures in most regions.

Hemphill (1976) reported that, in 1975, greenhouse/nursery businesses in southcentral Alaska encountered considerable problems in developing field space for growing trees and shrubs because very high property taxes and land values forced many growers to sell the land or divert it to more profitable uses. Most of the businesses Hemphill surveyed maintained small plantings, but these were used mainly for demonstration purposes rather than crop production. Greenhouse/nursery owners also predicted that little expansion would occur in propagating plants in Alaska or in the acreage devoted to growing of shrubs and trees because of high labor costs and a short growing season. In addition, sale of woody perennials amounted to 2 to 35 percent of total sales and were not the primary crop grown or sold in most businesses. Consequently, investment in large amounts of field space was un-

warranted. The great majority or woody ornamentals would continue to be shipped in and sold in the same year.

These predictions are supported by this survey which found that only 156.33 acres of land, averaging 2.6 acres per business, are devoted to production and/or sale of woody and herbaceous perennial plants. Thirty-seven percent of the businesses surveyed had no field space. In addition, more than three-quarters of the businesses responding purchased 100 percent of their bareroot, balled and burlapped, or containerized nursery stock from other nurseries for resale (table 16). Major suppliers of nursery stock continue to be nurseries in Minnesota, Montana, Washington, and Oregon.

Product Sales and Service

One greenhouse/nursery owner indicated that the reliance on non-Alaska sources for nursery stock limits the type of plant materials that can be sold to what is available in other regions. Certain plant materials that have been found to be extremely hardy in Alaska are not grown in other regions of the United States and thus are not available.

Despite the reliance on non-Alaska sources, most greenhouse/nursery owners attempted to sell high-quality, reliably hardy plant materials. However, some business owners commented that variety stores with plant departments frequently import large volumes of nonhardy plant materials and sell them at very low prices. This complaint also was expressed by Alaska greenhouse/nursery owners 9 years ago (Hemphill 1976) and probably will continue as long as local sources of reasonably priced plant materials are not available and consumers are willing to purchase nonhardy plant materials that may have been commonplace in their "lower 48" landscapes.

Nursery growers in 1975 indicated that there was an increasing demand for Alaska native plants (Hemphill 1976), particularly such ground covers as kinnikinnick (bearberry). This interest was seen as an outgrowth of restrictions against removing plants from wild stands and an increase in the number of homeowners who used the services of landscapers rather than collecting their own plants. Demand for and use of Alaska native plants is still strong (table 24), but fewer than half of Alaska nursery/greenhouse businesses sell them (table 13). This result may be due partly to continued restrictions on collecting from wild stands and the lack of propagation and growth facilities in local nurseries. In addition, many native

plants generate lower returns when compared with exotic species and cultivars and thus are not sold as often. One landscape contractor in Anchorage also indicated that native species such as highbush cranberry *(Viburnum edule)* were not sold because of the availability of related exotic species that were more uniform and predictable in Alaska urban landscapes than native plants, particularly those dug from the wild. Native plants comprise no more than 20 percent of total plant sales in all Alaska businesses (table 13).

Many landscape contractors from all regions of Alaska listed plant materials that would be used if they were available locally or statewide (table 24). However, this list is not a reliable indication of contractor needs partly because of strong regional differences in the industry. For instance, kinnikinnick (bearberry) was listed most frequently by contractors statewide, but demand for this species is low in the Anchorage area, and thus it is not often sold. At least one interior Alaska contractor requested a source of honeysuckle *(Lonicera caerulea),* but it is not as desirable as other *Lonicera* species in the Anchorage region. Several plant materials such as locally grown lawn seed and sod and cultivars of mountain ash *(Sorbus Aucuparia)* are available from Alaska sources, but only in certain regions. Consequently, contractors working in regions whose population and economy do not support a diversified nursery industry frequently listed plant materials that were considered commonplace in other regions.

In addition to strong regional differences in selection and availability of plant materials, some landscape contractors were not familiar with plant materials recommended for their region or with existing suppliers of hardy plants. Consequently, they requested plants that were not reliably hardy in their region or that were readily available from local (Alaska) sources. These results indicate a greater need for in-state marketing networks among horticulture businesses in Alaska. The Alaska Horticultural Association or some other cooperative forum should be utilized to a greater extent to promote market networking, to provide a means of continuous discourse among owners of various horticultural enterprises in Alaska, to provide information on hardy plant materials, and to promote stabilization and self sufficiency within the industry. In addition, these results emphasize the need for a greater attention to regional differences in future surveys in order to develop a more accurate picture of the horticulture industry in Alaska.

More Alaska horticulture businesses sold flowering annual bedding plants than any other crop, although no businesses sold this crop exclusively (table 13). Thirty-eight years ago, flowering annuals and vegetable transplants also were popular

greenhouse crops, but the two largest greenhouses that were located in Fairbanks were used mainly for the production of vegetables. Greenhouses in southcentral and southeastern Alaska were used primarily to grow flowers (Magruder 1949). Today, few greenhouses specialize in vegetable crop production possibly because of greater availability of fresh vegetables from "lower 48" sources and the reluctance of some grocery stores to handle local products that are available for a very short time. In addition, Logsdon (1982) reported that vegetables, grown either as bedding plants or for fruit production, generate lower returns than ornamentals in Alaska greenhouses. Nevertheless, many businesses still grow some vegetable crops to utilize greenhouse space after crops of bedding plants have been sold.

Flowering annual and vegetable bedding plants were the crops sold by most businesses in most regions of Alaska (table 14). One notable exception is the Anchorage area where more businesses sold trees and shrubs than bedding plants. This result may indicate a growing interest in perennial ornamental landscape gardening in the Anchorage area. However few businesses had total plant sales comprised of more than 20 percent of these plant materials (table 13).

The needs of the florist industry and variety stores are not now fully met by the existing greenhouse businesses since there is a demand for locally grown, high-quality crops such as potted flowering plants, cut flowers, and foliage plants (table 25). Business owners frequently indicated the desire to purchase local products in order to obtain a higher-quality product, to avoid high shipping costs and delays in shipping during holiday seasons, and to obtain a greater variety of plants than was available from "lower 48" sources. Seasonal availability was not a great concern for most businesses as long as a high-quality, competitively priced product was available for a specific period of time.

Employees

The number of people that worked in the 58 greenhouse, nursery, and interiorscape operations was 679 for an average of 11.7 employees per business. Regionally, the number of employees per business ranged from 3 employees in southeastern Alaska to 22.3 emloyees in the Anchorage area. This total includes all individuals employed either part time or full time, seasonally or year-round, and owners who work in the business. In order to estimate the total number of employees in the greenhouse, nursery, and interiorscape businesses, the estimated number of businesses per region.

that did not respond to the survey (table 1) was multiplied by the average number of employees per business in the corresponding region. This estimated number of employees for nonrespondents was added to the known number of employees for respondents in each region. The resulting estimated total number of employees in the Alaska greenhouse, nursery, and interiorscape businesses is 1,559; nearly half of this total is in the Anchorage region (table 28).

The 11 variety stores surveyed had 15 employees, for an average of 1.4 employees per store. The estimated total number of employees for the 41 variety stores that have plant departments is 57. Employee information was not gathered from florists or landscape contracting businesses. Assuming that there is at least one employee and working owner for each of the 304 landscape contracting businesses and for each of the 80 florist businesses, an additional 768 jobs exist. The estimated total number of employees statewide in all the the various horticultural enterprises totals 2,384. This estimate is conservative as it does not include employees of excavation companies involved in topsoil processing and delivery, transportation companies that bring at least 50 vanloads of horticultural products into the state annually, condominium and commercial grounds maintenance crews, the 19 businesses involved

Table 28. Estimated total number of employees in greenhouse, nursery, and interiorscape businesses in Alaska, by region.

	Interior Alaska	Anchorage area	Matanuska-Susitna Borough	Kenai Peninsula	Southeastern Alaska	Western Alaska	Kodiak Valdez
Number of respondents	13	16	8	14	6	0	1
Estimated number of businesses per region	25	32	41	37	13	1	6
Number of employees of respondents	167	356	41	91	18	—	6
Average number of employees per respondent	12.8	22.3	5.1	6.5	3.0	—	6.0
Estimated number of employees of nonrespondents	153.6	356.8	168.3	149.5	21.0	1.0*	30.0
Estimated total number of employees	320.5	712.8	209.2	240.5	39.0	1.0	36.0

*Since no businesses responded from this region, the estimate is based on one owner/employee per business.

in greenhouse construction, the 25 landscape architect offices, or the "kid down the street with the lawnmower."

Gross Sales

The questionnaire designed for greenhouse, nursery, and interiorscape businesses solicited information regarding gross sales by categorical ranges. Respondents were requested to check one of six categories ranging from $0 to 24,999 to a maximum of $1 million+ (Appendix 1). A categorical format, instead of one requesting specific financial information, was used intentionally to encourage a greater response rate. This method proved successful, but upon completion of the study the categories were found to be inadequate. For instance, the $1 million+ category underestimated the possible maximum value of gross sales in the industry. Five businesses reported gross sales exceeding $1 million, and one specified $2.7 million (table 18). In a survey completed by Nursery Business magazine (Morey and Gammel 1985), the 2 top nursery retailers in Alaska reported gross sales of $1.6 million and $1.1 million for 1984. One of these businesses was ranked seventy-second based on gross sales in the top 100 nursery retailers in the US. Each of these businesses exceeded the maximum category by at least $100,000. The lack of valid baseline data prior to this study contributed to the inadequacy of the chosen categories.

Because categories were used, a total gross sales value for the 55 greenhouse, nursery, and interiorscape businesses surveyed could not be calculated directly, but it was estimated using the midpoint within each category multiplied by the number of businesses responding to each category. For the maximum value category, $1 million was used unless specific information was available (table 29). Any overestimated values that occurred from using the midpoint of each category were believed to be compensated adequately by the underestimated values in the $1 million+ category. Using this method, the estimated total gross sales for the 55 businesses is $13,062,500. The 5 largest businesses account for 56.6 percent of this total.

In order to estimate the total gross sales for the 155 greenhouse, nursery, and interiorscape businesses in Alaska, the midpoint of gross sales was multiplied by the estimated number of businesses in each category. The number of businesses was estimated using the percentage of respondents in each category (table 30). Since it is believed that most of the largest operations were surveyed, the gross sales value

Table 29. Estimated gross sales value for 55 greenhouse, nursery, and interiorscape businesses.

Number of businesses	Midpoint value of gross sales ($)	Gross sales ($)	Total gross sales ($)
24	12,500	300,000	
5	37,500	187,500	
9	75,000	675,000	
10	300,000	3,000,000	
2	750,000	1,500,000	
5	1,000,000	7,400,000*	
			13,062,500

*One business specified $2,700,000; also see Morey and Gammel 1985.

Table 30. Estimated total gross sales for Alaska's greenhouse, nursery, and interiorscape industry.

Estimated total number of businesses	Businesses surveyed (%)	Midpoint value of gross sales ($)	Gross sales ($)	Total gross sales ($)
72	48	12,500	900,000	
15	10	37,500	562,500	
27	18	75,000	2,025,000	
30	20	300,000	9,000,000	
6	4	750,000	4,500,000	
—	—	1,000,000	7,400,000*	
				24,387,500

*From Table 29

for the $1 million+ category was considered a reliable statewide estimate and was not included in further estimations of gross sales for that category. Using this method, the estimated total gross sales for the greenhouse, nursery, and interiorscape industry in Alaska is $24,387,500. This estimate includes only the greenhouse, nursery, and interiorscape portion of the Alaska horticulture industry. It does not include the horticultural products grown and/or sold by the 304 landscape contracting businesses, the 80 florist businesses, or the 41 variety stores that have plant departments. Consequently, $24,387,500 still substantially underestimates the size of the entire horticulture industry in Alaska.

This estimate is substantially higher than those previously reported by other individuals and/or agencies. For instance, the Alaska Crop and Livestock Reporting Service (1985) estimated the total cash receipts for greenhouse and nursery products along with forest products, berries, seed, and field crops (excluding barley, hay, oats, and vegetables) to be $11,923,000 for 1984. This discrepancy may be due partly to different sample populations or to an underestimation of the number and types of horticultural enterprises in Alaska, but it also indicates a lack of information on the composition, size, and value of this industry to Alaska's agricultural economy. The estimated total cash receipts of the greenhouse, nursery, and interiorscape industry in Alaska is nearly twice the value reported for all other Alaska farm commodities ($13,488,000) including livestock products, feed crops, and field vegetable crops (Alaska Crop and Livestock Reporting Service 1985).

Industry Needs

Owners of greenhouse, nursery, interiorscape, and landscape businesses feel that their industry would benefit by additional support from public institutions and agencies in Alaska, particularly those involved with horticultural research and public information, agricultural loans, and agricultural land disposal programs. Business owners, particularly in interior Alaska, stressed the need for an extension specialist to assist in diagnosing grower problems, to inform businesses of research in progress, and to coordinate with research horticulturists in solving grower problems that are unique to Alaska. Presently, many growers rely on the facilities and expertise of Canadian extension programs (Alaska Horticultural Association 1985), but problems unique to Alaska cannot be addressed adequately.

Because of its importance in Alaska's agricultural economy, annual statistics on crops, gross sales, and field and greenhouse production acreage are needed to identify trends in horticultural production and to monitor this industry's growth. Because of the diversity of Alaska horticultural enterprises, individual components such as greenhouses, nurseries, landscaping services, and garden centers must be defined clearly, and surveys, consistent from year to year, would allow accurate comparisons. Information gathered annually would assist commercial horticulturists in assessing market conditions and would provide public agencies with a more reliable method of studying industry growth and development.

CONCLUSIONS AND RECOMMENDATIONS

The results of this survey revealed several characteristics and trends occurring in the Alaska greenhouse industry and related enterprises. The following conclusions and recommendations provide a synoptic interpretation of the results.

1. There are more horticulture businesses in Alaska having higher total gross sales than was estimated and reported previously, and the number of greenhouse, nursery, interiorscape, and landscape contracting businesses has more than tripled since 1970. Future growth in the greenhouse, nursery, and interiorscape industry most likely will occur in areas having ready access to natural gas and a population base large enough to support additional businesses.
2. Greenhouse facilities vary by region and type of business with respect to structural design, covering, and heating and lighting sources, with energy conservation a primary consideration. Quonset and even-span gable greenhouses covered with fiberglass or double layers of polyethylene are the most popular structures throughout the state. Because of the variety of greenhouse types encountered, investigations regarding energy efficiency of various greenhouse designs and coverings, as well as other methods of fuel conservation, are recommended to determine optimum greenhouse facilities for Alaska conditions.
3. Greenhouse businesses in Alaska tend to be diversified, producing and selling a wide variety of plants, horticultural equipment, and related services. The most commonly grown crops are flowering annual and vegetable bedding plants. A substantial amount of plant materials, particularly woody ornamentals used in landscaping, are purchased from sources outside Alaska.
4. Presently, the plant material needs of the florist industry, variety stores, and landscape contractors are not being met fully by the existing greenhouse businesses. This may be due, in part, to a lack of networking and infrastructure in the horticulture industry in Alaska. The Alaska Horticultural Association or a similar cooperative forum should be utilized to a greater extent to promote market networking and provide a means of communication among commercial businesses.
5. Given that horticulture is a multimillion-dollar business in Alaska, additional support from public institutions and agencies is warranted, not only to provide problem-solving expertise, but to foster the growth of the horticulture industry

in Alaska and to encourage the development of new crops and new technologies that are compatible with consumer demand and conditions in the North.

6. Industry surveys should be conducted annually in order to identify trends in horticultural production and monitor future growth. Particular attention should be paid to regional differences in order to develop a more accurate picture of the horticulture industry in Alaska.

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APPENDIXES

Appendix 1

The format of each survey has been abbreviated for publication purposes only. All questions are listed below.

Greenhouse and Nursery Survey 1984

Any questions that you desire to answer will be of value to my survey. Thank you for taking this time to reply.

1) Name of business
2) Business location
3) Business mailing address
4) Owner/manager
5) In operation since what year?
6) How many sq.ft. of each of the following types of growing area do you have under the following categories: A)year-round heated greenhouses; B)spring, summer fall-heated greenhouses; C)nonheated greenhouses; D)hot frames; E)cold frames; F)field space?
7) With what type of covering is each of these structures covered?
8) What type of energy sources are used to heat these areas?
9) What type of structural design are your greenhouses?
10) Do you use supplemental light sources? If so, what type of lighting?
11) How many people are employed by you: A)year round and full time (include owners if applicable); B)year round and part time; C)seasonally, full time; D)for transplanting only?
12) What other services do you offer besides plant sales (tools, fertilizer, consulting, classes, landscaping, plant or yard maintenance, etc.)?
13) What percentage of the types of plants listed below do you sell and in what size container do you sell them? A)houseplants; B)flowering annuals; C)vegetable starts; D)herbaceous perennials; E)fuchsia, geranium, and begonia baskets; F)planters and baskets with annuals; G)roses (containerized); H)Alaska native

plants; I)shrubs; J)trees; K)other

14) Are there plants that you have requests for but do not sell? A)If so, what are they? B)And why do you not sell them?
15) What percent of you bedding plants do you start from seed?
16) Do you buy plants from other sources (roughly what percent?) A)rooted cuttings; B)potted plants; C)bare rooted trees and shrubs; D)balled and burlapped trees and shrubs?
17) What is you cropping season? (do you grow a crop before or after bedding plant production for example?)
18) What percentage of your sales are: A)retail; B)wholesale; C)mailorder?
19) Do you have a price list which you mail to interested parties?
20) Do you do any type of consumer surveys of your own?
21) How did you get into this business? (family training, inhertance, education, making a hobby pay, etc)
22) Are you a member of any professional or business organizations? If so please list them.
23) Estimate of total value of sales for 1984: (please check the appropriate value) $0-25,000; $25,000- $50,000; $50,000-$100,000; $100,000- $500,000; $500,000-$1,000,000; $1,000,000+.
24) Do you have any comments or questions you may wish to ask or which can be passed on to the appropriate parties ? (you may wish to use another sheet of paper)
25) Would you like to receive a copy of the completed report?

Landscape Contractors Survey 1984

Any questions that you desire to answer will be of value to my survey. Thank you for taking this time to reply.

1) Name of business
2) Business location
3) Business mailing address
4) Business phone number
5) Owner/manager
6) How long have you been in operation in Alaska?

7) Is there any type of plant material that you would use if you could find it in your area (or statewide)? If so please list as many as you can here.
8) Do you use Alaska native plants?
9) Do you grow any of the annuals, perennials, trees or shrubs for your jobs? (please circle those that apply)
10) What percent (of the total number of plants used) do you import into Alaska for your jobs? And from where (region, state, province etc.) A)trees, B)shrubs, C)annuals, D)herbaceous perennials, E)ground covers.
11) Do you buy plant materials from Alaskan sources? If so, about what percentage A)trees, B)shrubs, C)annuals, D)herbaceous perennials, E)ground covers?
12) Do you prefer a particular size of annual or perennial in your designs(as pot size, height, or fullness for example)?
13) Do you have a list of plants that you prefer to use on your projects? If so, would you send a copy to me?
14) Estimate of total value of plant materials used for 1984 (please check the appropriate value)$0-499; $500-1999; $2000-9999; $10,000-19,999; $20,000-49,999; $50,000+.

Florist Survey 1984

1) Name of business
2) Business location
3) Business location
4) Business phone number
5) Owner/manager
6) How long have you been in operation in Alaska?
7) Would you buy flowers, foliage or other plant products from local (statewide) sources if they were available? If not, why?
8) What types of flowers, foliage or other plant products would you be interested in obtaining from local (statewide) sources?
9) Would quantity and the short growing season be a factor in buying from local sources?

Store Survey 1984

1) Name of business
2) Business location
3) Business mailing address
4) Owner/manager
5) How long have you been selling plants in your store?
6) Do you hire someone with plant experience to maintain the plant materials that you bring in? If so, how many of these positions do you have?
7) Do you buy any of the following types of plants from the following sources? Alaskan sources, "Outside" sources: A)cut flowers, B)house plants, C) bedding plants, D) potted flowers, E) shrubs, F) trees, G) seeds, H) bulbs, I)garden supplies, J)garden equipment, K) other.
8) Would you buy from Alaskan sources if they were available?
9) What would be your considerations in buying Alaskan plant materials?
10) What is the estimated value of sales (annually) in the following areas: cut, arranged and potted flowers and houseplants; bedding plants, bulbs and seeds; garden supplies and equipment? Please check the appropriate category: $0-19,999; $20,000-49,999; $50,000-99,999; $100,000-199,999; $200,000+.

Appendix 2

Glossary

Anchorage area region—This area includes Anchorage, Eagle River, Chugiak, Peters Creek, Indian, and Girdwood.

Cold frame—An unheated, boxlike structure covered with glass, fiberglass, or plastic that is used to protect and harden young plants and overwinter nursery stock.

Greenhouse—A building constructed proncipally of glass, fiberglass, or plastic in which temperature, humidity, etc. are regulated for the cultivation of plants.

Horticulture—The cultivation, sale, and processing of fruits, nuts, vegetables, ornamental plants, and flowers.

Hot frame—A cold frame that is heated by electricity, manure, heating oil, etc.

Interior Alaska region—This area includes businesses in Fairbanks, North Pole, Two Rivers, Tok, Delta Junction, Nenana, Glenallen, and Copper Center.

Interiorscape (interior plantscaping)—A form of landscaping in which the site of design and construction is located inside a structure, usually a building where foliage and flowering house plants are the medium for interior decorating.

Kenai Peninsula region—Includes businesses in Kenai, Soldotna, Sterling, Nikiski, Anchor Point, and Homer.

Kodiak and Valdez—Includes businesses in Kodiak Island and an area within 15 miles of Valdez.

Landscape contractor—A business involved in the construction, engineering, and planting of ornamental landscapes near buildings, roadways, etc.

Matanuska-Susitna Borough region—Includes businesses in Palmer, Wasilla, Talkeetna, Big Lake, Houston, and Willow.

Nonheated greenhouse—A greenhouse that is not heated by any means other than the sun.

Potted plants—Plants that are sold and intended to be grown in the same pot for an extended period of time including chrysanthemums, poinsettias, foliage plants, etc.

Seasonally heated greenhouse—A greenhouse that is not heated throughout the season, for instance, those heated only in spring and/or fall.

Variety stores—Stores that sell a broad range of commodities including food products, housewares, as well as plants

Western Alaska region—Includes businesses in Bethel, Kotzebue, and anything west of 152 °W.

Year-round heated greenhouses—A greenhouse that is heated throughout the winter, therefore having favorable plant-growing conditions throughout the year.